



# DEVELOPMENT OF OECD INTER- COUNTRY INPUT-OUTPUT DATABASE AND APPLICATIONS

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### What's new

» AGRICULTURE: OECD and FAO see likely end to period of high agricultural prices but call for vigilance

» SKILLS: Improve skills to build fairer, more inclusive societies

» UK: Statement by OECD Secretary-General Gurría on referendum result

» INTERNET: World must act faster to



### Focus

#### OECD Gender Data Portal



What is the gender pay gap in your country? Do boys or girls perform better at school? In which country is it easiest for women to start a business? The new OECD Gender Data Portal

- Current membership : 35 countries (Latvia, July 2016)
- Accession talks: Costa Rica, Lithuania
- Key partners: Brazil, India, Indonesia, PR China, South Africa
- Global relations
- 250 committees, 40000 officials visit each year
- 2500 staff



# OECD departments and special bodies

- **Office of the Secretary General**
- **Departments**
  1. Development Co-operation Directorate
  2. **Economics Department**
  3. Directorate for Education and Skills
  4. Directorate for Employment, Labour and Social Affairs
  5. Centre for Entrepreneurship, SMEs and Local Development
  6. **Environment Directorate**
  7. **Directorate for Financial and Enterprise Affairs**
  8. Public Governance and Territorial Development Directorate
  9. **Directorate for Science, Technology and Innovation**
  10. **Statistics Directorate**
  11. Centre for Tax Policy and Administration
  12. **Trade and Agriculture Directorate**
- **Special Bodies**
  1. **Development Centre** (DEV)
  2. Financial Action Task Force
  3. **International Energy Agency** (IEA)
  4. **International Transport Forum** (ITF)
  5. Nuclear Energy Agency (NEA)
  6. Sahel and West Africa Club
- **General Secretariat, Executive Directorate, Public affairs**
- **General Secretariat**



# Contents

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- What is ICIO?
- Features of OECD ICIO
- Development procedure of ICIOs
- Application 1: TiVA
  - Key findings for major economies and Korea
    - How to estimate?
    - Bilateral trade flows (gross exports)
    - VA flows embodied in trade
- Application 2: Global environment : CO<sub>2</sub> footprint
- Application 3: Jobs embodied in trade (productivity)
- Summary



# What does ICIO look like?

ICIO (3 country 3 industry) (current basic price)		Intermediate										Final demand						Re-exports & Reimports adjustments	
		Country A			Country B				Country C			Country A		Country B		Country C			Unspecified Destination
		Ind1	Ind2	Ind3	Ind1a	Ind1b	Ind2a	Ind2b	Ind34	Ind1	Ind2	Ind3	FD	CONS _ABR	FD	CONS _ABR	FD		
Country A	Industry 1					Z(1,2,A,B)							-	F(1,A,B)	FD(1,A,B)			FU(1,A)	REEX(1,A)
Country A	Industry 2												-						
Country A	Industry 3												-						
Country B	Ind1a Processing																		
	Ind1b Non-prc																		
	Ind2a Processing																		
	Ind2b Non-prc																		
Country B	Industry 3																		
Country C	Industry 1																		
	Industry 2																		
	Industry 3																		
Taxes less subsidies on products																			
Value-Added																			
OUTPUT																			

Domestic transaction
International trade
"-" No value by definition

Notes: International trade and insurance margin services are allocated in exports of service providers

Country B has 2 heterogenous sectors in industry 1 and industry 2

Z(1,2,A,B) = intermediate transaction from industry 1 of country A to industry 2 of country B

F(1,A,B) = Final expenditure of products from industry 1 of country A by country B

FC(1,A,B) = Final expenditure by non-residents from B in country A

FU(1,A) = Exports of product from industry 1 of country A to unspecified destination

REEX(1,A) = Re-exports and re-imports adjustments of Country A's industry 1



# Review: Input-Output Table

## Domestic table

	Intermediate demand		Personal expenditure	Other final expenditures	Exports	Imports cif	Output
	ind 1	ind 2					
Industry 1: Goods	$Z_{11}$	$Z_{12}$	HC1	FE1	EX1	-IM1	$X_1$
Industry 2: Services	$Z_{21}$	$Z_{22}$	HC2	FE2	EX2	-IM2	$X_2$
Imports	$IM_{Z_1}$	$IM_{Z_2}$	$IM_{HC}$	$IM_{FE}$	Re-Exports	Total IM	
Taxes less subsidies on products	$NTZ_1$	$NTZ_2$	NTHC	NTFE	NTEX	NTIM	
Value-added (total)	$V_1$	$V_2$					
Labor compensation	$VL_1$	$VL_2$					
Operating surplus	$VO_1$	$VO_2$					
Net taxes on production	$VT_1$	$VT_2$					
Output at basic price	$X_1$	$X_2$					

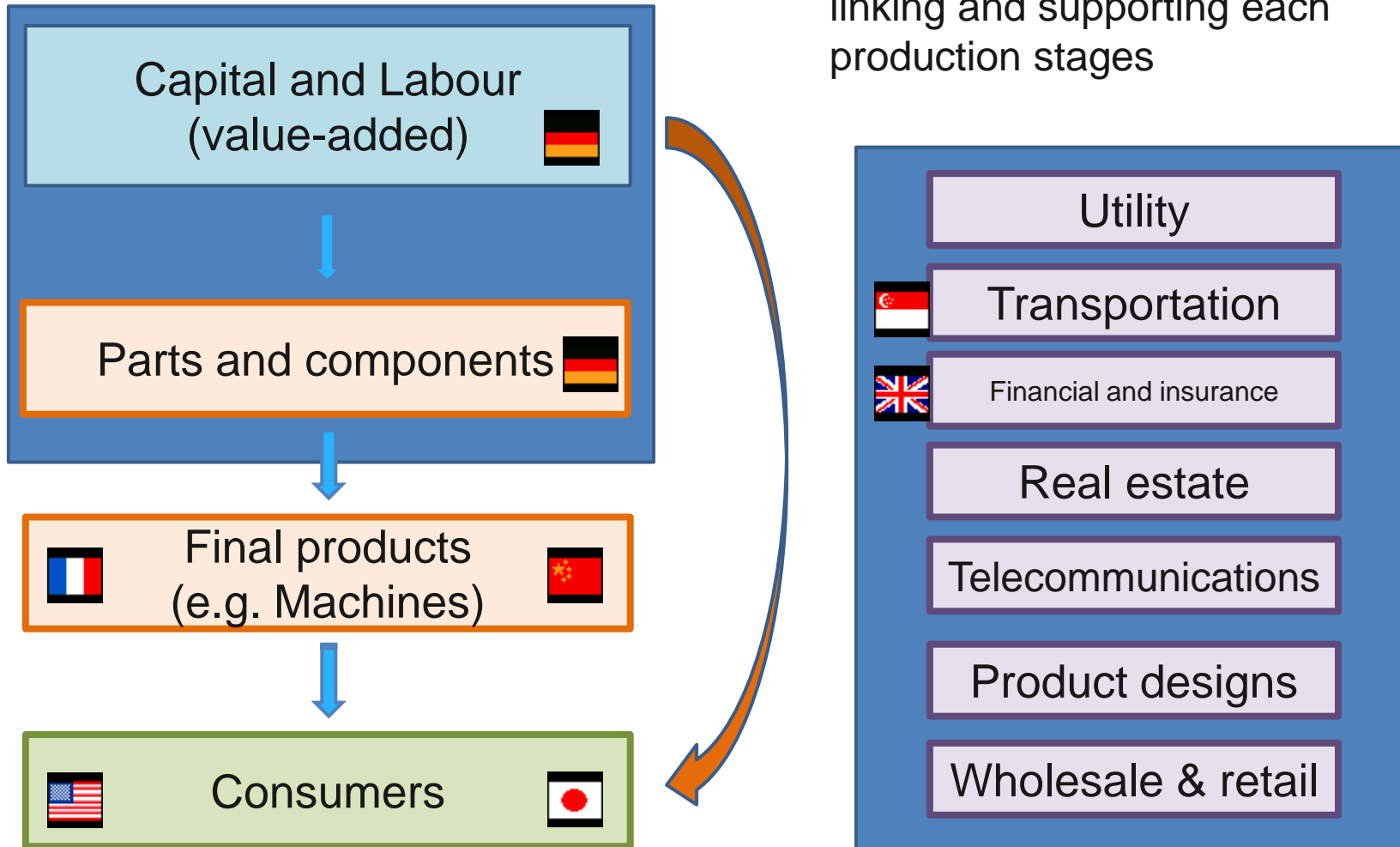
## Import matrix in c.i.f.

	Intermediate demand		Personal expenditure	Other final expenditures	Re-exports	Imports cif
	ind 1	ind 2				
Product p1: Goods	$ZM_{11}+TMZ_{11}$	$ZM_{12}+TMZ_{12}$	$HCM_1+TMHC_1$	$FEM1+TMFE1$	$REX1+TMREX1$	$IM1+TM1$
Product p2: Services	$ZM_{21}+TMZ_{21}$	$ZM_{22}+TMZ_{22}$	$HCM_2+TMHC_2$	$FEM2+TMFE2$	$REX2+TMREX2$	$IM2+TM2$



# International production networks

Business service activities are linking and supporting each production stages





# OECD2015 approach

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- Institutional long-term
- Official I-O data used for all countries
- Benchmarked to National Accounts (exports, imports and value-added)
- Benchmarked to Balance of Payment
- Allocation trade by end-use categories
- Re-exports adjustment
- Rest of the world (closed model)

## *New features*

- *Non-resident expenditures (tourism)*
- *Explicit linkage between goods and distribution*



# Trade flows in Inter-country I-O

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- Inter-country transactions are valued at basic price by industry
- Exports = Imports !
- Exports goods bp = SNA exports in goods fob pu + inbound TSA pu (goods) - distribution services - tax less subsidy margins (exporter) - reimports - reexports
- Exports services bp = SNA exports in services fob pu - inbound TSA pu (goods) + distribution services + tax less subsidy margins (goods)

Note: SNA: National Accounts, pu : purchasers' prices, bp: basic price, TSA: tourism satellite account



## Coverage, 1995- 2011

OECD	All OECD 34 countries
BRIICS	Brazil, China, India, Indonesia, Russian Federation, South Africa
Other EU28	Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, Romania
Other G20	Argentina, Saudi Arabia
Other South Eastern Asia	Brunei Darussalam, Cambodia, Malaysia, Philippines, Singapore, Thailand, Viet Nam
Other Eastern Asia	Chinese Taipei, Hong Kong China
Other	Columbia, Costa Rica, Tunisia, RoW
Region groups	OECD, Non-OECD, APEC, ASEAN, EasternAsia, EU28, EuroArea, NorthAmerica, etc

Covers 38 countries of Top40 steel exporters in 2011



# Industry list

Agriculture, Mining	Agriculture [01T05], Mining [10T14]	
Manufacturing (16)	Food products [15T16], Textiles & apparel[17T19] Wood [20] Paper print publishing [21T22] Coke, petroleum[23] Chemicals[24] Rubber & plastics[25] Non-metallic minerals[26]	<b>Basic metals[27]</b> Fabricated metals[28] Machinery [29] ICT & electronics [30,32,33] Electrical machinery [31] Motor vehicles [34] Other transport [35] Other manufacturing [36T37]
Utility and Construction	Utilities [40T41] Construction [45]	
Business services for industry and households (9)	Wholesale & retail [50T52] Hotels & restaurants [55] Transport & storage [60T63] Post & telecoms [64] Finance & insurance [65T67]	Real estate [70] Renting of machinery [71] IT services [72] Other business services [73,74]
Community services	Public admin [75]; Education [80]; Health [85];	Other services [90T93]; Private households [95]



# International standard classification (industry/product/consumption)

## Detailed structure and explanatory notes

### ISIC Rev.3

(International Standard Industrial Classification of All Economic Activities, Rev.3)

Click on any

- [A](#) - Ag
- [B](#) - Fis
- [C](#) - Mit
- [D](#) - Ma

## Correspondence between ISIC Rev.4 and ISIC Rev.3.1

The following table shows the links between the selected classifications. In case of a partial link, the detail column specifies the portion of the ISIC Rev.3.1 code that is linked to the ISIC Rev.4 code. Comments, such as changes after ISIC Rev.3.1, are shown in the detail column. Click on any link to go to the definition of that part of the ISIC Rev.3.1 code.

737 records found

ISIC Rev.4	ISIC Rev.3.1	Part	Detail
<a href="#">0111</a>	<a href="#">0111</a>	*	
<a href="#">0112</a>	<a href="#">0111</a>	*	
<a href="#">0113</a>	<a href="#">0111</a>	*	Growing of
	<a href="#">0112</a>	*	Production of fruit bearing
<a href="#">0114</a>	<a href="#">0111</a>	*	
<a href="#">0115</a>	<a href="#">0111</a>	*	
<a href="#">0116</a>	<a href="#">0111</a>	*	
<a href="#">0119</a>	<a href="#">0111</a>	*	Growing of
	<a href="#">0112</a>	*	Growing of
<a href="#">0121</a>	<a href="#">0113</a>	*	
<a href="#">0122</a>	<a href="#">0113</a>	*	
<a href="#">0123</a>	<a href="#">0113</a>	*	

## Detailed structure and explanatory notes

Notes

### COICOP

(Classification of Individual Consumption According to Purpose)

Click on any code to see more detail. Click [here](#) for top level only.

- [01-12](#) - Individual consumption expenditure of households
- [01](#) - Food and non-alcoholic beverages
  - [01.1](#) - Food
  - [01.2](#) - Non-alcoholic beverages
- [02](#) - Alcoholic beverages, tobacco and narcotics
  - [02.1](#) - Alcoholic beverages
  - [02.2](#) - Tobacco
  - [02.3](#) - Narcotics
- [03](#) - Clothing and footwear
  - [03.1](#) - Clothing
  - [03.2](#) - Footwear
- [04](#) - Housing, water, electricity, gas and other fuels
  - [04.1](#) - Actual rentals for housing
  - [04.2](#) - Imputed rentals for housing
  - [04.3](#) - Maintenance and repair of the dwelling
  - [04.4](#) - Water supply and miscellaneous services relating to the dwelling
  - [04.5](#) - Electricity, gas and other fuels
- [05](#) - Furnishings, household equipment and routine household maintenance
  - [05.1](#) - Furniture and furnishings, carpets and other floor coverings
  - [05.2](#) - Household textiles



# Data sources for OECD Inter-country inter-industry model

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## Data sources

- Supply-use and Input-Output tables (National sources/ Eurostat / Asian Dev Bank)
- Bilateral trade statistics for goods and services (OECD / UNSD)
- National Accounts: main aggregate and satellite account(National, OECD, UNSD)
- Balance of Payments (National / IMF)

## Intermediate analytical data products at OECD

- Harmonised SUT / symmetric Input-Output tables (OECD I-O)
- Bilateral Trade Database by Industry and by End-use for goods (BTDIxE)
- Sectoral Value-Added, Output, Employment(STAN)
- Harmonised Bilateral Trade in Services (OECD-WTO)
- Adjusted National Accounts (currency, non-resident expenditures and re-exports)

## Additional information

- Employment / Educational attainment / Occupation
- Energy consumption ie co2 emissions



# Data source availability: National Accounts

	###	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AUS	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX	SNX
AUT																	D
BEL																	
CAN																	
CHL	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND
CZE																	
DNK																	
EST																	
FIN																	
FRA																	
DEU																	
GRC	S	S	S	S	S												
HUN																	
ISL																	
IRL																	
ISR																	
ITA																	
JPN	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
KOR																	
LUX																	
MEX	S	S	S	S	S	S	S	S									
NLD																	
NZL	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
NOR																	
POL																	
PRT																	
SVK																	
SVN																	
ESP																	
SWE																	
CHE																	D
TUR	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
GBR																	
USA	S	S	S														
	###	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
ARG	SND	SND	SD	SD	SND	SND	SND	SND	SD	SND	SND	SND	SND	SND	SND	SND	SND
BGR	SD	SD	S														SD
BRA	SD	SD	SD	SD	SD												SD
BRN		TD	TD	SD	SD	TD		SD		SD	SD	SD	TD	TD		TD	TD
CHN	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX	SNDX
COL																	
CRI	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CYP	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
HKG	S	S	S	S	S	S	S	S	S	S	S	SN	SN	SN	SN	SN	SN
HRV	D	D	D	D										D	D	D	D
IDN	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND
IND	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
KHM	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX	DVX
LTU	S	S	S	S	S	S	S	S								S	S
LVA																	
MLT	SND	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
MYS	SD	SD	SD	SD	SD	S	S	S	S	S	S	S	S	S	S	S	SN
PHL	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND	SND
ROU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RUS																	
SAU	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
SGP	T	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
THA	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
TUN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TVN	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VNM	D	SD	SD	SD	SD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZAF	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

- S Subsidies on products are merged with taxes on products
- N Separate figures for NPISH is NOT available
- T Both taxes and subsidies on products are NOT available
- D Direct purchases of non-residents expenditure is not available
- V Sectoral value-added (more than 6 sectors)
- X Sectoral Output (more than 6 sectors)



# Data source availability: Supply and Use Tables

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
AUS	..	..	..	..	..	..	ps	..	..	pm	pm	pm	pm	pm	..	..	..
AUT	p	..	p	..	p	p	p	p	p	p	p	p	p	p	p	p	..
BEL	p	..	p	..	p	p	p	p	p	p	p	p	p	p	p	p	..
CAN	..	..	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p
CHL	..	ps	..	..	..	..	..	..	ps	..	..	..	..	p	p	p	..
CZE	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
DNK	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
EST	..	..	p	..	..	p	p	p	p	p	p	p	p	p	p	p	..
FIN	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
FRA	p	..	p	..	p	p	p	p	p	p	p	p	p	p	p	p	..
DEU	p	..	p	..	p	p	p	p	p	p	p	p	p	p	p	p	..
GRC	..	..	..	..	..	p	p	p	p	p	p	p	p	p	p	p	p
HUN	..	..	..	p	p	p	p	p	p	p	p	p	p	p	p	p	..
ISL	..	..	..	..	..	..	..	..	ps	..	..	..	..	..	..	..	..
IRL	..	..	..	ps	..	ps	p	p	p	p	p	p	p	p	p	p	..
ISR	p	..	..	..	..	..	..	..	ps	..	pb	..	..	..	..	..	..
ITA	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
JPN	r	..	..	..	..	r	..	..	..	..	r	..	..	..	..	..	..
KOR	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	bs	bs
LUX	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps
MEX	..	..	..	..	..	..	..	..	ps	..	..	..	..	ps	..	..	..
NLD	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
NZL	..	..	..	..	..	..	..	..	..	..	..	..	ps	..	..	..	..
NOR	..	..	..	..	..	..	p	ps	ps	ps	ps	ps	ps	..	ps	ps	ps
POL	..	..	..	..	..	p	p	p	p	p	p	p	p	p	p	p	..
PRT	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
SVK	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
SVN	..	p	..	..	..	p	p	p	p	p	p	p	p	p	p	p	..
ESP	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
SWE	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
CHE	..	..	..	..	..	..	ps	..	..	p	..	..	ps	..	..	..	..
TUR	..	p	..	p	..	..	..	p	..	..	..	..	..	..	..	..	..
GBR	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
USA	r	..	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r
ARG	..	..	p	..	..	..	..	..	p	..	..	..	..	..	..	..	..
BGR	..	..	..	..	..	p	p	p	p	p	p	p	p	p	p	p	..
BRA	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	..	..	..	..
BRN	..	..	..	..	..	..	..	..	ps	..	..	ps	..	..	..	..	..
CHN	..	..	ps	..	..	..	..	ps	..	..	..	ps	..	..	..	..	..
COL	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
CRI	..	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p
CYP	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	..
HKG	..	..	..	..	..	..	..	..	..	r	..	..	..	..	..	..	..
HRV	..	..	..	..	..	..	..	..	p	p	..	..	..	..	..	..	..
IDN	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
IND	..	..	..	ps	..	..	..	..	p	..	..	p	p	..	..	..	..
KHM	..	..	..	..	..	..	..	..	..	ps	..	..	..	..	..	..	..
LTU	..	..	..	..	..	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps	ps
LVA	..	p	..	p	..	..	..	..	p	..	..	p	p	p	p	p	..
MLT	..	..	..	..	..	p	p	..	p	..	..	..	p	..	..	..	..
MYS	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	pm
PHL	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ROU	..	..	..	..	..	p	..	..	p	p	p	p	p	p	p	p	..
RUS	ps	..	..	ps	ps	ps	ps	..	ps	ps	..	ps	..	..	..	..	..
SAU	..	..	..	..	..	..	..	..	pm	pm	pm	pm	pm	..	..	..	..
SGP	..	..	..	..	..	..	..	..	..	..	pm	..	pm	..	..	..	pm
THA	r	..	..	mm	..	r	..	..	..	..	r	..	..	..	..	..	..
TUN	..	..	..	..	..	..	..	..	..	..	..	..	..	..	p	p	..
TWN	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
VNM	..	..	..	..	..	..	..	..	..	..	..	ps	..	..	..	..	..
ZAF	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..



# Development of ICIO and publishing analytical results

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- Collection of data sources
- Harmonisation of main aggregate components of National Accounts
- Harmonisation of national SUTs
- Domestic and import matrices
- Bilateral trade partner shares
- Development of IC-Use and ICIO
- Introducing heterogeneity within economy
- Indicator calculations
- Dissemination



## Software and computing environment used to compile ICIO system

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- National Accounts constraints: EXCEL, R
- IO/SNA Data source cleaning / collection: EXCEL, R, Access
- Bilateral trade (goods): SQL, SAS, R
- Bilateral trade (services): STATA, EXCEL
- SUT balancing : R



# Balancing procedure of inter-country use table

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- Balance international flows in pu price
- Stage 1: Reconciliation of sectoral exports and imports
  - Sum of total exports of goods and services of all countries matches total imports
- Stage 2: Reconciliation of national import tables using adjusted trade vectors and national accounts constraints
- Stage 3: Linking national import table with bilateral trade coefficients
- Stage 4: Convert international use at pu price to bp price i.e. distribution



# National Accounts constraints

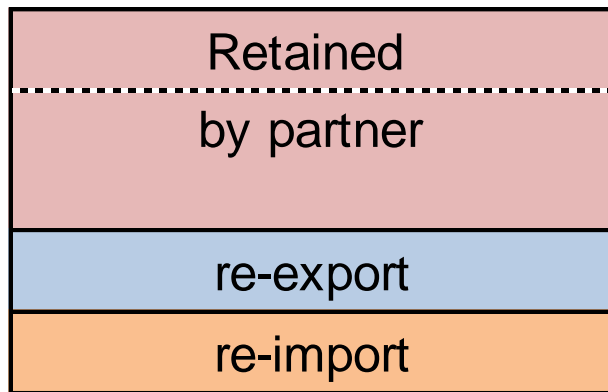
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- SNA93 system
- Exports/imports by goods and services  
OECD /UNSD/TWN 170+ countries
- Direct purchases
  - SNA final consumption
  - EBOPS travel (236)
  - Tourism satellite account



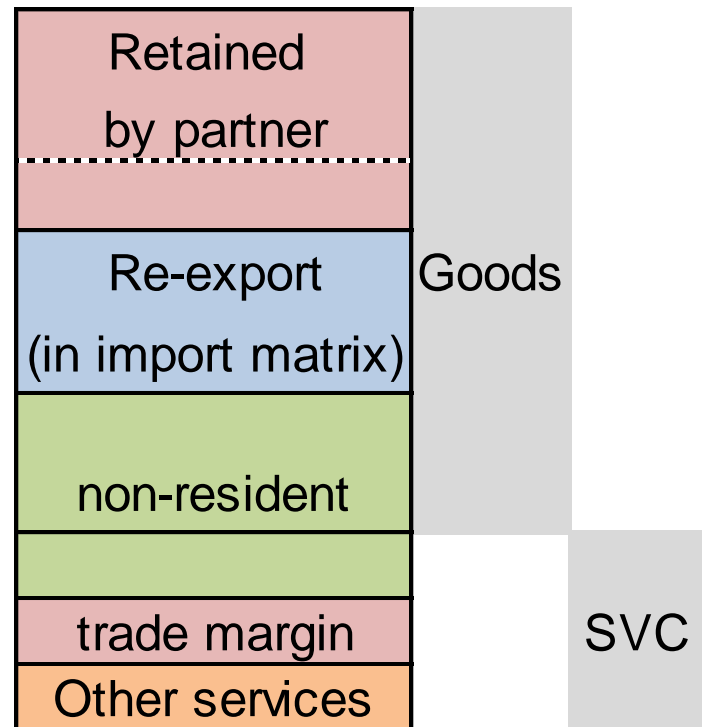
# Adjusting merchandise trade statistics to SNA framework (goods exports)

Merchandise trade (fob)



goods

SUT / IO / NA export





## International use > > > inter-country IO

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- Combining balanced international use table , national inter-industry domestic table
- Combining Supply table and Intl Use table
- Split firm heterogeneity (MEX, CHN)



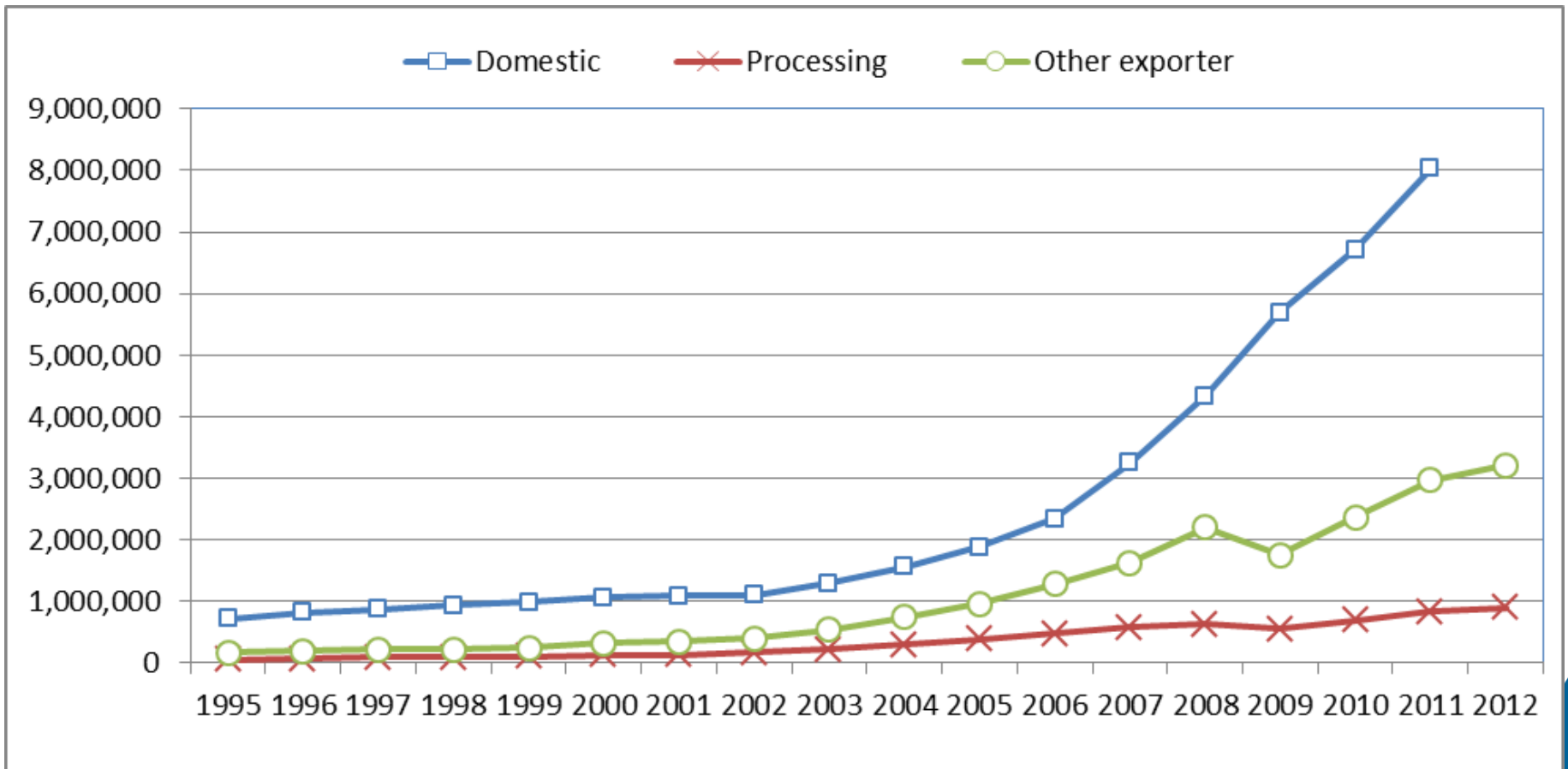
# Heterogeneity within manufacturing industry and other extensions

---

- China (Domestic/Processing/Other)
  - 2007 DPN I-O (CAS,NBS,Customs,MOFCOM)
  - Balance of Payment
  - Customs merchandise trade statistics (processing / non-processing)
- Mexico (Global Manuf/Non-GM)
  - 2008 Global manufacturing IO (INEGI)
  - Balance of Payment
  - Maquiladoras
- eSUT project
  - Proof of concept first estimates (USA, JPN, CRI)
- Other dimensions: regions, firm size

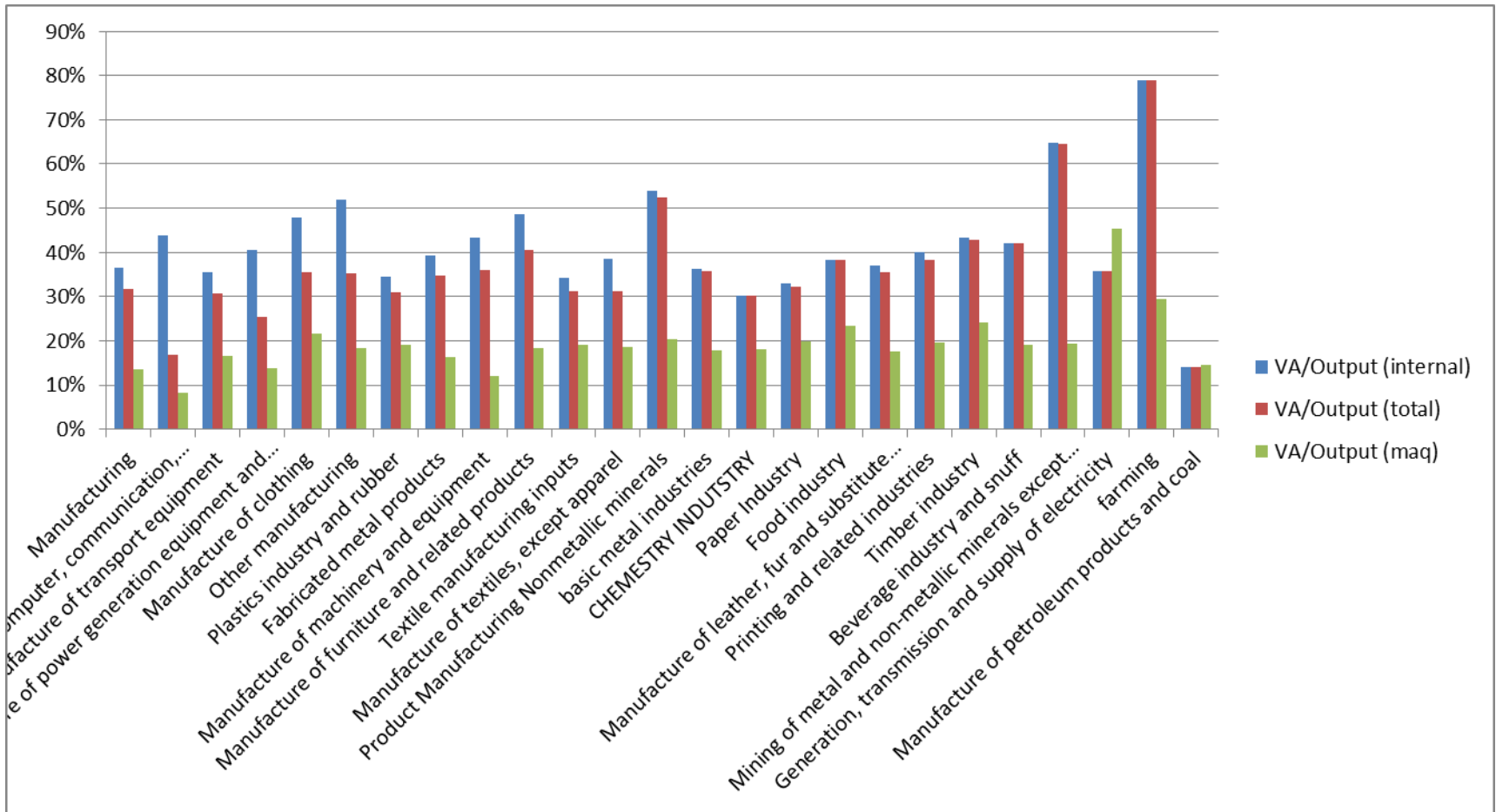


# China: Domestic/Processing/Other (manufacturing output, 1995-2011, USD Million)



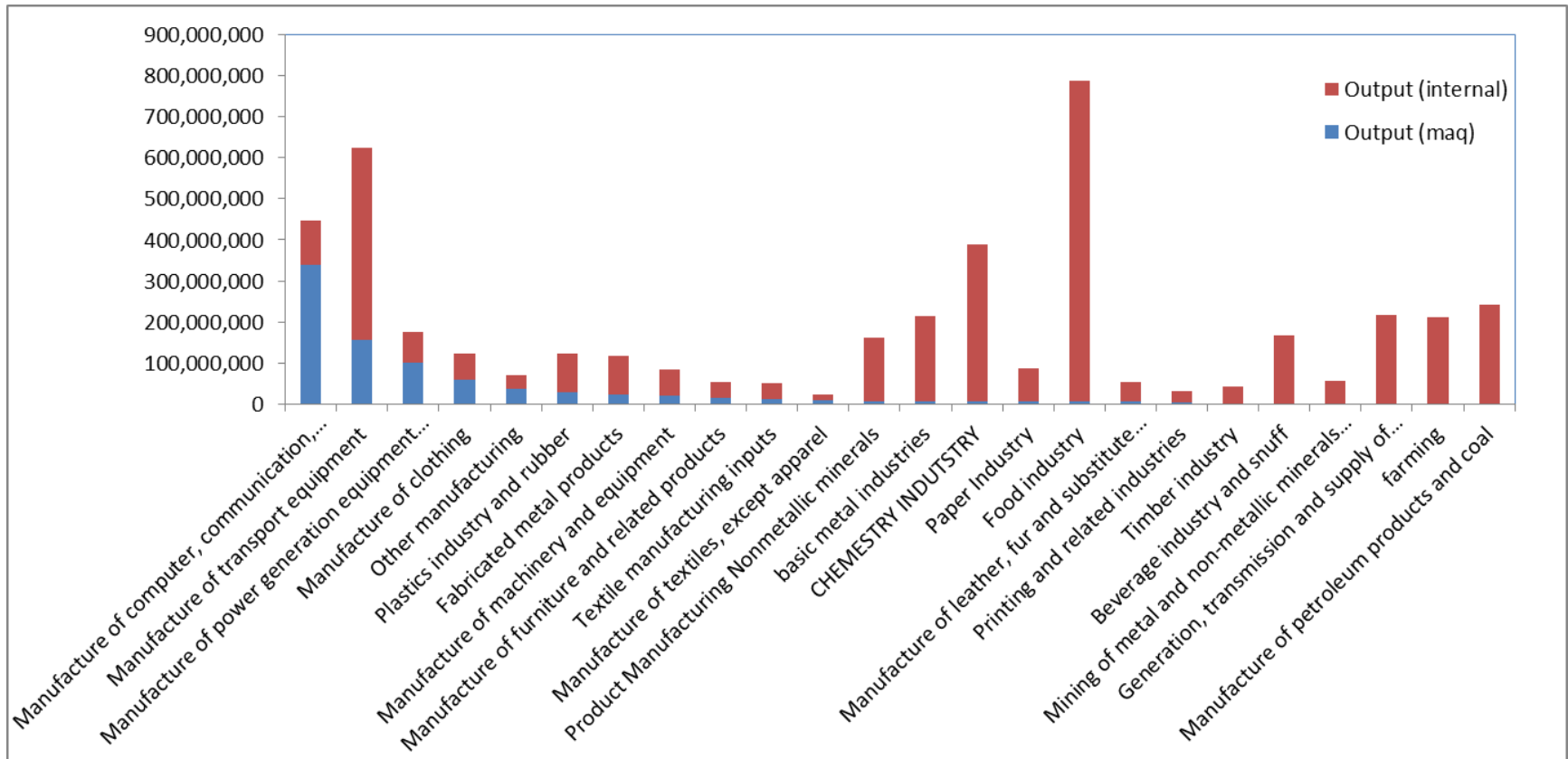


# Value added / output ratio (Mexico, 2003)





# Shares of maquiladora production in total output (mexico 2003)





# Direct purchases (abroad, non-residents)

[ordinary format]

[preferred sectoral info]

	HC_ DOM_ TTL	EXP_ ABR_ NRS	IMP_ DOM_ RES
Prod 1	50	15	20
...	60	10	15
Prod n	100	5	5
Dir.pur resid	22		22
Dir.pur non- resid	-20	+20	
TOTAL	82	50	

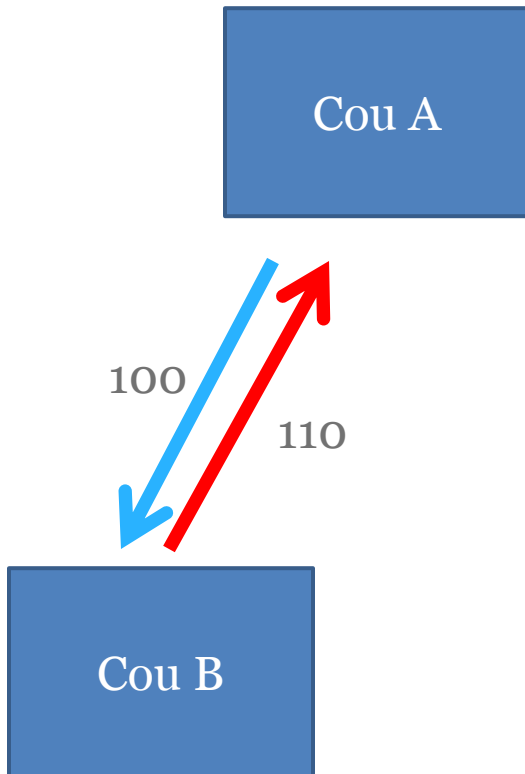
	HC_ DOM_ RES	EXP_ DOM_ NRS	EXP_ ABR_ NRS	IMP_ DOM_ RES	IMP_ ABR_ RES
Prod 1	48	2	15	20	5
...	55	5	10	15	5
Prod n	87	13	5	5	12
Dir.pur resid					
Dir.pur non- resid					
TOTAL	80	20	30	40	22

HC: household consumption, EXP: Exports, IMP: Imports  
 DOM: Domestic territory, ABR: Consumption abroad  
 RES: Residents, NRS: Non-residents, TTL: Total



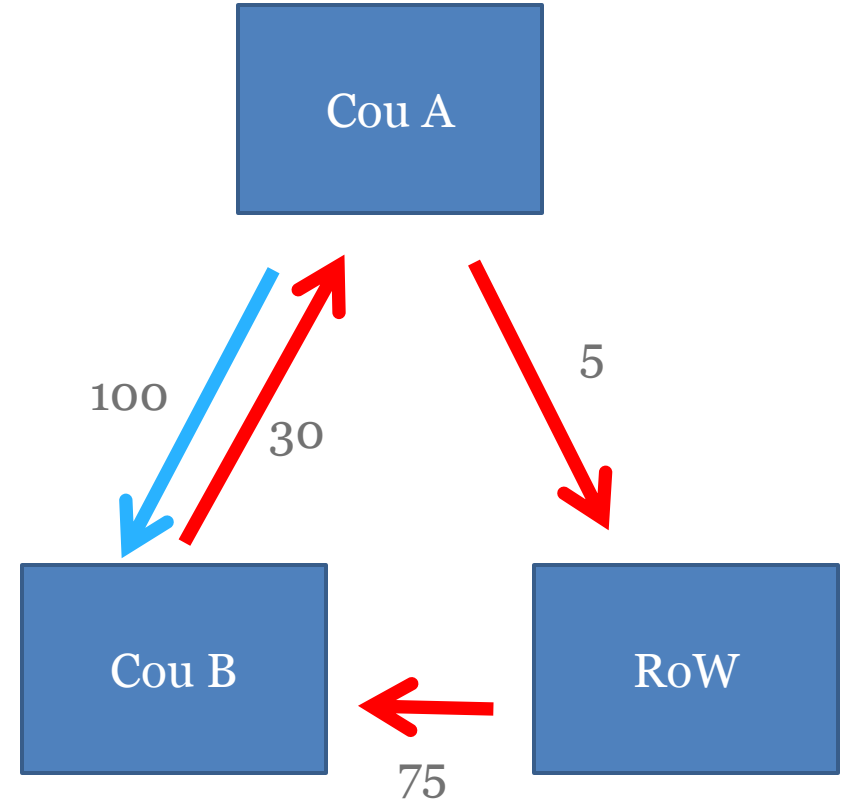
# Gross trade and TiVA flows

## Conventional trade balance



$$\begin{aligned} \text{Gross trade balance A - B} \\ = 100 - 110 = -10 \end{aligned}$$

## TiVA balance



$$\begin{aligned} \text{VA trade balance A - B} \\ = 100 - 30 = 70 \\ \text{Reimports} = 5 / 110 \end{aligned}$$



# Basic ICIO methodology

## Value Added = final demand

- Methodology:

$$\mathbf{VBF} = \begin{bmatrix} \mathbf{V} & \mathbf{B} & \mathbf{F} \end{bmatrix}$$
$$= \begin{bmatrix} \mathbf{VD} & \mathbf{0} \\ \mathbf{0} & \mathbf{VF} \end{bmatrix} \begin{bmatrix} \mathbf{B}_{DD} & \mathbf{B}_{DF} \\ \mathbf{B}_{FD} & \mathbf{B}_{FF} \end{bmatrix} \begin{bmatrix} \mathbf{FDd} & \mathbf{FFd} \\ \mathbf{FDf} & \mathbf{FFf} \end{bmatrix}$$

$\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-1}$  Global Leontief inverse matrix

$\mathbf{VB}$  = Value added multiplier matrix

$\mathbf{F}$  =  $\mathbf{FDd}$ : final demand of dom products by domestic

$c$  = Country

$i$  = Industry



# Global ICIO analysis (TiVA)

VA/Output	Global Leontief	Final demand
$\begin{bmatrix} V_d & 0 \\ 0 & V_f \end{bmatrix}$	$\begin{bmatrix} B_{dd} & B_{fd} \\ B_{df} & B_{ff} \end{bmatrix}$	$\begin{bmatrix} F_{d,d} & F_{d,f} \\ F_{f,d} & F_{f,f} \end{bmatrix}$

- Domestic VA embodied in Foreign demand:  $V_d (B_{dd} * F_{fd} + B_{fd} * F_{ff})$
- Foreign VA embodied in Domestic demand:  $V_f (B_{df} * F_{dd} + B_{ff} * F_{df})$
- V can be any sectoral variables, employment, labour compensation, GHG emissions



# Sample R code for ICIO analysis 1: Korean VA embodied in KoreanFD

```
load('DATA.ICIOeconVA.Rdata') # VA
load('DATA.ICIOeconX.Rdata') # OUTPUT
load('DATA.ICIOeconB.Rdata') # LEONTIEF
load('DATA.ICIOeconFD.Rdata') # FINAL DEMAND
year = 1995
vax<-diag(DATA.ICIOeconVA[year,,]/ DATA.ICIOeconX[year,,]);
vax[is.nan(vax)]<-0
result<-vax%*%DATA.ICIOeconB[year,,]
%*%DATA.ICIOeconFDTTLdisc[year,,"KOR"]
print(round(result[613:646])) # Korean DVA in Korean FD

[1] 26629 1610 8127 5520 940 6168 1925 8320 2244 5761 [11] 7740
3275 8744 8187 3089 8241 2133 2427 7835 49930 [21] 31388 12024
11566 6839 24493 33515 2294 2394 14610 26470 [31] 22205 10390 14301
209
```



# Sample R code for ICIO analysis 2: Korean VA embodied in Foreign FD

```
load('DATA.ICIOeconVA.Rdata') # VA
load('DATA.ICIOeconX.Rdata') # OUTPUT
load('DATA.ICIOeconB.Rdata') # LEONTIEF
load('DATA.ICIOeconFD.Rdata') # FINAL DEMAND
year = 1995
vax<-diag(DATA.ICIOeconVA[year,,]/ DATA.ICIOeconX[year,,]);
vax[is.nan(vax)]<-0
result<-vax%*%DATA.ICIOeconB[year,,] %*%
(rowSums(DATA.ICIOeconFDTTLdisc[year,,]) -
DATA.ICIOeconFDTTLdisc[year,,"KOR"])
print(round(result[613:646])) # Korean DVA in Korean FD
```

```
[1] KOR_C01T05AGR      KOR_C10T14MIN      KOR_C15T16FOD      KOR_C17T19TEX
      3394              796              1029              6275
      KOR_C20WOD      KOR_C21T22PAP      KOR_C23PET          KOR_C24CHM
      203              2290             1097              5340
```



# Sample R code for ICIO analysis 3: Foreign VA embodied in Korean Exports

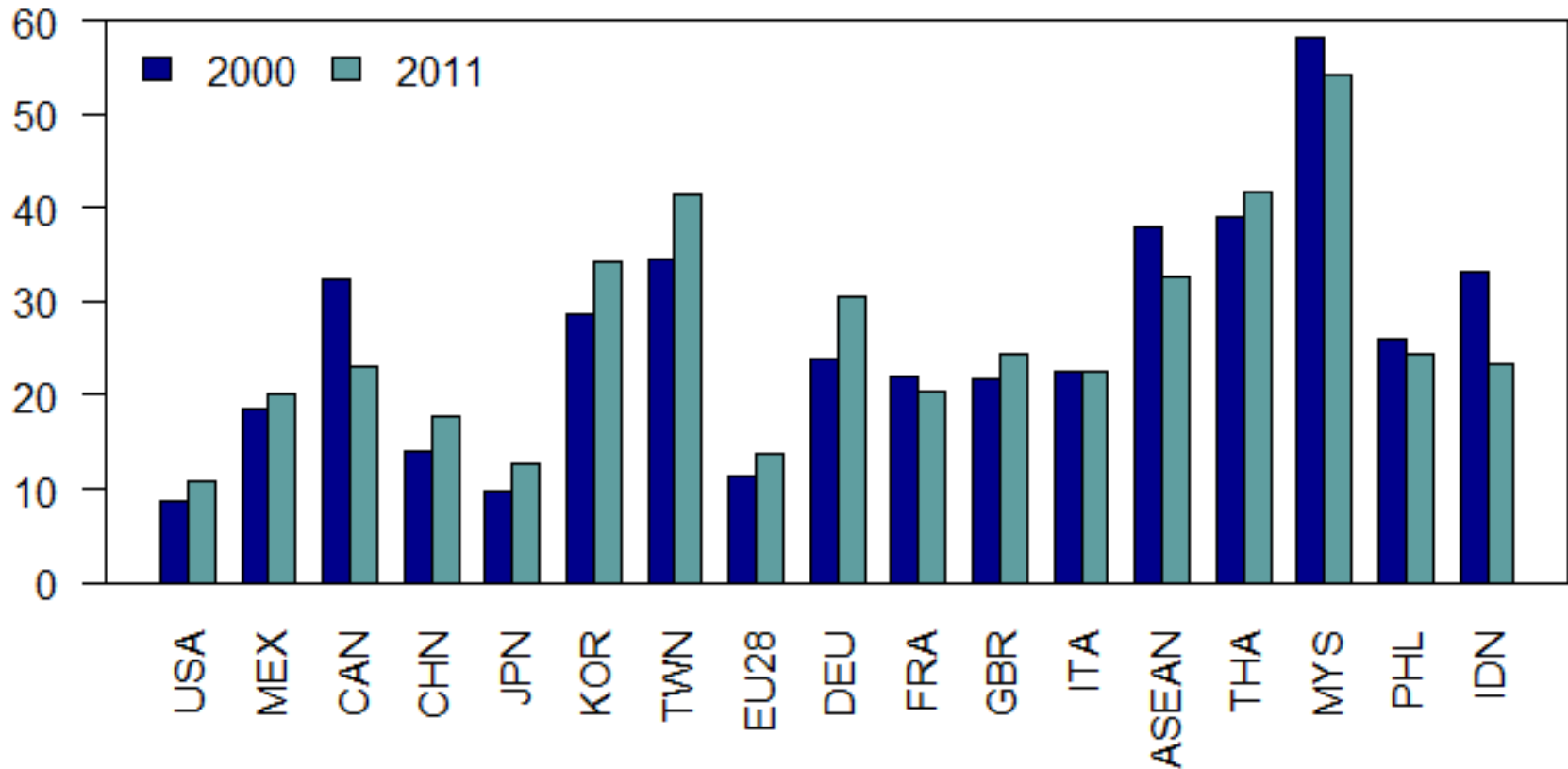
```
load('DATA.ICIOeconVA.Rdata') # VA
load('DATA.ICIOeconX.Rdata') # OUTPUT
load('DATA.ICIOeconB.Rdata') # LEONTIEF
load('DATA.ICIOeconGRTR.Rdata') # EXPORTS OF INT & FD
year = 1995
vax<-diag(DATA.ICIOeconVA[year,,]/ DATA.ICIOeconX[year,,]);
vax[is.nan(vax)]<-0
temp<-DATA.ICIOeconGRTR[1,,1]; temp[]<-0
temp[613:646]<-DATA.ICIOeconGRTR[1,613:646,1]
result<-vax%*%DATA.ICIOeconB[year,,] %*% temp
print(round(result[613:646])) # Korean DVA in Korean FD
```

<i>[1] KOR_C01T05AGR</i>	<i>KOR_C10T14MIN</i>	<i>KOR_C15T16FOD</i>	<i>KOR_C17T19TEX</i>
<i>39</i>	<i>9</i>	<i>13</i>	<i>87</i>
<i>KOR_C20WOD</i>	<i>KOR_C21T22PAP</i>	<i>KOR_C23PET</i>	<i>KOR_C24CHM</i>
<i>3</i>	<i>53</i>	<i>12</i>	<i>101</i>
<i>KOR_C25RBP</i>	<i>KOR_C26NMM</i>	<i>KOR_C27MET</i>	<i>KOR_C28FBM</i>
<i>136</i>	<i>20</i>	<i>83</i>	<i>49</i>



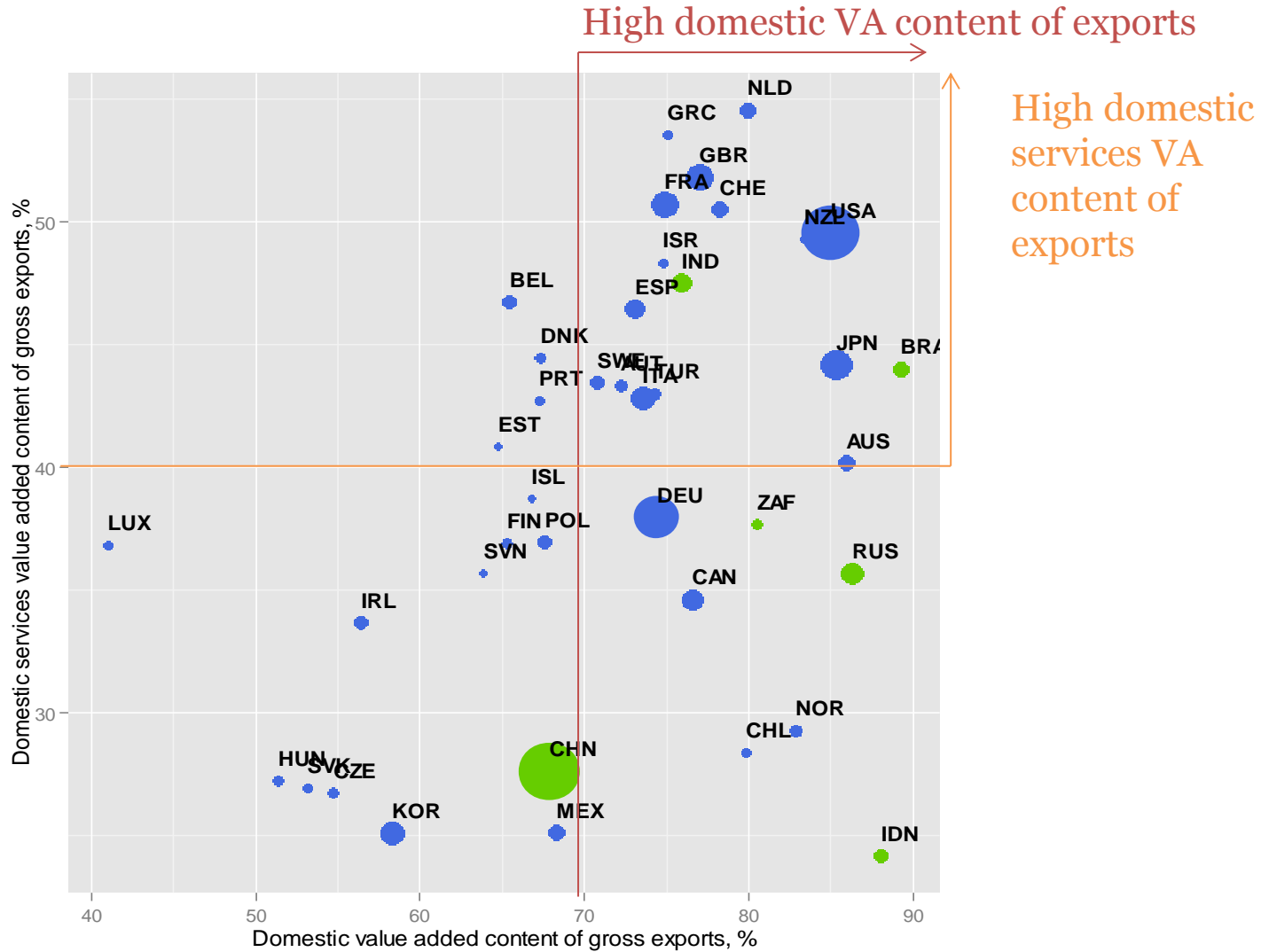
# VA sustained by foreign demand as % of total domestic VA

## DVA in Foreign Demand as % of total DVA





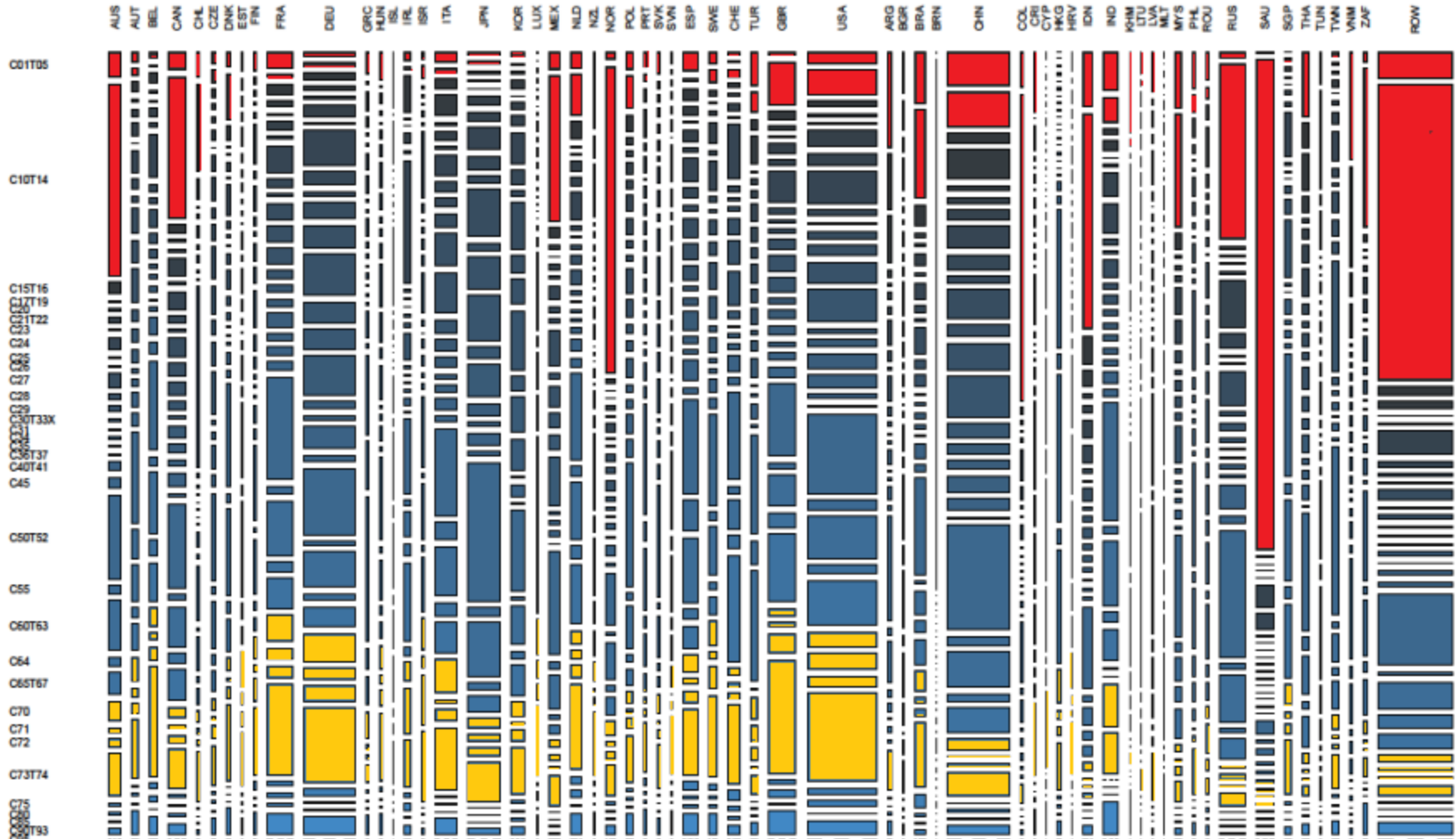
# Services VA content of exports (2009)





# The genome of world trade

Value added in world exports by source country and source industry, 2011



Coefficient = DATA.ICIOeconCVB ; Demand = DATA.ICIOeconGRTR ; Calculation = couSindS  
 ExportCou = WOR ; ExportInd = CTOTAL ; DemandCou = WOR





# Comtrade.un.org : exports, imports, re-exports, and re-imports at HS 6digit

The screenshot shows the UN Comtrade website interface. At the top, there are browser tabs for 'uncomtrade - Google Sea', 'United Nations Statistics', and 'OECD Statistics'. The address bar shows 'comtrade.un.org/db/default.aspx'. The main header features the UN Comtrade logo and the text 'United Nations Commodity Trade Statistics Database | Statistics Division'. A navigation menu includes 'Home', 'My Account', 'Data Query', 'Data Availability', 'Metadata & Reference', 'Subscription & Support', and 'Fast tracks'. Below the navigation menu is a 'Shortcut Query' section with a form for searching by commodity type (Re-Export, Import, Export, Re-Import), country (Germany), and year (recent years). A 'General disclaimer' section is visible, along with a 'Welcome to UN Comtrade!' message. A 'What's New on Comtrade' section mentions a move to Twitter. At the bottom, there is a '2014 Data Availability' section with a pie chart showing a share of 5.76% of World trade value. A table on the right side of the page shows the number of country periods for released data.

**UN comtrade** United Nations Commodity Trade Statistics Database | Statistics Division

Home My Account Data Query Data Availability Metadata & Reference Subscription & Support Fast tracks

Home

Shortcut Query

See the new [beta interface](#)? Take a look and tell us what you think.

Show **Re-Export** of  in the year

from  of  to

in **Re-Export** classification.

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[2014.03.07]UN Comtrade news has moved to twitter: [@UNTradeStats](#) [more...](#)

**Work on IMTS**

- > Methodology IMTS
- > Analytical Tables\*
- > Int.Coop. & Workshops
- > Newsletter\*

\* regularly updated

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**Released data**

	# of country periods
<a href="#">today (2015.11.10)</a>	0
<a href="#">in a week</a>	38
<a href="#">in a month</a>	71
<a href="#">year-to-date</a>	310
<a href="#">in a year</a>	365

**2014 Data Availability**  
(share of World trade value)

n.a.: 5.76%



# HS (0-4) and ISIC/CPA

HS	HS 6-digit	Description	BTDixE	BTDI	BEC	EUC
0	010111	Horses, live pure-bred breeding	C01	D01	41	CAP
0	010119	Horses, live except pure-bred breeding	C01	D01	111	INT
0	010120	Asses, mules and hinnies, live	C01	D01	111	INT
1	010111	Horses, live pure-bred breeding	C01	D01	41	CAP
1	010119	Horses, live except pure-bred breeding	C01	D01	111	INT
1	010120	Asses, mules and hinnies, live	C01	D01	111	INT
2	010110	Live horses/asses/mules/hinnies: pure-bred breeding	C01	D01	41	CAP
2	010190	Live horses/asses/mules/hinnies other than pure-bred breeding	C01	D01	111	INT
3	010110	Live horses/asses/mules/hinnies: pure-bred breeding	C01	D01	41	CAP
3	010190	Live horses/asses/mules/hinnies other than pure-bred breeding	C01	D01	111	INT
4	010121	Live animals // Live horses, asses, mules and hinnies	C01	D01	41	CAP
4	010129	Live animals // Live horses, asses, mules and hinnies	C01	D01	111	INT
4	010130	Live animals // Live horses, asses, mules and hinnies	C01	D01	111	INT
4	010190	Live animals // Live horses, asses, mules and hinnies	C01	D01	111	INT
0	010210	Bovine animals, live pure-bred breeding	C01	D01	41	CAP
0	010290	Bovine animals, live, except pure-bred breeding	C01	D01	111	INT
1	010210	Bovine, live pure-bred breeding	C01	D01	41	CAP
1	010290	Bovine, live except pure-bred breeding	C01	D01	111	INT
2	010210	Live bovine animals: pure-bred breeding animals	C01	D01	41	CAP



## BTDIxE end-use categories

---

- **3 main end-use categories**

- Intermediate inputs
- Household consumption
- Capital goods

- **6 mixed end-uses**

- packed medicaments
- personal computers
- passenger cars
- phones (fixed and mobile)
- Valuables
- fuel

+ other n.e.c

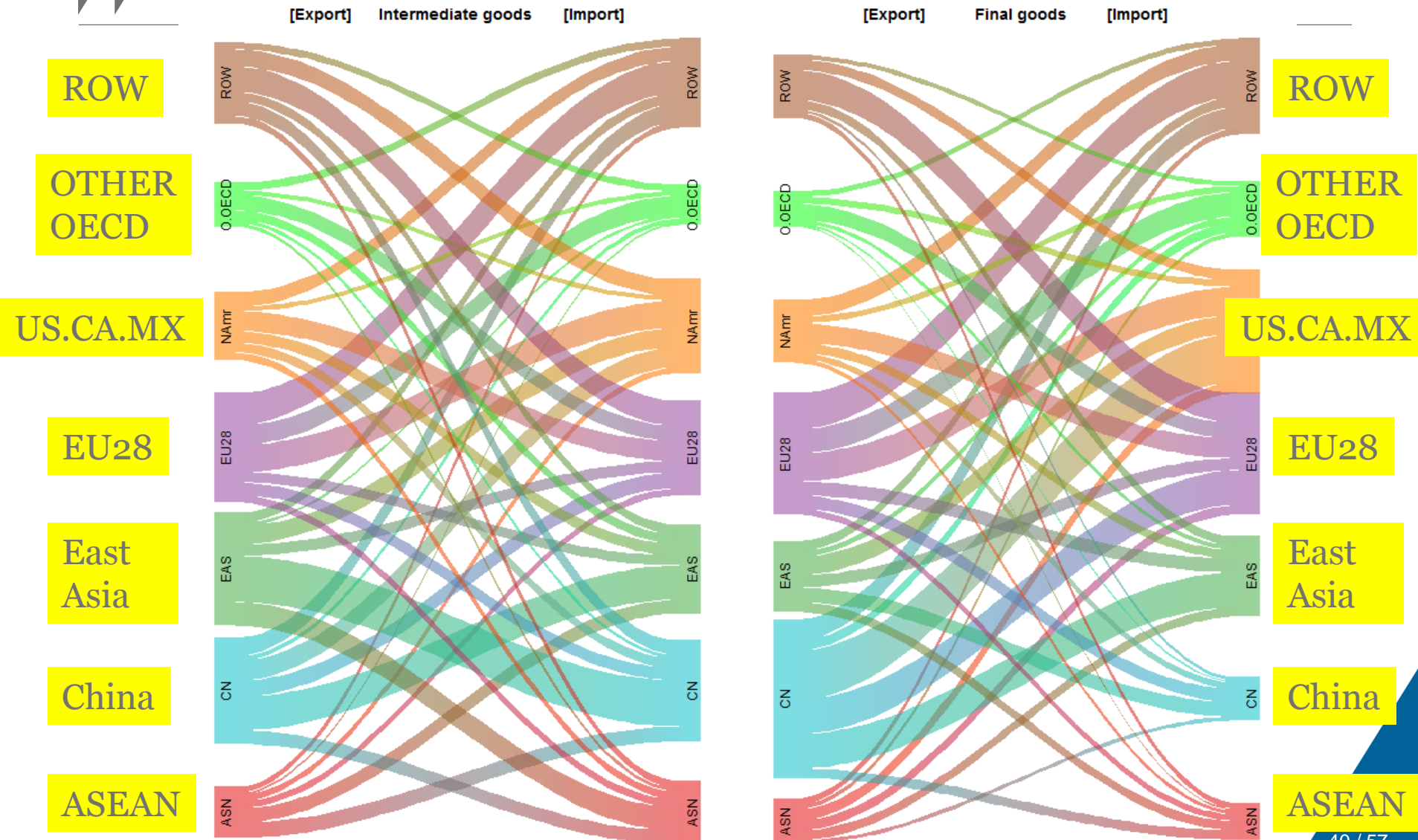
### Data sources

- Un comtrade (6dgt)
- National (8-10dgt)

Reported HS-EUC  
concordance



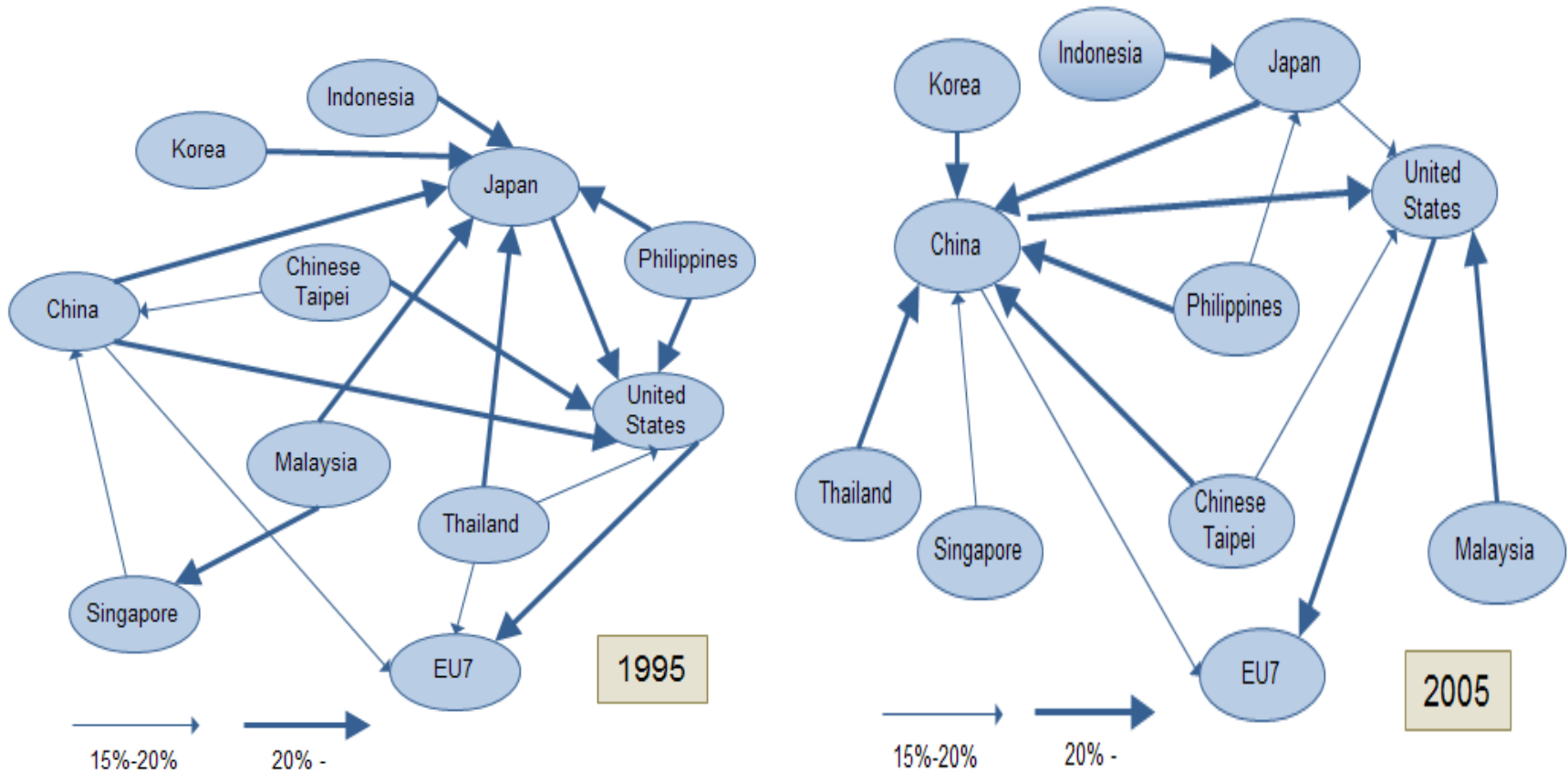
# Trade flows of intermediate and final goods(2013)



Source: OECD BTDIKE June 2015, import flows

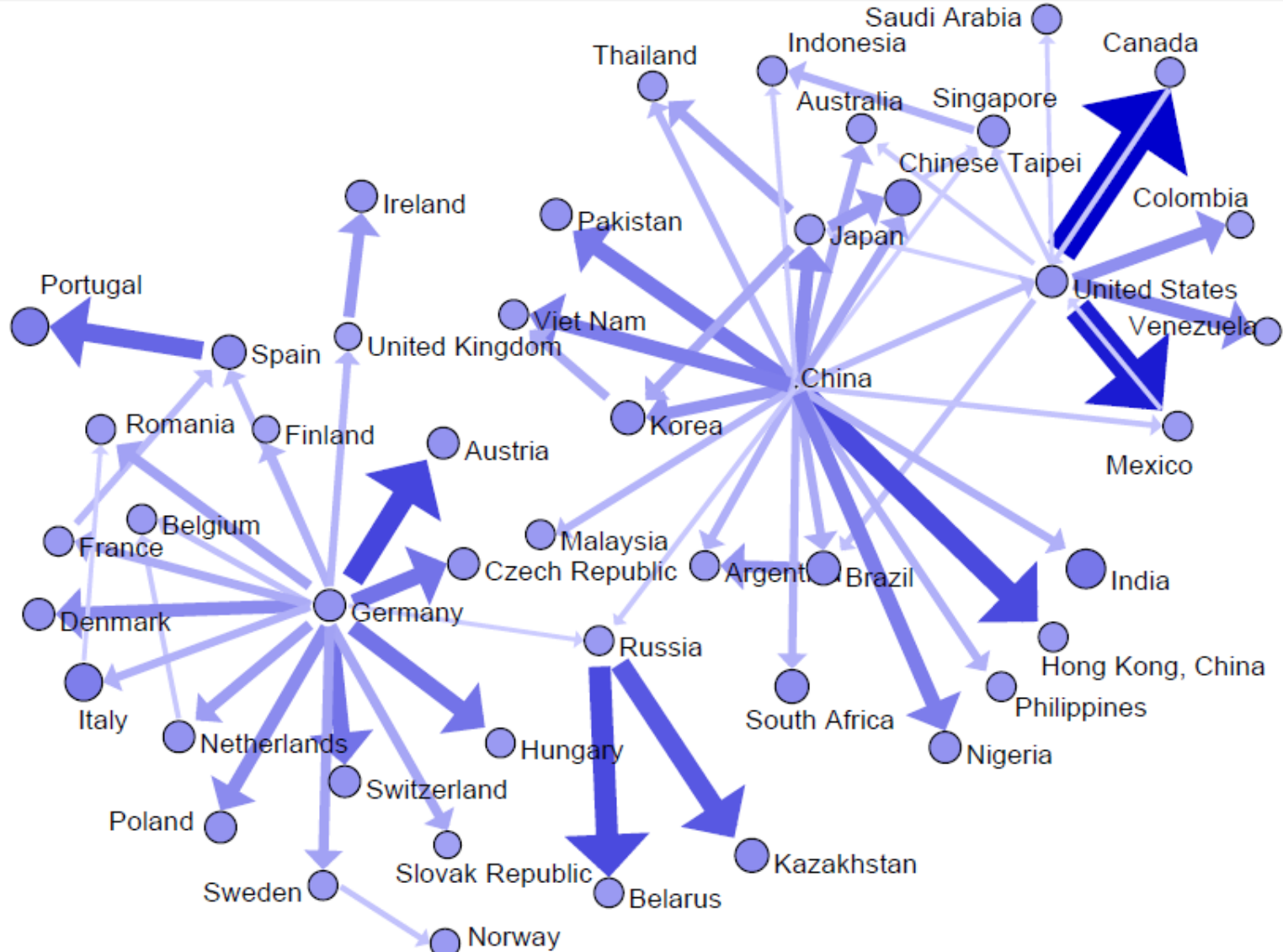


# Manufacturing intermediate demand hubs (10%, 12%, 15% > total imports)



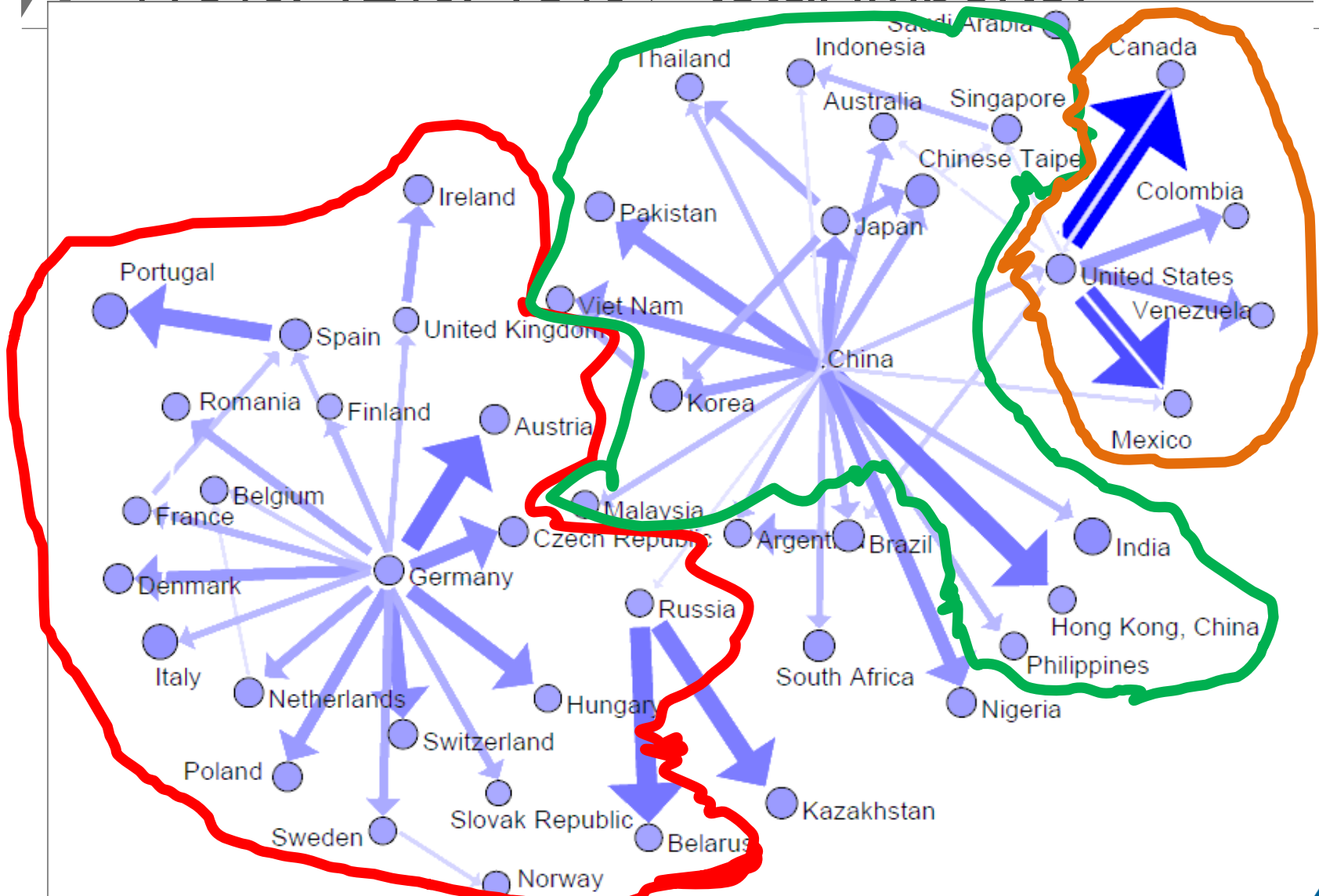
Arrows indicate export flows of countries dominantly supply to a country as Export destination.

# Manufacturing intermediate supply hubs (10%, 12%, 15% > total imports)



Source: OECD BTDIXE June 2015

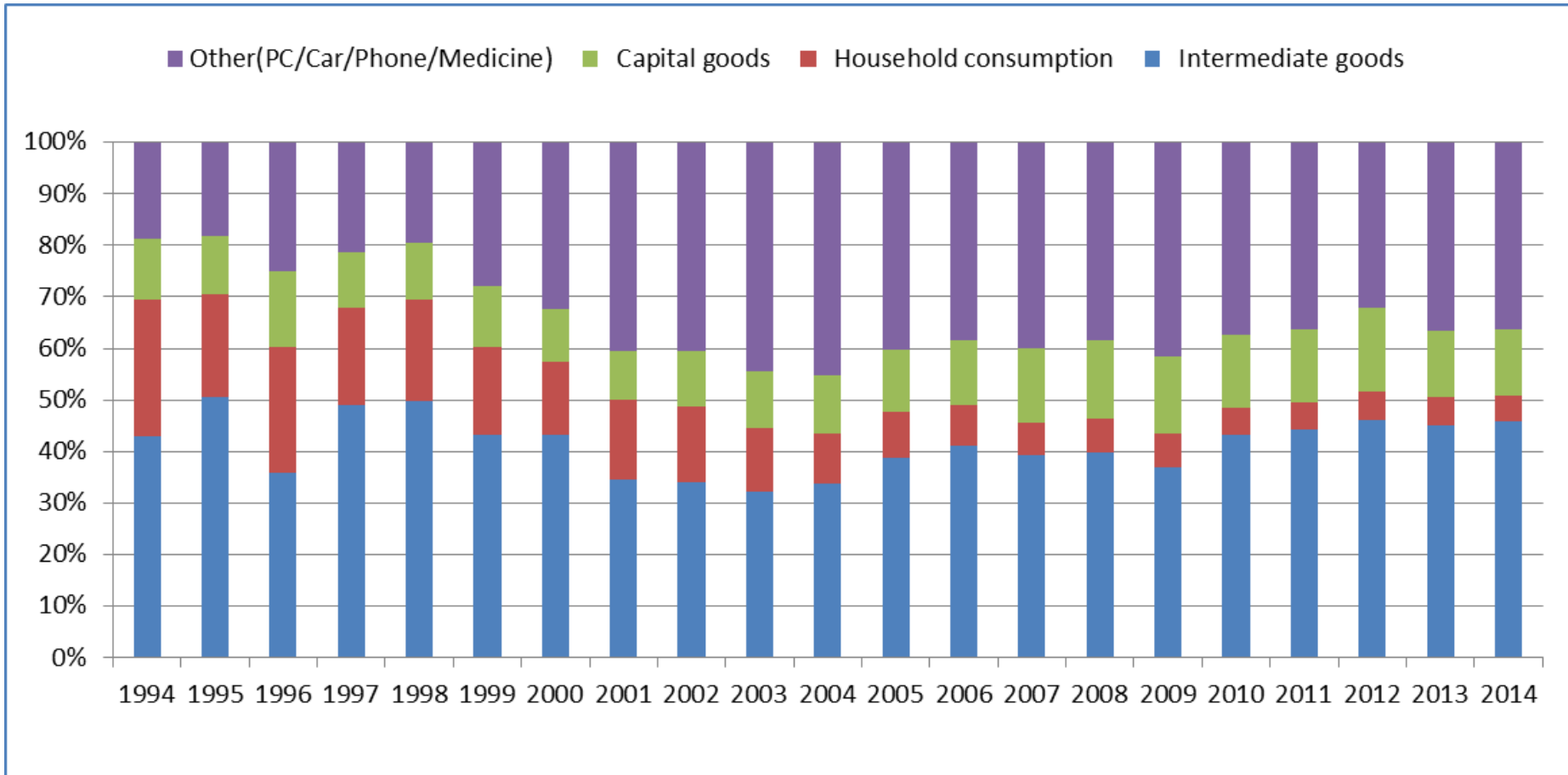
# Manufacturing intermediate supply hubs (10%, 12%, 15% > total imports)



Source: OECD BTDIXE June 2015

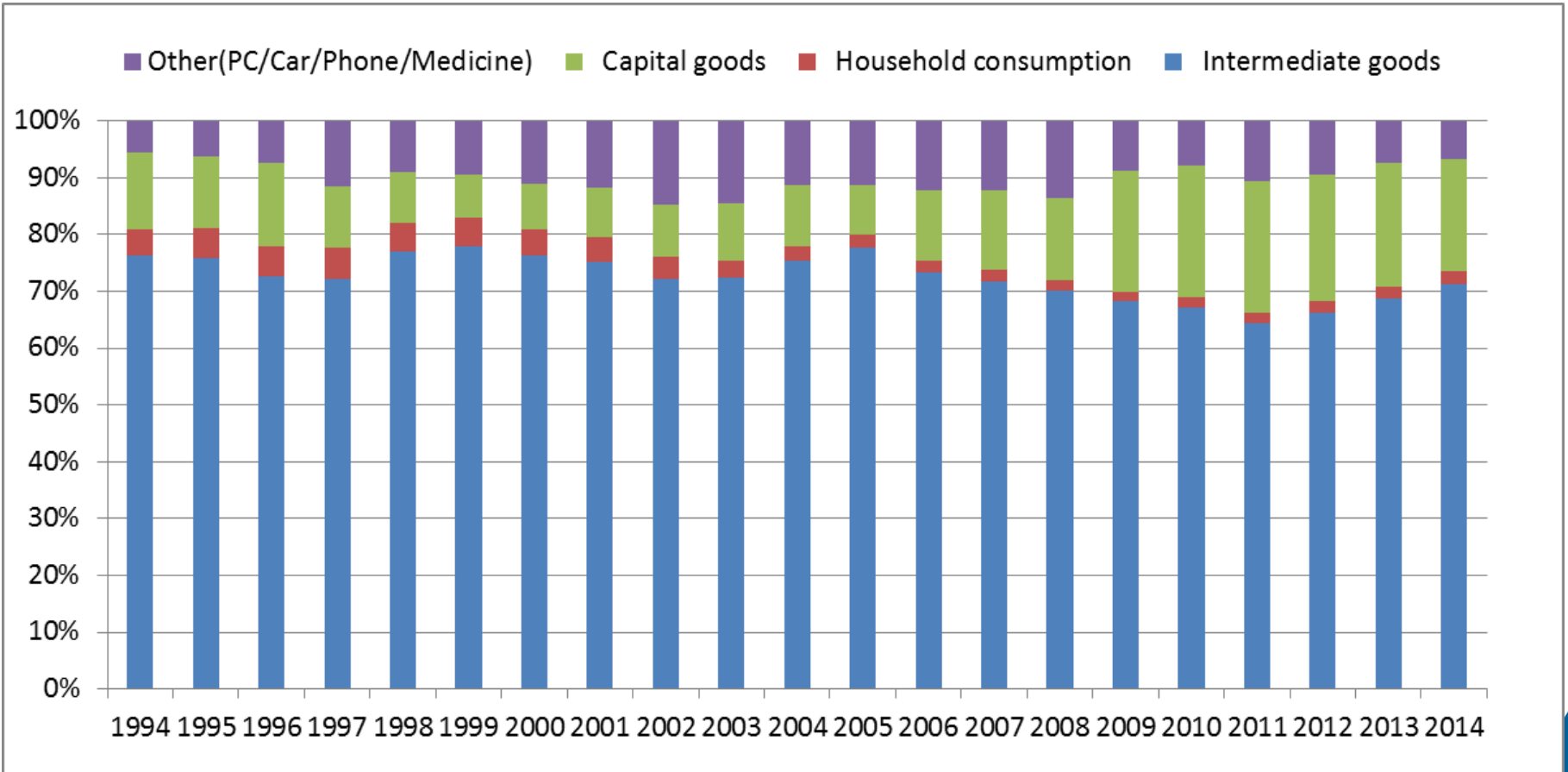


# KOR exports to USA (total goods)





# KOR exports to CHN (total goods)





# TiVA Korea Country Note (key findings)

---

[http://www.oecd.org/sti/ind/tiva/CN\\_2015\\_Korea.pdf](http://www.oecd.org/sti/ind/tiva/CN_2015_Korea.pdf)

- Korea is highly integrated within global value chains, with the highest share of foreign content (41.6%) of exports in 2011 in the G20, a near doubling over the last two decades.
- Integration within Factory Asia drives Korea's value chains, with China being by far the most significant importer of Korea's exports of intermediates in value-added terms in 2011, accounting for 37.1% of the total. However, the United States still imported over 10% of all Korea's intermediate exports in value-added terms in 2011.
- Over half of all of Korea's intermediate imports in 2011 were destined for use in producing exports, with shares of up to two-thirds in products used in key export industries such as ICT & electronics and Motor Vehicle (parts and components).
- However the service content of Korea's manufactured exports was the second lowest in the OECD in 2011, lagging behind only Chile (a significant exporter of refined copper).



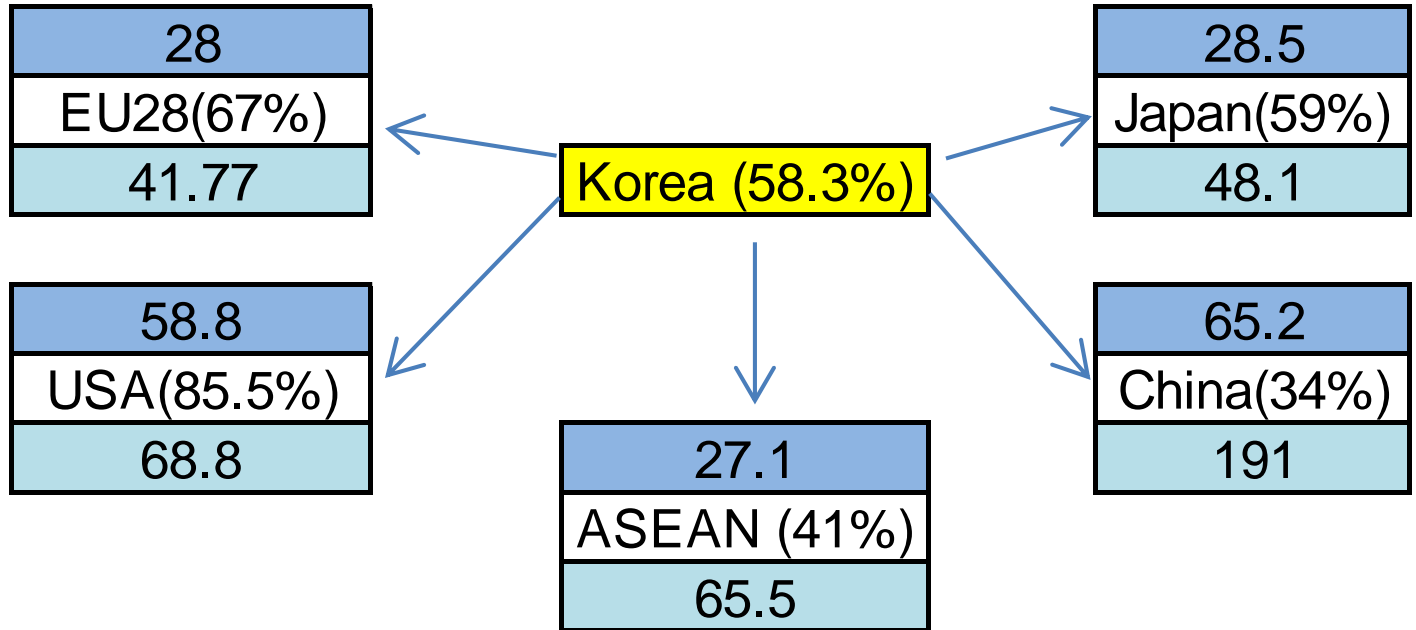
## Bilateral TiVA indicators

---

- Domestic VA embodied in exports to **country A**
- **Foreign VA** embodied in domestic exports
- Domestic VA embodied in imports from **country A**
- **Final consumption destinations** of intermediate exports



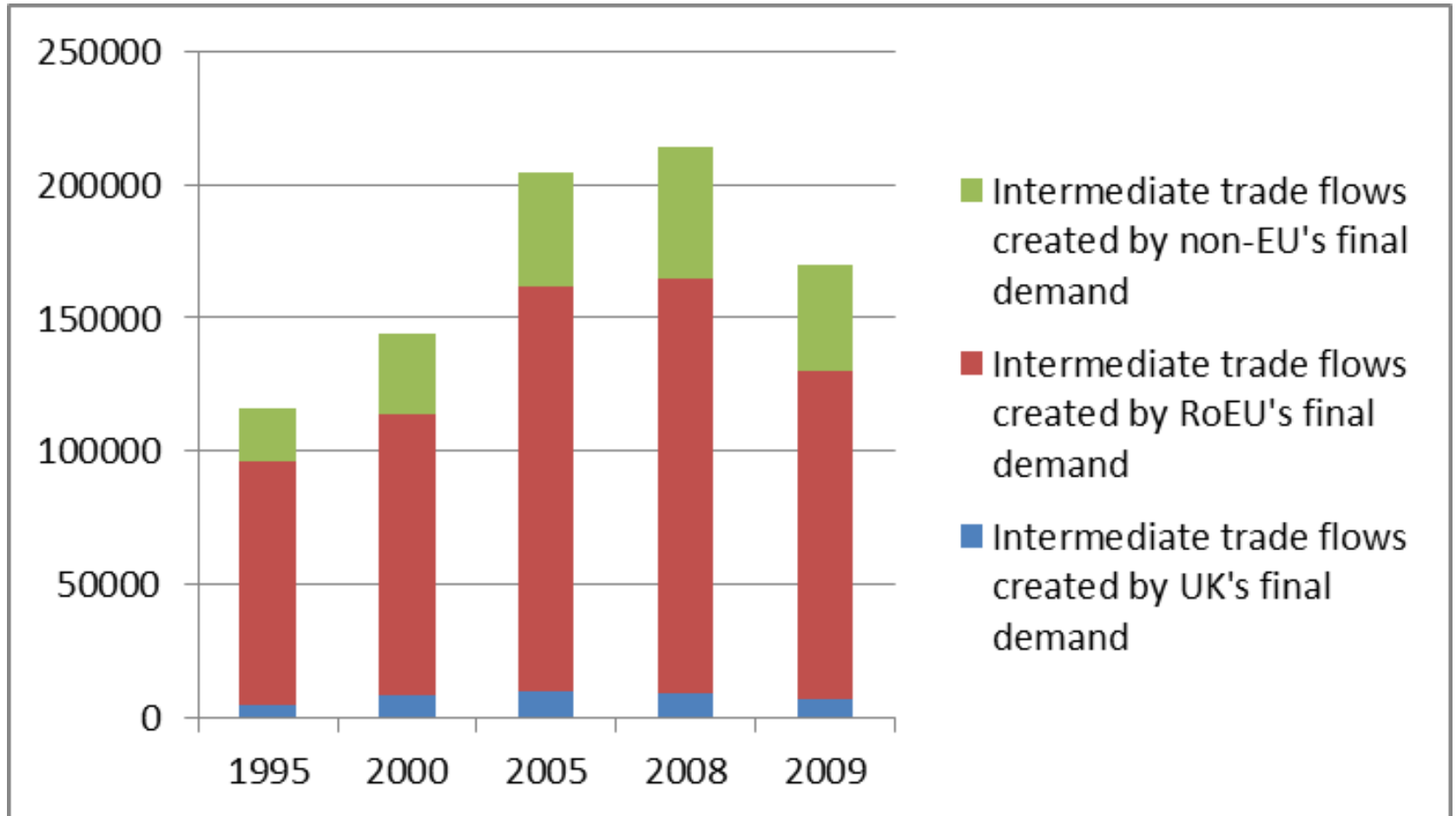
# Gross exports v DVA embodied in foreign demand



FFD_DVA
Country(EXGR_DVA%)
gross exp

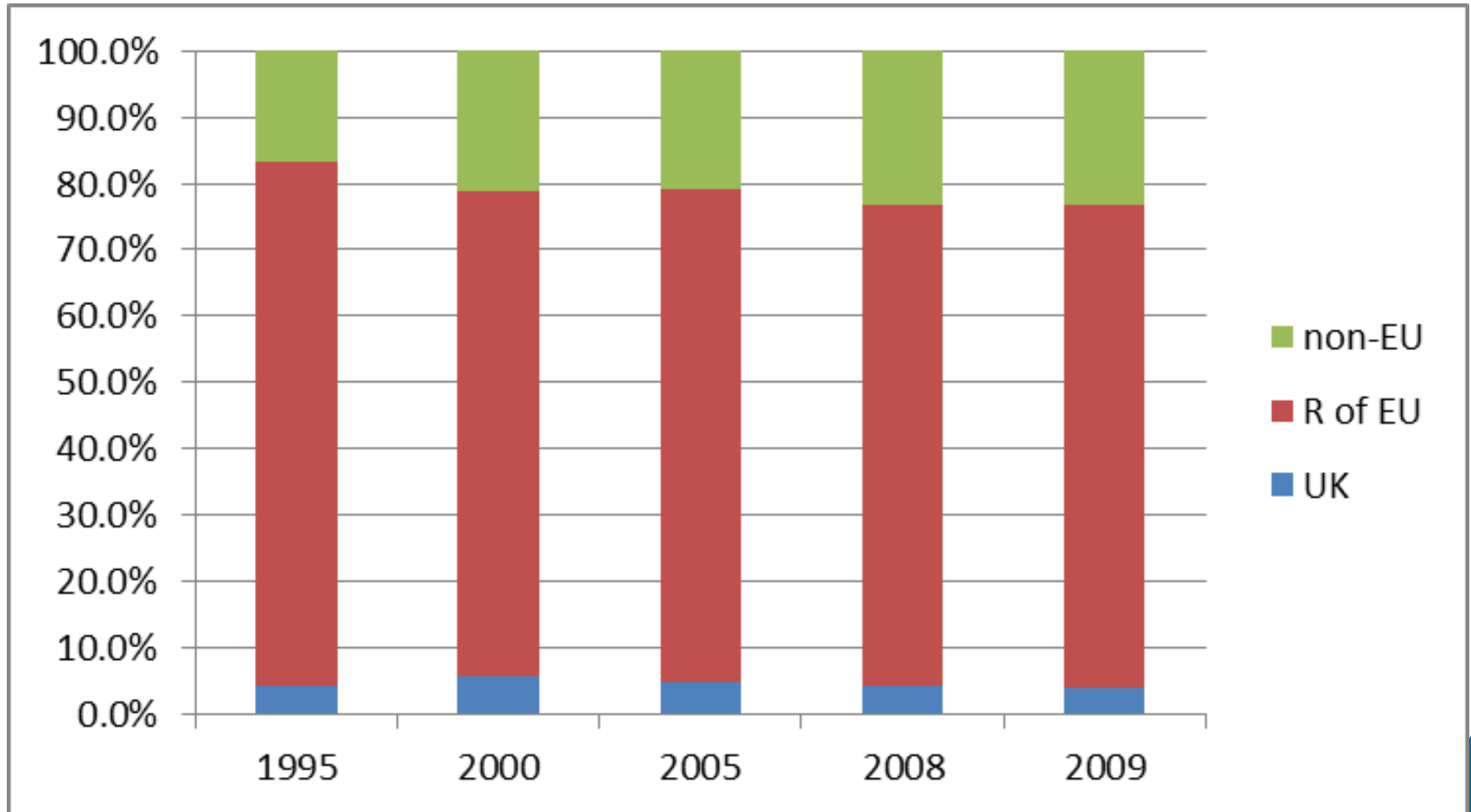


# Decomposition of UK intermediate gross exports by final destination (USD Million)





# Final destination of UK intermediate exports (%)





# Heterogeneity (VBF) and complementary industrial analysis

---

- Value added :
  - Service contents
  - Trade in Labor comp.
  - Income repatriation of foreign cooperate profits
  - GreenHouse Gas Global warming (CO<sub>2</sub> footprint)
- Leontief: Heterogeneity within industry (exporters, region, SME/Large )
- Final demand:
  - Domestic/foreign demand
  - Import contents of consumption, capital formation and gov. expenditure



## CO2 emissions embodied in international trade

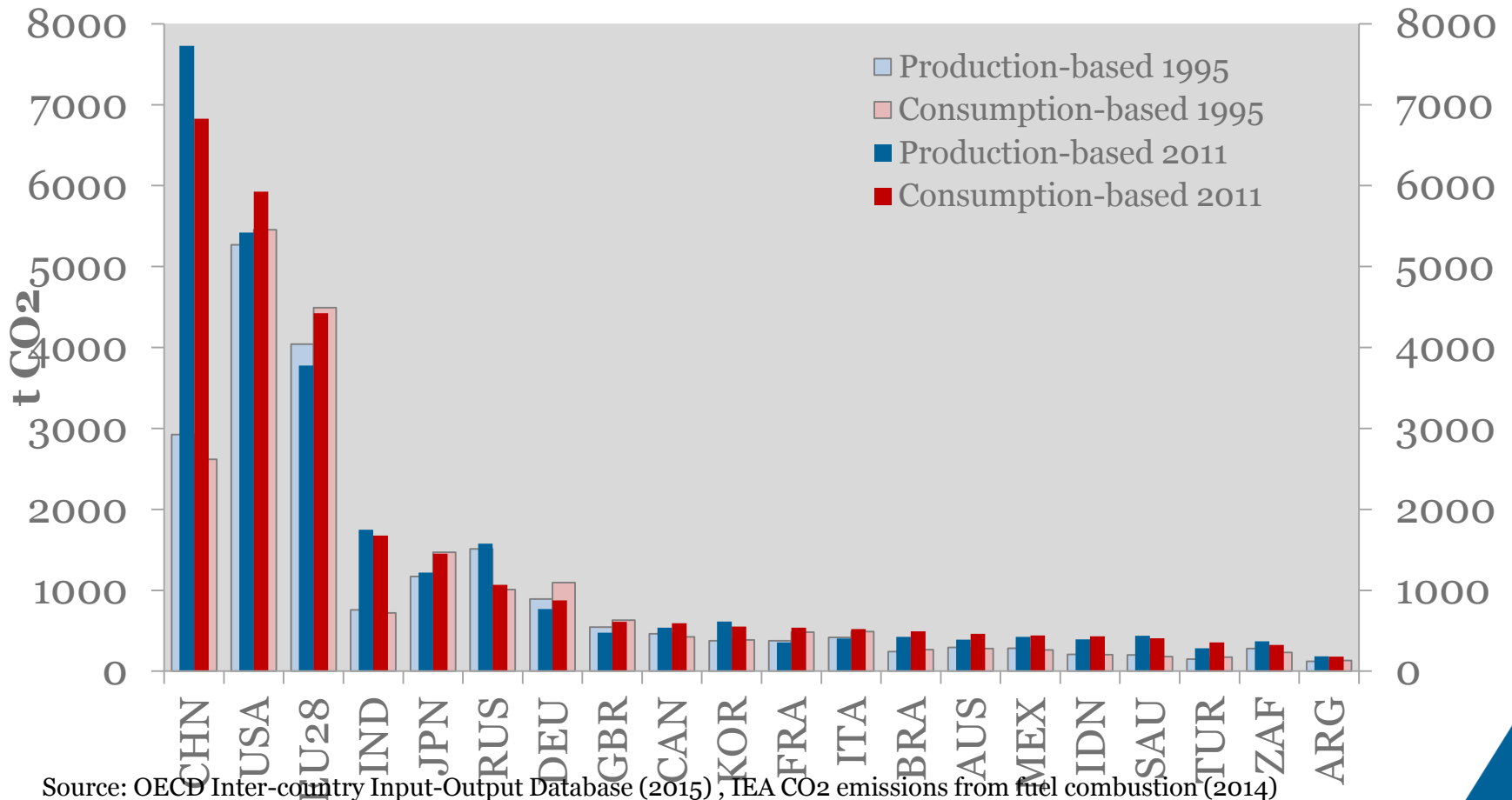
---

- CO<sub>2</sub> production = C
- CO<sub>2</sub> emitted by foreign final demand =  $C/X * B * FFD$
- CO<sub>2</sub> consumption by domestic final demand =  $C/X * B * DFD$

C = CO<sub>2</sub> emissions, X = Output, FFD= foreign final demand,



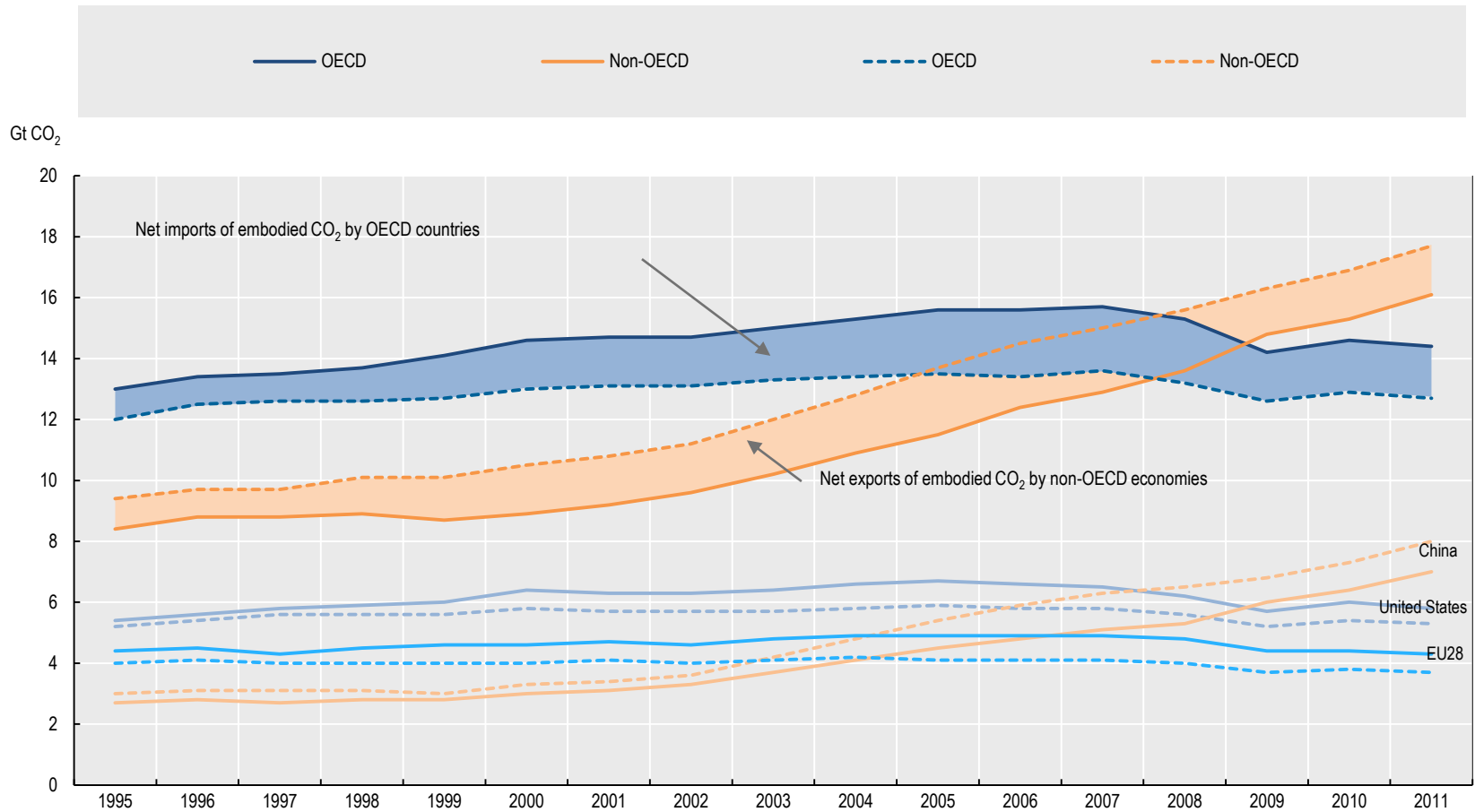
# Production and consumption-based CO2 emissions – G20 (1995 & 2011)



Source: OECD Inter-country Input-Output Database (2015), IEA CO2 emissions from fuel combustion (2014)



# 3.1 OECD versus non-OECD



Source: Scoreboard (2015)





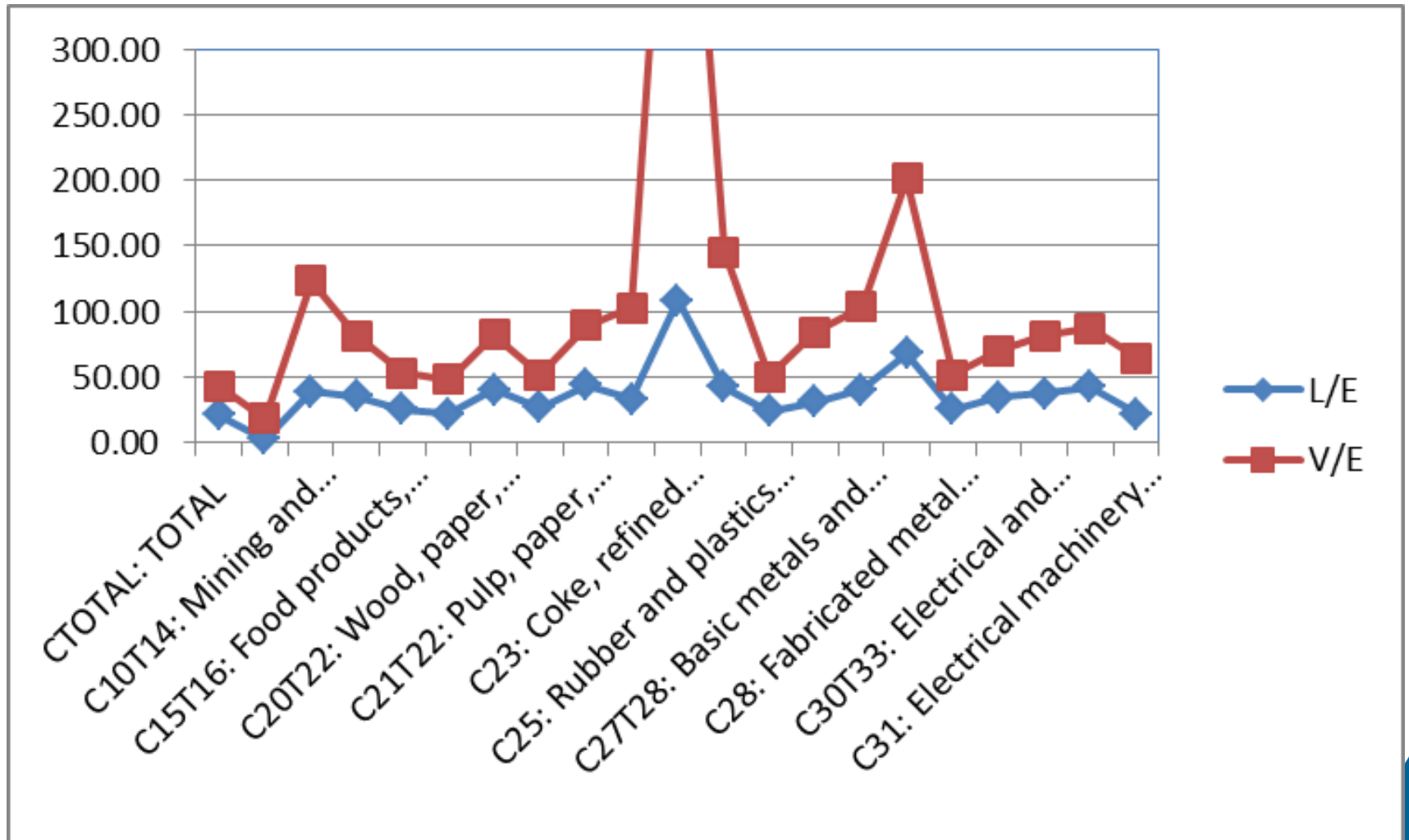
# TiVA and Trade in Employment

---

- Compensation of employees and Jobs stay at production country.
- Labour productivity and capital – labour ratios differ across industries
- Positions of countries on participation in GVCs are different in total value added, employment and wages.



# VA/EMPN , L/E (Manufacturing 2000, 2011)





# Evolution of domestic jobs embodied in foreign demand

---

- Economic activity ?
- Converging across countries ?
- Converging across industries ?
- Regional differences?
- Skill: Occupation / Education ?



# Sectoral Jobs Databases

---

- Primary sources
  - National Accounts
  - Population census
  - Labour Force Survey
  - Satellite Account of Input-Output
- International
  - ILO LABORSTA
  - OECD STAN
  - World Input-Output Database



# Employment data (Korea)

**KOSIS** Korean Statistical Information Service

HOME SITEMAP

Statistical Database Visualization Bulletin Board About KOSIS

## Statistical Database

Home > Statistical Database

Statistics List Compensati... ×

### Compensation calculation base (administrative and other position) (2009~2014)

Source : Korea Federation of Small & Medium Business, Survey on Wages by occupation

Data Updated on : 2016-01-19 / Term : Annual 2009 ~ 2014

Setting Criteria + ITEM[7/7] By class[35/35] Time[1/6]

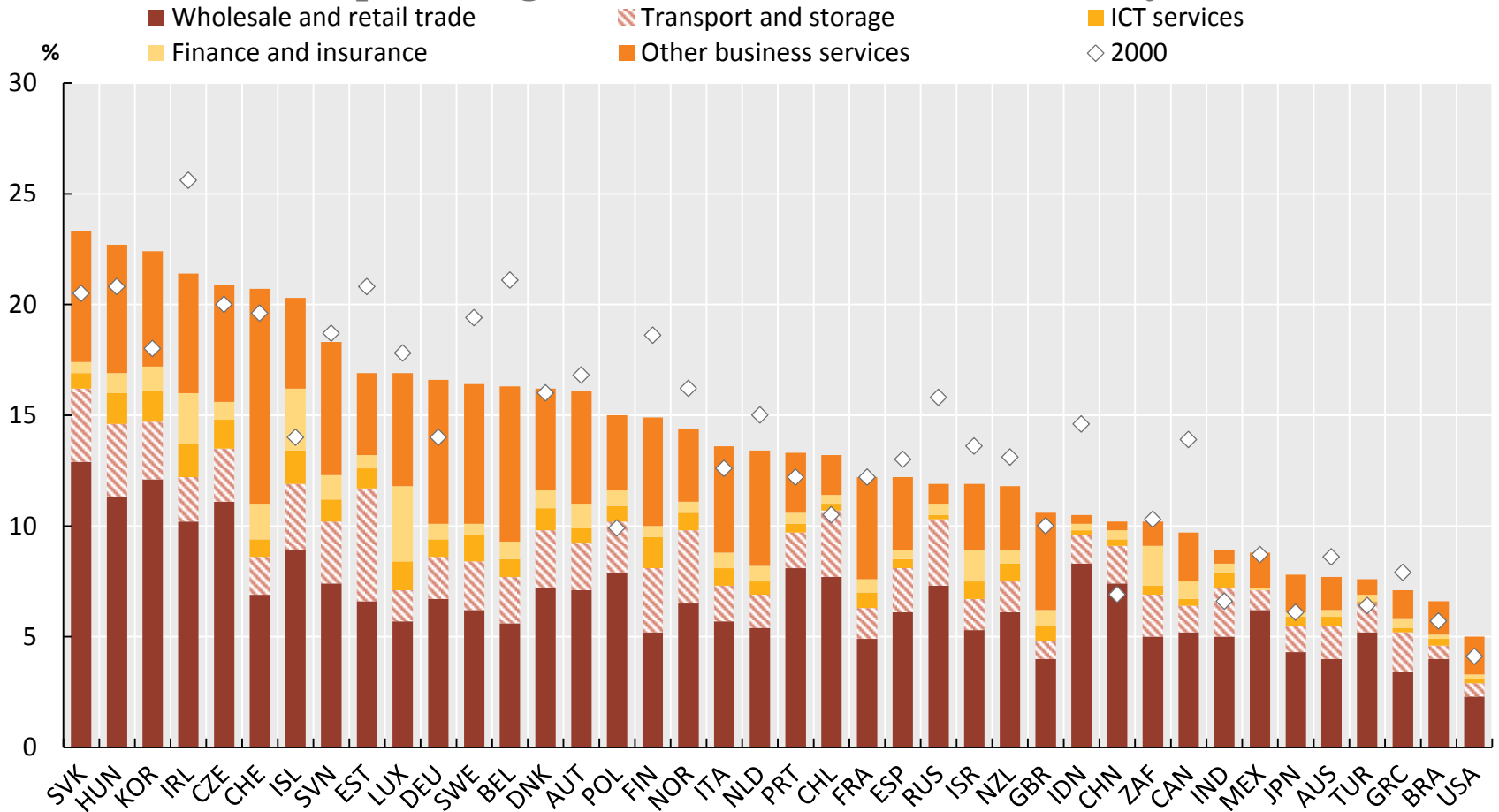
Zoom in > | URL > |

By class(1)	By class(2)	2014				
		Number of businesses (number)	Hourly compensation (%)	Daily compensation (%)	Weekly salary (%)	Monthly salary (%)
	Cokes, briquettes, refined petroleum products	53	5.0	0.0	0.0	
	Chemical material and chemical products	1,090	0.0	0.0	0.0	



# 4. Business sector service jobs sustained by foreign final demand for manufactured goods, 2011

As a percentage of total business sector service jobs



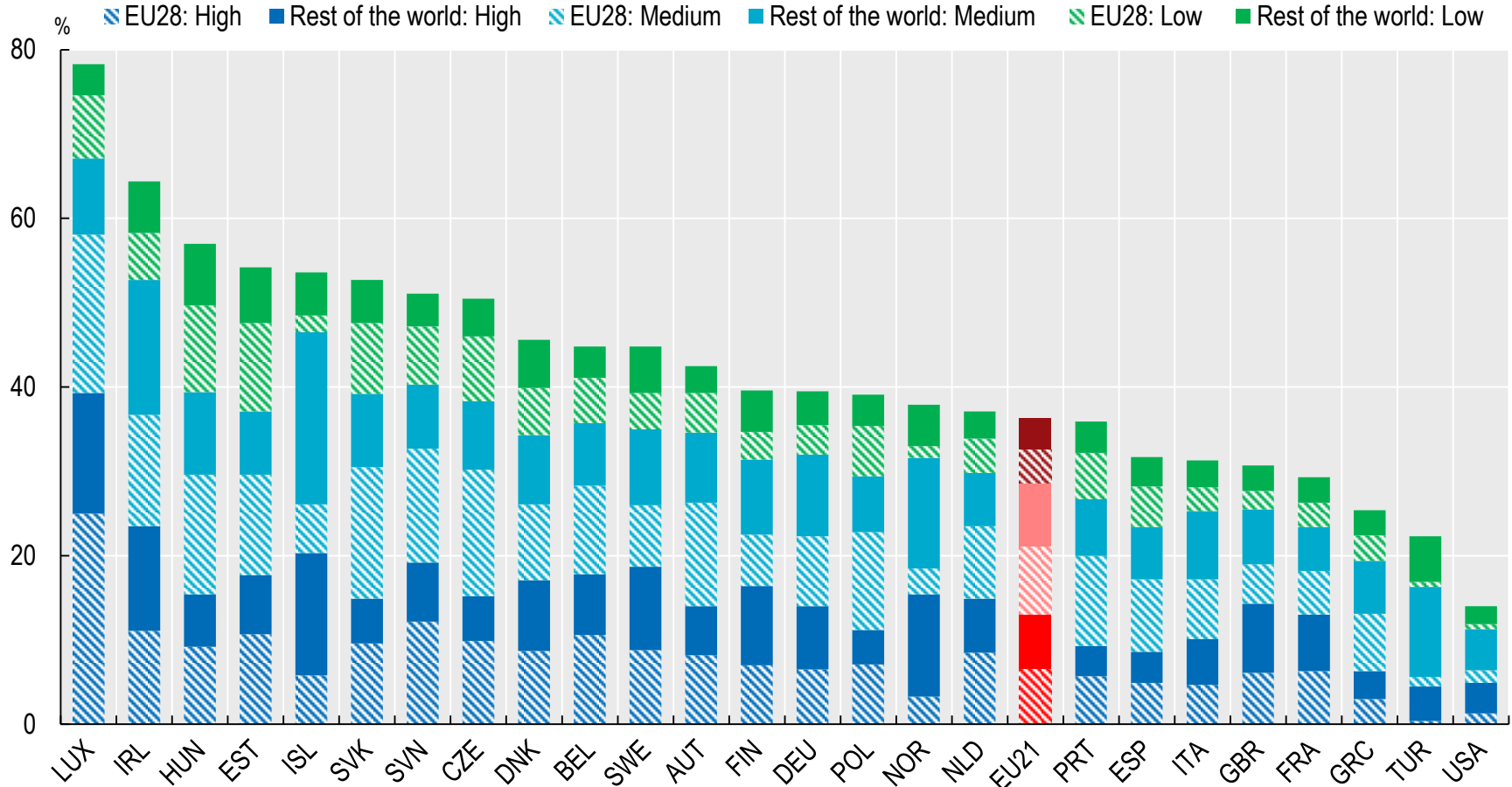
Source: OECD (2015), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth*, OECD Publishing, doi: [http://dx.doi.org/10.1787/sti\\_scoreboard-2015-en](http://dx.doi.org/10.1787/sti_scoreboard-2015-en).

Sectors are defined according to ISIC rev. 3: Total business sector services (Divisions 50-52, 60-74); Wholesale and retail trade (50-52); Transport and storage (60-63); Finance and insurance (65-67); Other business services (70,71,73-74). ICT services is an aggregate of Telecommunications (64) and Computer and related service activities (72).



## 6. Jobs sustained by foreign final demand, by skill intensity, 2011

As a percentage of total business sector employment



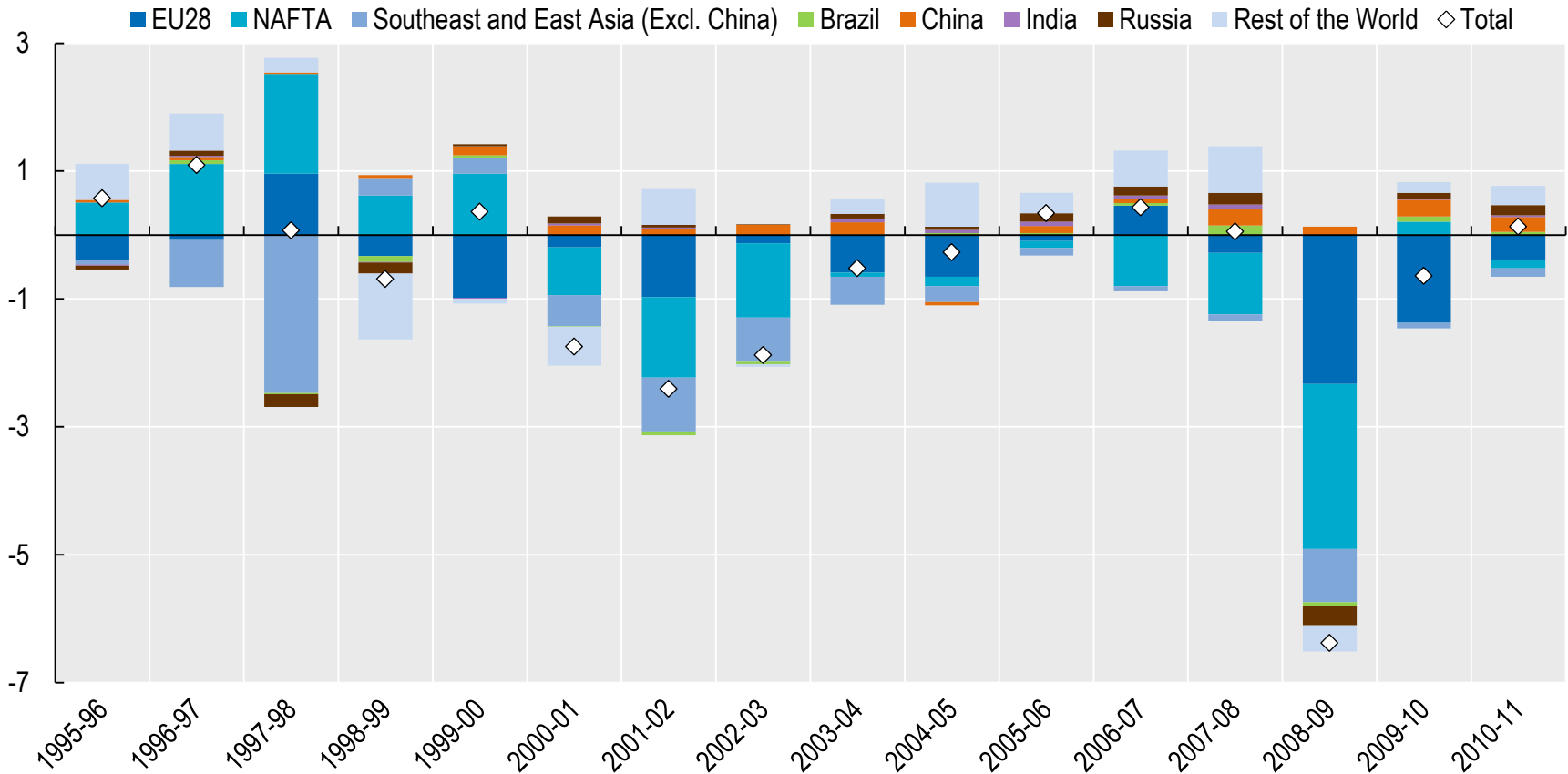
Source: OECD (2015), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth*, OECD Publishing, doi: [http://dx.doi.org/10.1787/sti\\_scoreboard-2015-en](http://dx.doi.org/10.1787/sti_scoreboard-2015-en).

The business sector is defined according to ISIC Rev. 3 Divisions 10 to 74.



## 5. Origin of demand for manufacturing jobs in OECD, 1995-2011

Millions of persons, annual changes by region of demand

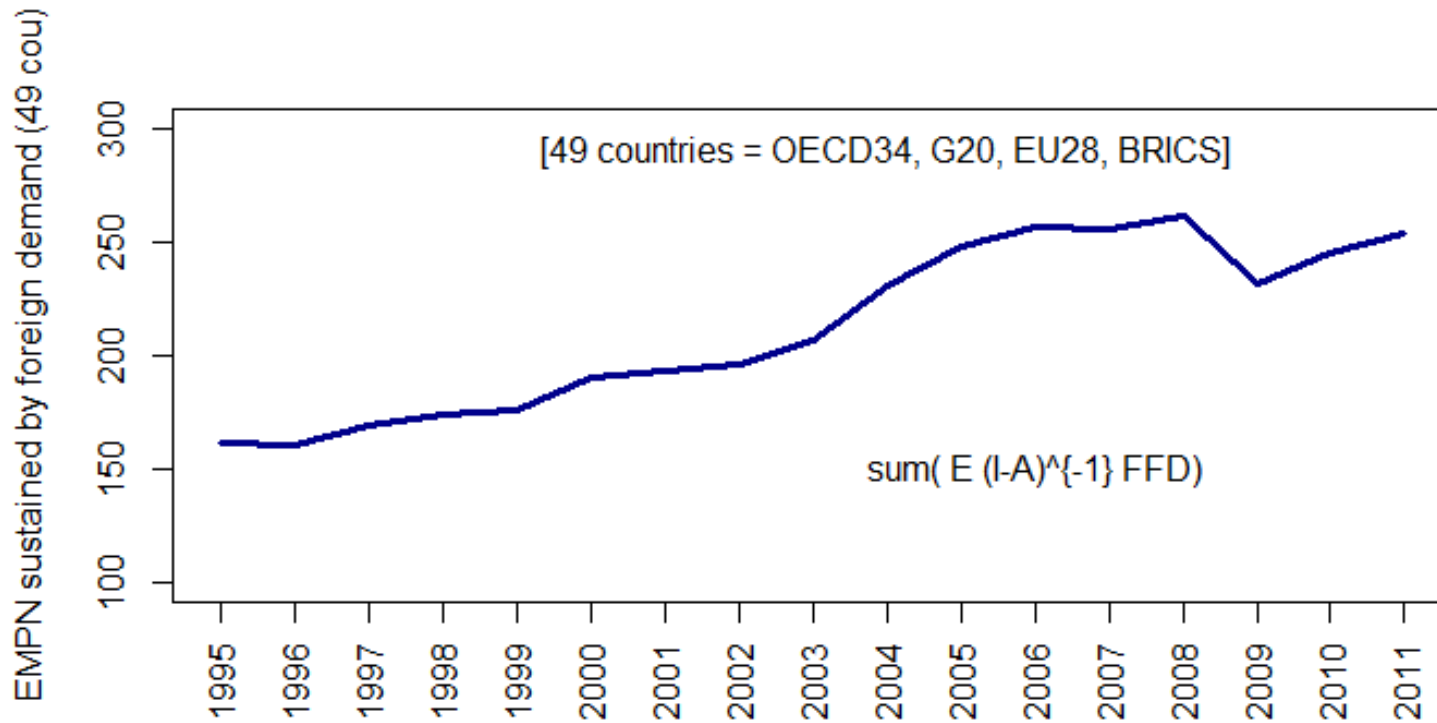


Source: OECD (2015), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth*, OECD Publishing, doi: [http://dx.doi.org/10.1787/sti\\_scoreboard-2015-en](http://dx.doi.org/10.1787/sti_scoreboard-2015-en).

The manufacturing sector corresponds to ISIC Rev. 3 Divisions 15 to 37.



# Jobs sustained by foreign demand

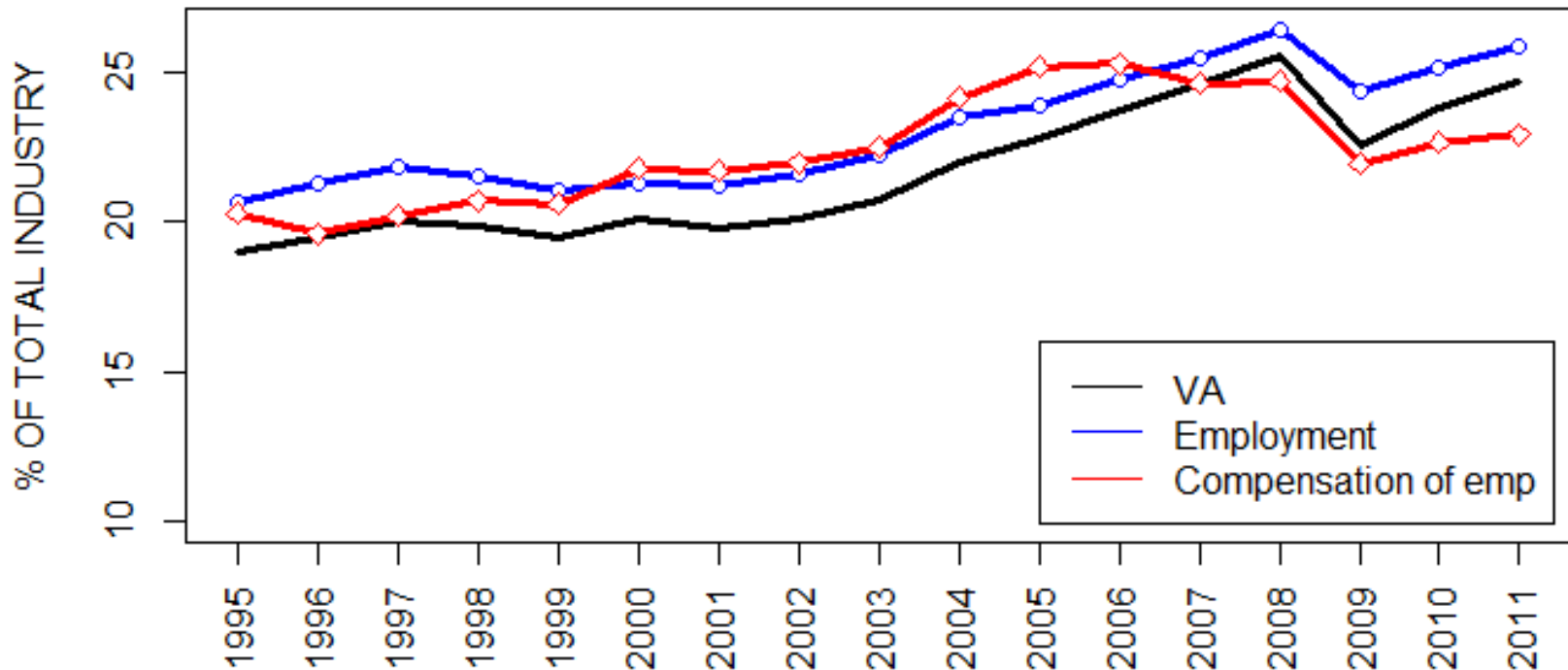


\* 49 countries (OECD34, EU28, BRICS)

OECD Inter-Country I-O (2015); OECD sectoral employment (2016)



# VA and jobs sustained by foreign demand as % of total industry (world\*)

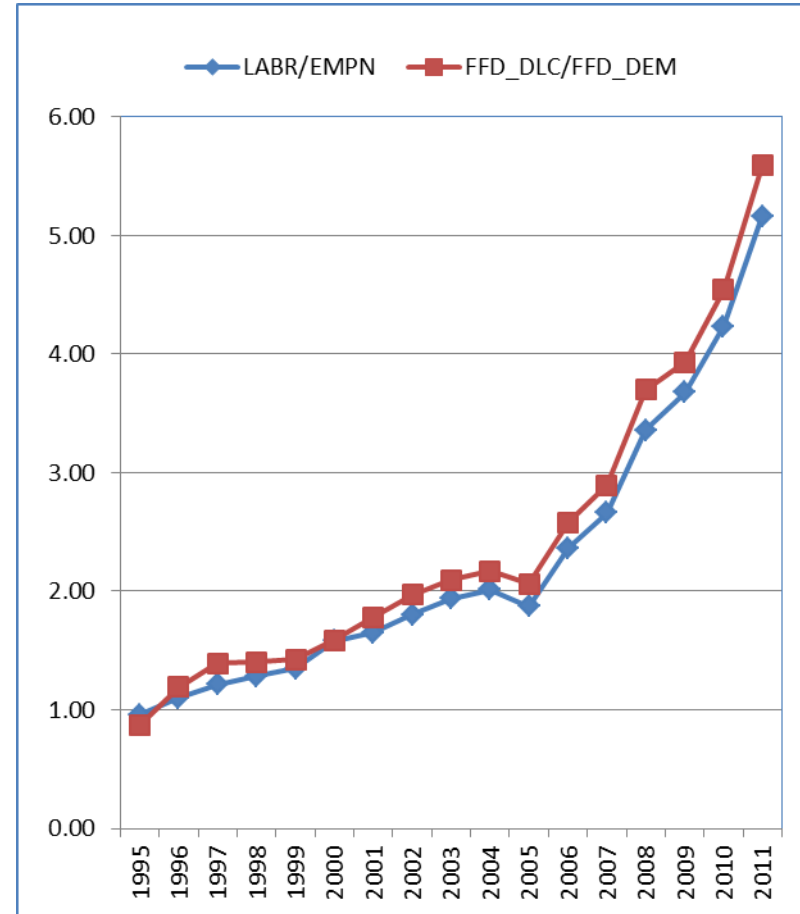
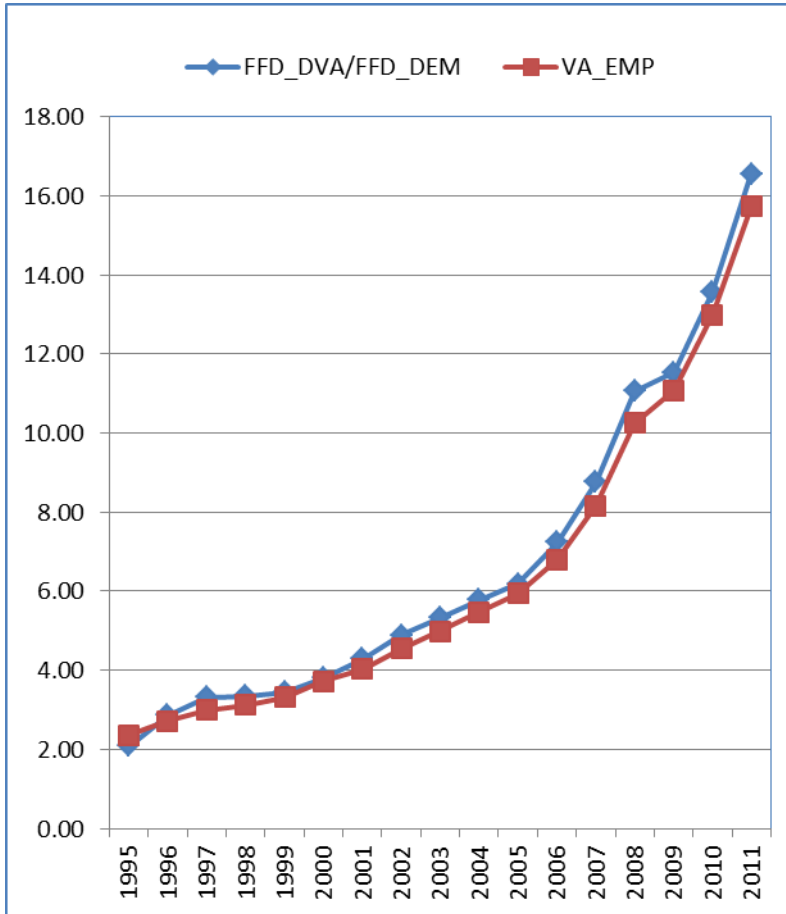


\* 49 countries (OECD34, EU28, BRICS)

OECD Inter-Country I-O (2015); OECD sectoral employment (2016)

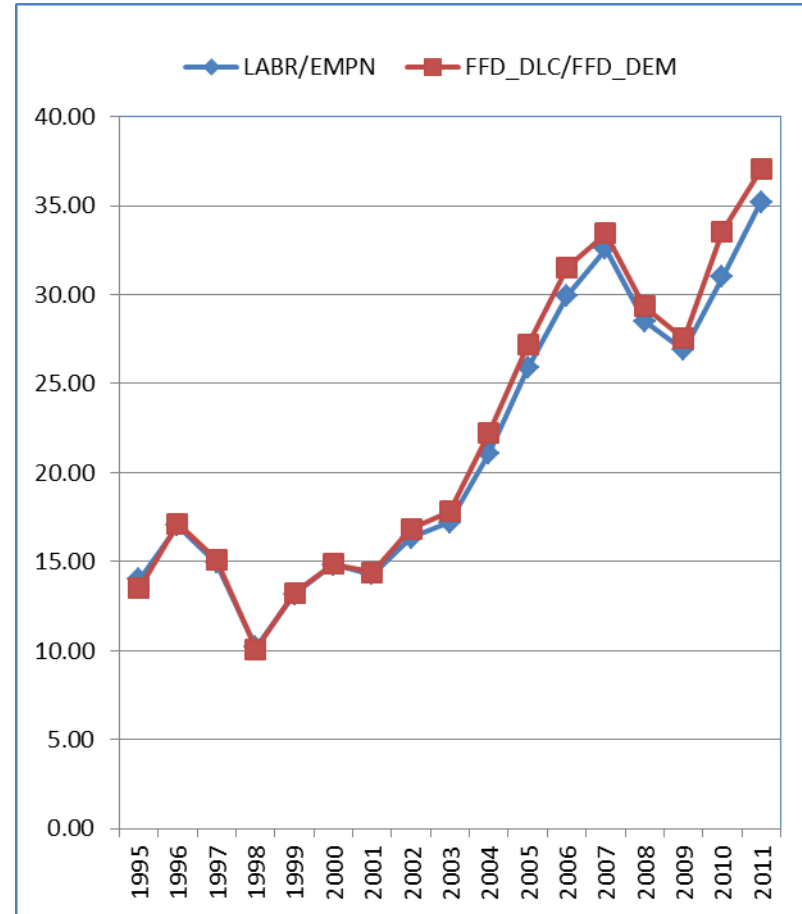
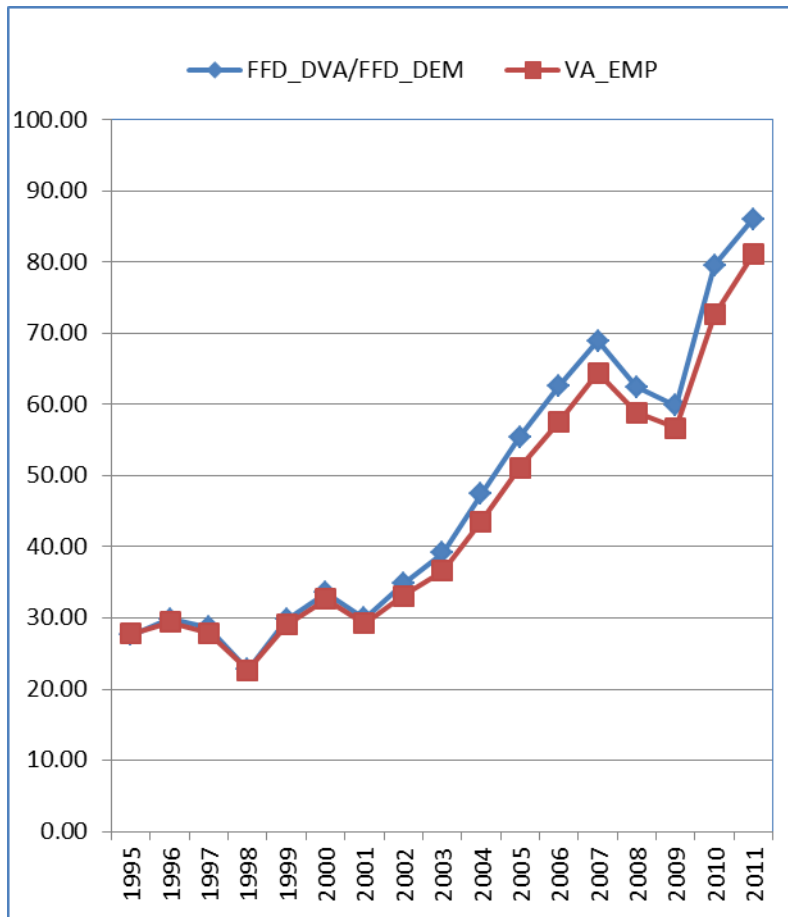


# VALU/EMP\_N & FFD\_DVA/FFD\_DEM (Manufacturing, CHN, 1995-2011)



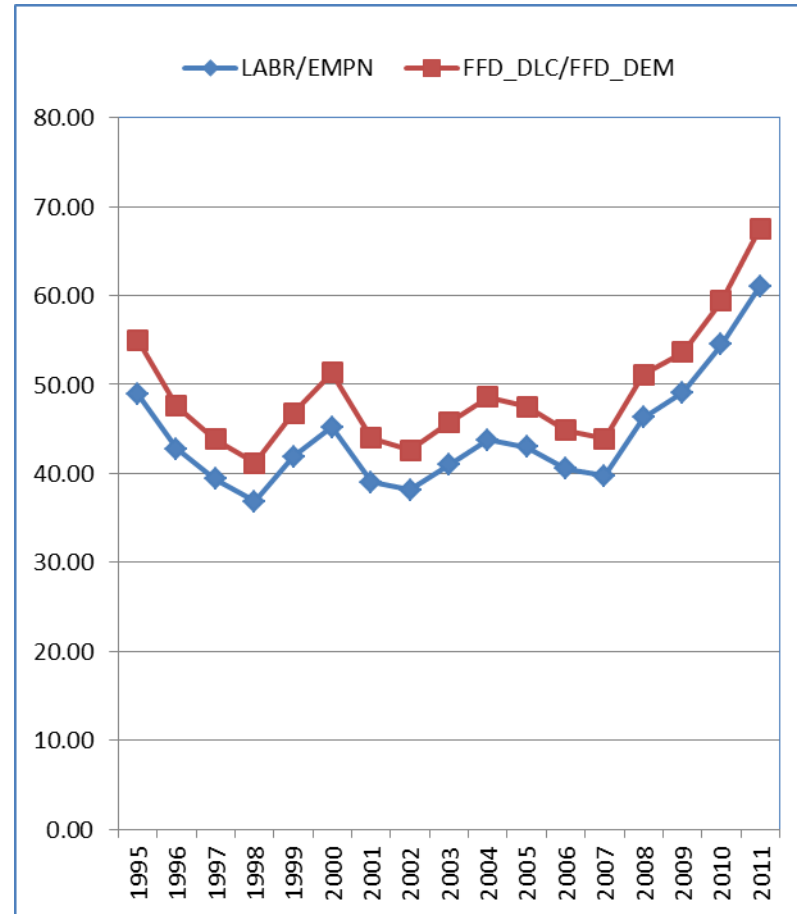
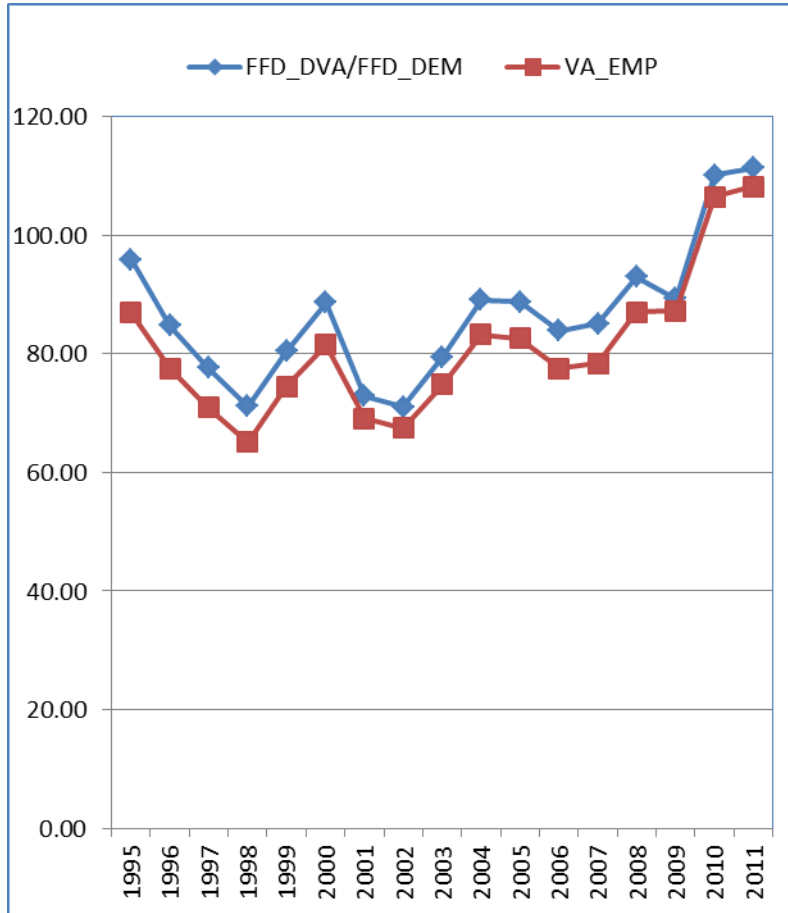


# VALU/EMP<sub>PN</sub> & FFD<sub>DVA</sub>/FFD<sub>DEM</sub> (Manufacturing, KOR, 1995-2011)





# VALU/EMP\_N & FFD\_DVA/FFD\_DEM (Manufacturing, JPN, 1995-2011)





## Summary/Next steps:

# Heterogeneity and complementary analysis

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- Value added :
  - Service contents
  - Trade in Labor comp.
  - Income repatriation of foreign cooperate profits
  - GreenHouse Gas Global warming (CO<sub>2</sub> footprint)
- Leontief: Heterogeneity within industry  
(exporters, region, SME/Large )
- Final demand:
  - Domestic/foreign demand
  - Import contents of consumption, capital formation and gov. expenditure



# THANK YOU

More information at  
<http://oe.cd/i-o>