Global Value Chains assessment in the 2000s: an approach with income transfers
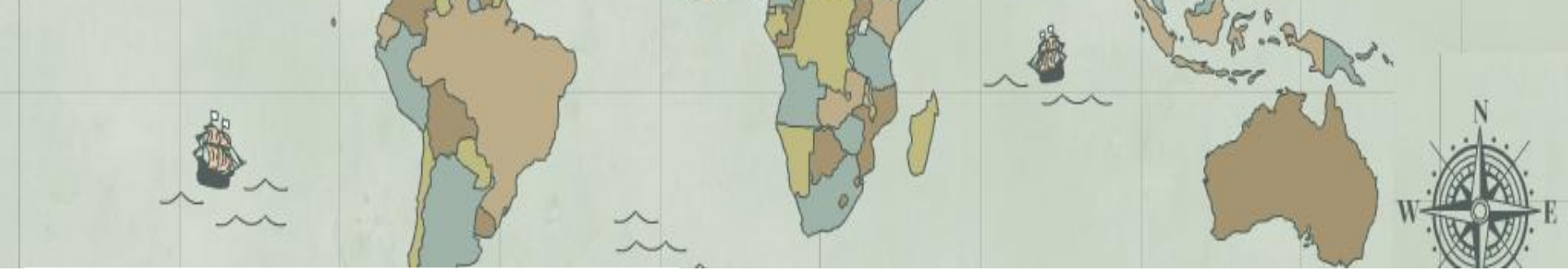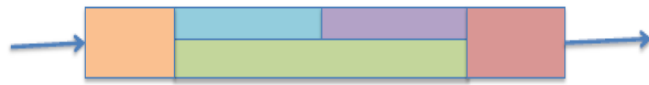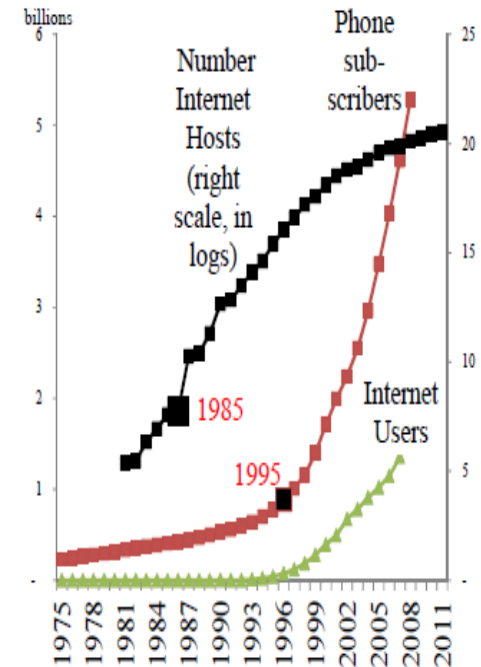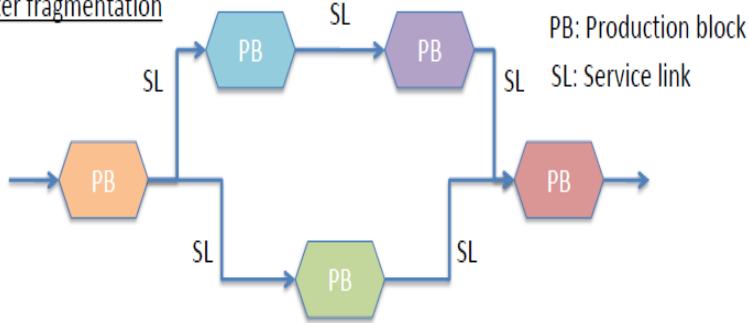
Enrique Martinez-Galán (ISEG, GPEARI)
Maria Paula Fontoura (ISEG, UECE)

Before fragmentation

After fragmentation

PB: Production block
SL: Service link

— Averge global trade cost measure
— Global trade flow (right scale in logs)

1912 1974 1985 1995

billions

Number Internet Hosts (right scale, in logs)

Phone sub-scribers

Internet Users

1985 1995

The importance of Global Value Chains

- **GVC represent 80% of world trade** - UNCTAD 2013

- **Trade in intermediate goods represent 60% of world trade** ((56% for goods and 70% for services) - MIROUDOT *et al* (2009)

- *Factory Asia*: **Trade in parts and components represents** 70 % of Chinese exports of manufactured goods - MIROUDOT *et al* (2009)

Purposes

1. **To measure the degree of insertion of most OECD-member countries and major emerging economies into Global Value Chains (GVCs) with two income-related indicators built with the World Input-Output Database.**

2. **To capture whether the bilateral degree of GVC insertion of this group of countries is a determinant of Foreign Direct Investment (FDI) inflows in the 2000s.**

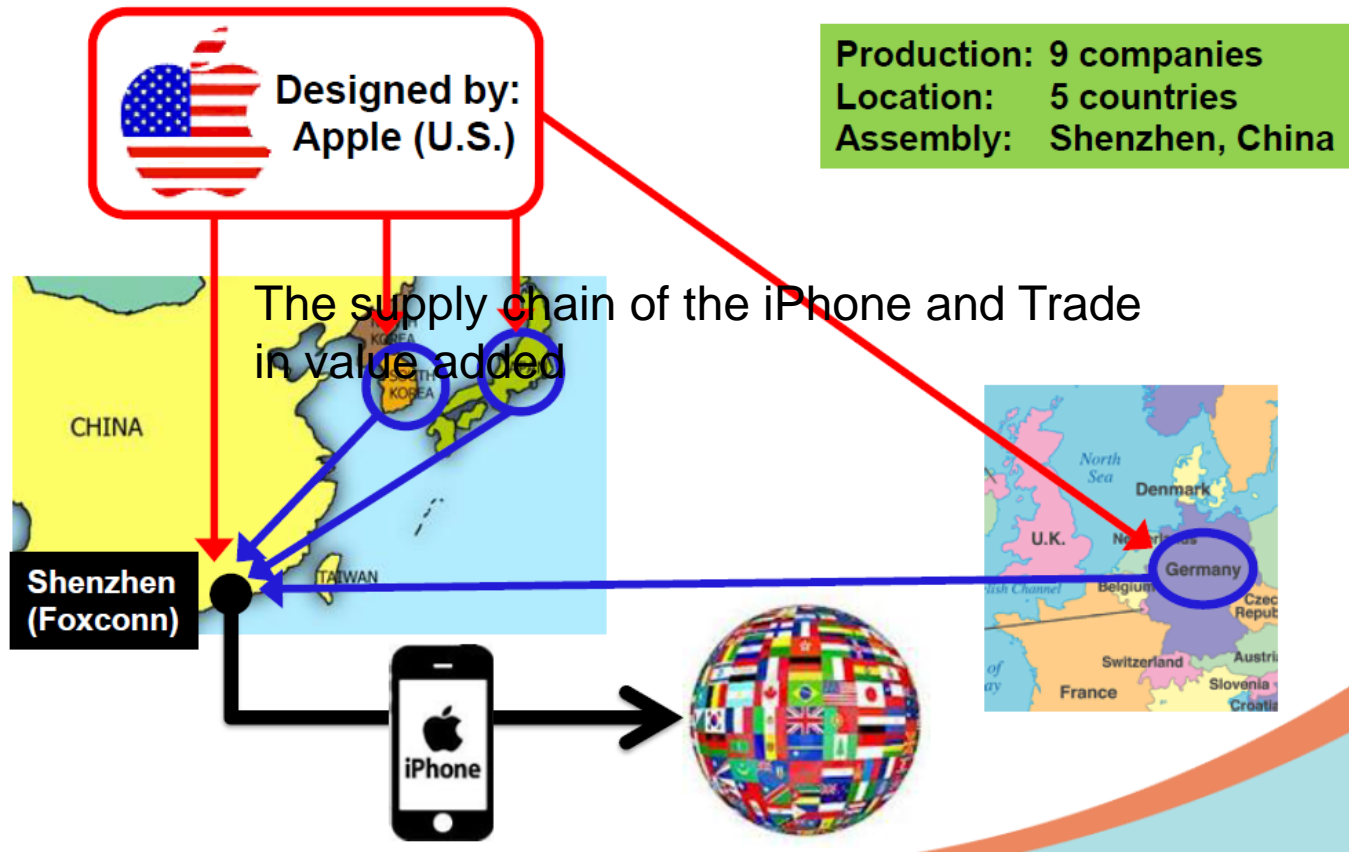# The supply chain of the iPhone and Trade in value added

Table 1 . Apple iPhone 3G's Major Components and Cost Drivers

Manufacturer	Component	Cost (USD)
Toshiba (Japan)	Flash Memory	$24.00
	Display Module	$19.25
	Touch Screen	$16.00
Samsung (Korea)	Application Processor	$14.46
	SDRAM-Mobile DDR	$8.50
Infineon (Germany)	Baseband	$13.00
	Camera Module	$9.55
	RF Transceiver	$2.80
	GPS Receiver	$2.25
	Power IC RF Function	$1.25
Broadcom (USA)	Bluetooth/FM/WLAN	$5.95
Numonyx (USA)	Memory MCP	$3.65
Murata (Japan)	FEM	$1.35
Dialog Semiconductor (Germany)	Power IC Application Processor Function	$1.30
Cirrus Logic (USA)	Audio Codec	$1.15
Rest of Bill of Materials		**$48.00**
Total Bill of Materials		**$172.46**
Manufacturing costs		**$6.50**
Grand Total		**$178.96**

iPhone Manufacturing Cost Distribution by Country (%)

Germany 16.8
Korea 12.8
Other 26.8
US 6.0
Japan 33.9
China 3.6
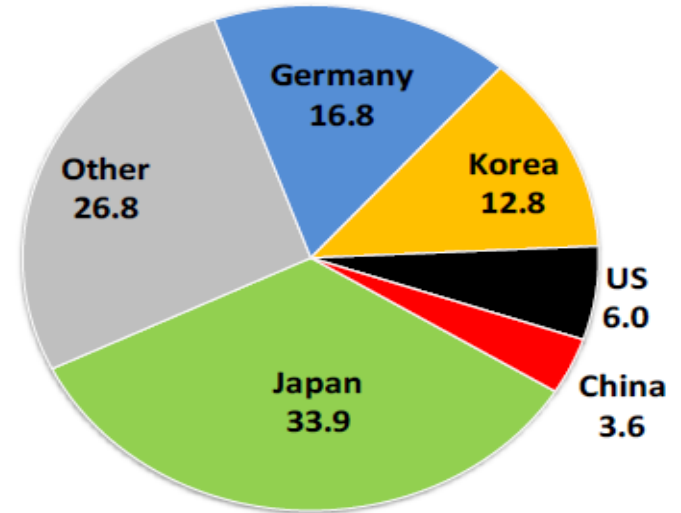
Source: Xing and Detert (2010)

Chinese workers' contribution = **$6.5 (3.6% of Total Cost)**

~~$6.5~~   ~~$73 mil~~

~~$173.96~~ x 11.3 mil units = $2.02 bil

U.S. Trade Deficit
~~$ 1.9 bil (0.8 % of Total)~~

$ 35 mil
surplus

~~$122 mil (parts)~~
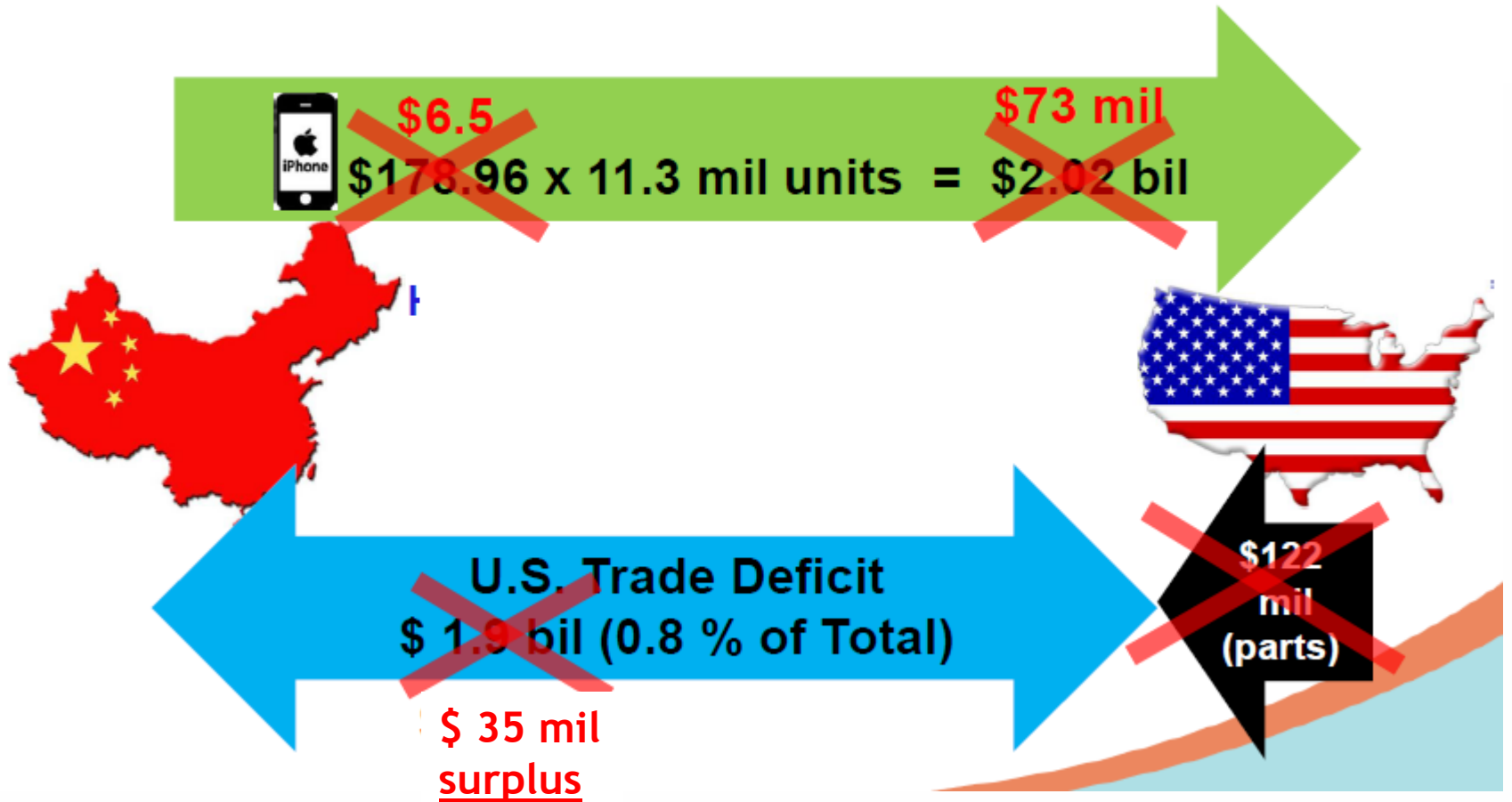
Current trade statistics greatly inflate China´s exports and the Sino-US trade imbalance

The basic structure of an input-output table: a simple example of a domestic transactions input-output table

Suppliers \ Users	Agriculture	Mining	Manufactures	Utilities	Construction	Services	Private final consumption	Government final consumption	GFCF	Exports	Industry Output at basic prices
Agriculture	2731	3	8260	36	59	615	962	62	567	8568	21863
Mining	4	282	2013	3979	188	60	28	0	210	5528	12292
Manufactures	3322	291	40218	480	8004	16999	16896	2340	8573	113777	210900
Utilities	983	53	2400	4395	85	3458	6184	14	439	238	18249
Construction	121	70	565	135	14103	9509	405	530	33974	832	60244
Services	2884	1078	28400	1404	9339	106994	126180	87409	16752	55512	435953
Imports	1779	1029	71117	1878	7572	33964	24189	1085	17771	81863	
Net taxes on products	129	67	497	706	249	8651	22908	-152	10233	0	
TOTAL use at purchaser's prices	11953	2873	153470	13013	39599	180250	197752	91288	88519	266318	
Value Added at basic prices	9910	9419	57430	5236	20645	255703					
Industry Output at basic prices	21863	12292	210900	18249	60244	435953					

Source: WIXTER et al (2006).

The basic structure of an internationally linked input-output table (for three regions)

		Country A						Country B						Rest of World						Country A			Country B			Rest of World				
		Agriculture	Mining	Manufactures	Utilities	Construction	Services	Agriculture	Mining	Manufactures	Utilities	Construction	Services	Agriculture	Mining	Manufactures	Utilities	Construction	Services	Private final consumption	Government final consumption	GFCF	Private final consumption	Government final consumption	GFCF	Private final consumption	Government final consumption	GFCF		Industry Output at basic prices
Country A	Agriculture	2731	3	8260	36	59	615	685	1114	771	857	857	942	86	514	428	257	428	343	962	62	56	343	257	171	86	257	171	8368	21863
	Mining	4	282	2013	3979	188	60	442	719	498	555	555	908	55	332	276	166	276	221	28	0	210	221	166	111	55	166	111	9928	12292
	Manufactures	3322	291	40218	480	8004	16999	9102	14791	10240	11378	11378	12515	1138	6827	5689	3413	5689	4551	16896	2340	8573	4551	3413	2276	1138	3413	2276	113777	210900
	Utilities	983	53	2400	4395	85	3458	19	31	21	24	24	26	2	14	12	7	12	10	6184	14	439	10	7	5	2	7	5	288	18249
	Construction	121	70	565	135	14103	9509	67	108	75	83	83	92	8	50	42	25	42	33	405		530	33974	25	17	8	25	17	832	60244
	Services	2884	1078	28400	1404	9339	106994	4441	7217	4996	5551	5551	6106	555	3331	2776	1665	2776	2220	126180	87409	16752	2220	1665	1110	555	1665	1110	55512	435953
Country B	Agriculture																													0
	Mining	36	21	1422	38	151	675																							
	Manufactures	160	93	6401	169	681	3057																							
	Utilities	89	51	3556	94	379	1698																							
	Construction	107	62	4267	113	454	2038																							
	Services	53	31	2134	56	227	1019																							
Rest of World	Agriculture	498	288	19913	526	2120	9510																							
	Mining	249	144	9956	263	1060	4755																							
	Manufactures	231	134	9245	244	984	4415																							
	Utilities	18	10	711	19	76	340																							
	Construction	125	72	4978	131	530	2377																							
	Services	62	5689	150	606	2717																									
	Imports	1779	1029	71117	1878	7572	33964																							
	Net taxes on products	129	67	497	706	249	8651																							
	TOTAL use at purchaser's prices	11953	2873	153470	13013	39599	180250																							
	Value Added																													

(...)

User's approach ou Upstream approach

Supplier's approach ou Downstream approach

Source: Author, based on TIMMER *et al* (2012).

Project	Institution	Data sources	Countries	Sectors	Years	Comments
World Input-Output Database (WIOD)	Consortium of 11 institutions led by Groningen University, EU funded	National Supply-Use tables	40	35	1995 to 2011	Based on official National Accounts statistics; uses end-use classification to allocate flows across partner countries; includes data on socioeconomic and environmental issues
Inter-Country-IO model	OECD-WTO, under the Made in the World Initiative (MIWI)	National IO tables	56	18	1995, 2000, 2005, 2008, and 2009	Based on national I-O tables harmonized by the OECD
Asian International IO tables	IDE-JETRO	National accounts and firm surveys	10	76	1975, 1980, 1985, 1990, 1995, 2000, 2005	US-Asia tables and also bilateral tables, including PRC-Japan
Global Trade Analysis Project	Purdue University	Contributions from individual researchers and organizations	129	57	2004, 2007	Unofficial dataset; includes data on areas such as energy volumes, land use, carbon dioxide emissions and international migration
Eora multi-region IO Database	Several Australian researchers, under funding by the Australian Research Council	National supply-use and IO data; plus data from Eurostat and United Nations	187	25-500, depending on the country	1990 to 2012	Still under improvement

Source: Authors.

WIOD (84% of World GDP, 78% of wold trade flows, 40 countries, 35 sectors, including 18 of services)

Countries: **OECD countries** except Chile, Iceland Israel, New Zealand, Norway and Switzerland
Non-OECD countries: Brazil, Bulgaria, Cyprus, India, Indonesia, Lithuania, Malta,China (PRC), Romania, Russia and Taiwan.

Data used: Income involved in the production of the inputs (parts and components) exported and imported by a country (flows of "transferred" income)

The income measure of embeddedness

$$EMBINCO_i = \frac{\sum_{j=1}^{n} GAININCO_{i,j} + \sum_{j=1}^{n} LOSTINCO_{i,j}}{OUTPUT_i}$$

The income measure of embeddedness of participating in GVCs (2011)

Country	OUTPUT (USD billion)	GAININCO (A) (USD billion)	LOSTINCO (B) (USD billion)	(A+B) (USD billion)	EMBINCO (%)
Luxembourg	160.6	76.2	63.1	139.3	**86.7%**
Ireland	477.1	147.4	131.4	278.8	**58.4%**
Hungary	309.4	87.1	78.0	165.1	**53.4%**
Taiwan	1,052.8	298.2	225.2	523.4	**49.7%**
Belgium	1,113.9	275.0	249.4	524.4	**47.1%**
Czech Rep.	532.2	128.8	112.0	240.8	**45.2%**
Malta	17.7	4.1	3.7	7.8	**44.1%**
Netherlands	1,659.0	384.1	324.6	708.7	**42.7%**
Slovakia	214.4	46.9	40.9	87.7	**41.0%**
Austria	811.2	171.5	128.1	299.6	**36.9%**
Portugal	439.5	39.7	45.5	85.2	**19.4%**

– The income measure of goodness

$$GOODINCO_i = \frac{\sum_{j=1}^{n} GAININCO_{i,j} - \sum_{j=1}^{n} LOSTINCO_{i,j}}{OUTPUT_i}$$

The income measure of net gains from participating in GVCs (2011)

Country	OUTPUT (USD billion)	GAININCO (A) (USD billion)	LOSTINCO (B) (USD billion)	(A-B) (USD billion)	GOODINCO (%)
Russia	3,262.7	448.2	138.4	309.8	9.5%
Luxembourg	160.6	76.2	63.1	13.1	8.2%
Taiwan	1,052.8	298.2	225.2	73.0	6.9%
Germany	6,773.1	1,248.6	813.0	435.6	6.4%
Sweden	1,036.3	201.7	142.2	59.5	5.7%
Austria	811.2	171.5	128.1	43.4	5.4%
Estonia	43.2	8.7	6.7	2.0	4.6%
Canada	3,184.5	427.9	289.9	138.0	4.3%
Australia	2,844.6	289.3	173.7	115.6	4.1%
Netherlands	1,659.0	384.1	324.6	59.5	3.6%
Portugal	439.5	39.7	45.5	-5.8	-1.3%

Country	GAININCO (A) (USD billion)	LOSTINCO (B) (USD billion)	(A-B) (USD billion)	GOODINCO (%)
France	3.77	2.38	1.39	3.5%
Spain	8.72	14.04	-5.32	-13.3%

Country	GAININCO (A) (USD billion)	LOSTINCO (B) (USD billion)	(A-B) (USD billion)	GOODINCO (%)
France	3.77	2.38	1.39	3.5%
USA	2.95	2.11	0.84	2.1%
Sweden	0.54	0.28	0.27	0.7%
Poland	0.36	0.19	0.17	0.4%
Turkey	0.26	0.10	0.16	0.4%
Czech Rep.	0.31	0.17	0.15	0.4%
Ireland	0.53	0.41	0.12	0.3%
Austria	0.46	0.34	0.11	0.3%
Romania	0.16	0.06	0.10	0.3%
Australia	0.10	0.03	0.07	0.2%
Finland	0.18	0.12	0.05	0.1%
Greece	0.10	0.05	0.05	0.1%
Hungary	0.11	0.09	0.03	0.1%
Mexico	0.33	0.31	0.02	0.0%
Slovenia	0.03	0.01	0.02	0.0%
Slovakia	0.07	0.06	0.02	0.0%
Cyprus	0.02	0.00	0.01	0.0%
Latvia	0.01	0.00	0.01	0.0%
Estonia	0.01	0.00	0.01	0.0%
Canada	0.31	0.30	0.00	0.0%
Malta	0.01	0.01	-0.01	0.0%
Japan	0.19	0.20	-0.01	0.0%
Denmark	0.16	0.17	-0.02	0.0%
Lithuania	0.01	0.03	-0.02	0.0%
Taiwan	0.04	0.07	-0.03	-0.1%
Bulgaria	0.03	0.07	-0.04	-0.1%
Belgium	1.23	1.29	-0.06	-0.2%
Indonesia	0.02	0.11	-0.08	-0.2%
Germany	4.35	4.44	-0.09	-0.2%
Luxembourg	0.06	0.22	-0.16	-0.4%
UK	1.71	1.89	-0.18	-0.5%
India	0.08	0.27	-0.19	-0.5%
South Korea	0.04	0.24	-0.20	-0.5%
Russia	0.19	0.41	-0.22	-0.5%
Rest of the World	7.69	7.97	-0.28	-0.7%
PRC	0.69	1.04	-0.35	-0.9%
Italy	1.43	2.02	-0.58	-1.5%
Brazil	1.62	2.29	-0.66	-1.7%
Netherlands	0.98	1.71	-0.73	-1.8%
Spain	8.72	14.04	-5.32	-13.3%
Total	39.84	45.46	-5.6	-

* OUTPUT was replaced by GAININCO, aiming a change in scale that avoids ending up with too small numbers.
Source: Authors estimations based on WIOD, 1st release.

Advantages of the proposed indicators

1. **They cover both the downstream and the upstream approaches, instead of using exclusively the former;**

2. **They are based on the actual use of the goods and services as inputs in the production process and not in its classification as intermediate or final goods or services;**

3. **They consider income "transfers" instead of trade flows.**

Pooled regression model for bilateral FDI flows of WIOD* countries (2002-2011)

$$FDI_{i,j}^t = \alpha + \beta_1. GDPpc_i^t + \beta_2. GDPpc_j^t + \beta_3. GDP_i^t + \beta_4. GDP_j^t +$$

$$+\beta_5. OPENESS_i^t + \beta_6. OPENNESS_j^t + \beta_7. DIST_{i,j} + \beta_8. CONTIG_{i,j} + \beta_9. COMLANG\_OFF_{i,j} +$$

$$+ \beta_{10}. COLONY_{i,j} + \beta_{11}. OFFSHORE_{i,j} + \beta_{12}. EMBINCO_{ij}^t + \beta_{13}. GOODINCO_{i,j}^t +$$

$$+\beta_{14-23}. YEAR\_DUMMIES\_2002to2011 + \beta_{24-60}. COUNTRY\_DUMMIES + e_{i,j}^t$$

Econometric method

Assuming that :

-the disturbances are uncorrelated through time and units and conditioned on the explanatory variables and

-identically distributed with a zero mean,

this is a pooled regression model which can be consistently and efficiently estimated by Ordinary Least Squares (OLS)

Expected and observed signs for selected variables in the pooled regression model used to estimate the determinants of FDI stock*

Variable	Expected sign	Observed sign
GDPpcj	+	+
GDPpci	+	+
GDPj	+	+
GDPi	+	+
OPENNESSi	+	+
OPENNESSj	+	+
DIST	-	-
CONTIG	+	+
COMLANG_OFF	+	+
CONLANG_ETHNC	+	+
COLONY	+	+
OFFSHORE	+	+
EMBINCO	+	+
GOODINCO	+	NS

*+ stands for significantly positive; - stands for significantly negative; NS stands for statistically insignificant.

Results for dummies show:

➡ The negative impact of the global financial crisis that started in 2008

➡ The significant role played by China in flows of FDI of the group of countries analysed

LIMITATIONS

(i) The **narrow number of countries and sectors covered** by the main international input-output databases (e.g. the WIOD covering just 40 countries and 35 sectors or the MIWI covering 56 countries but 18 sectors).

(ii) Trade in value-added being an **estimate based on a number of assumptions**, rather than a measurement.

(iii) Databases available do not **consider at least second-round effects** in the use of intermediates by GVC, i.e. the inputs used in the production of the inputs.

(iv) OECD's broad definition of FDI, since OECD's definition of FDI flows does not differentiate between speculative and productive FDI stock.

NEW AVENUES FOR RESEARCH

1.To individualize each one of main three regional GVC areas (Southeast Asia, North America and Central Europe).

2.To deepen the study of the relationship between GVC and FDI, for instance by separating the downstream approach from the upstream one and also using GVC indicators based on trade flows.

Os indicadores utilizados

Metodologia	+	-
Estatísticas de comércio internacional em partes e componentes	• Muito fáceis de obter e elevada comparabilidade internacional	• Apenas cobre bens, não serviços • Qualidade depende no grau de desagregação das estatísticas • Classificação nem sempre coincide com o uso efetuado (BI e BF) • Não permite leituras de *second-round effects*
Estatísticas das alfândegas para bens em processamento	• Mostram second-round effects • Segue de perto a origem inicial do produto	• Disponíveis em poucos países, logo comparabilidade internacional é quase nula
Dados ao nível das firmas	• Elevado grau de detalhe	• Dificuldade de obtenção (confidencialidade) • Comparabilidade muito limitada
(recente) <u>Matrizes input-output ligadas com dados de comércio internacional</u>	• Categoriza bens e serviços por uso efetivo, e não pela categoria • Aplicações práticas muito amplas	• Apenas espaçadas no tempo (95, 00, 05, 09) • Não mostram *second round effects*

World Input-Output Database

www.wiod.org

"Made in the World"

WORLD TRADE ORGANIZATION

www.wto.org/miwi