

**Vertical Specialization:  
Evidence from Puerto Rico (1977-2002)**

**Presentation to the Puerto Rico Planning Board**

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# Agenda

1. Introduction
2. Literature Review
3. Methodology
4. Results
5. Conclusions

# INTRODUCTION

- Motivation
- What is Vertical Specialization?
- Why Puerto Rico?

# Motivation

## Compared Business Systems – Aponte-García (2012)

### A. Module: Productions Systems

#### ➤ **Chains**

- ✓ Value Chain [VC] – Porter (1985, 1990)
- ✓ Global Commodity Chain [GCC] – Gereffi (1995, 1999)
- ✓ Global Production Networks [GPN] – Dicken (2002)

# Motivation

“The NIDL, **global commodity chains** and production networks all fit well with IB research agenda. The progress of research in this area depends on interdisciplinarity and connectivity... this type of *creative connectivity* is needed in pushing forward the frontiers of research...the comparative advantage of IB scholars has always been their ability to combine different approaches and to see the big picture.”

Buckley & Ghauri (2004)  
JIBS [A\*], pp. 91, 92

# Why Vertical Specialization?

“**Global Value Chains: Investment and Trade for Development**”

UNCTAD: WORLD INVESTMENT REPORT 2013

“A sluggish Postcrisis, Mega Trade Negotiations and **Value Chains: Scope for Regional Action**”

UN-ELCAC: DIVISION OF INTERNATIONAL TRADE AND INTEGRATION 2013

“Trade Crisis and Recovery: Restructuring of **Global Value Chains**”

WORLD BANK: GLOBAL TRADE AND  
FINANCIAL ARCHITECTURE 2010

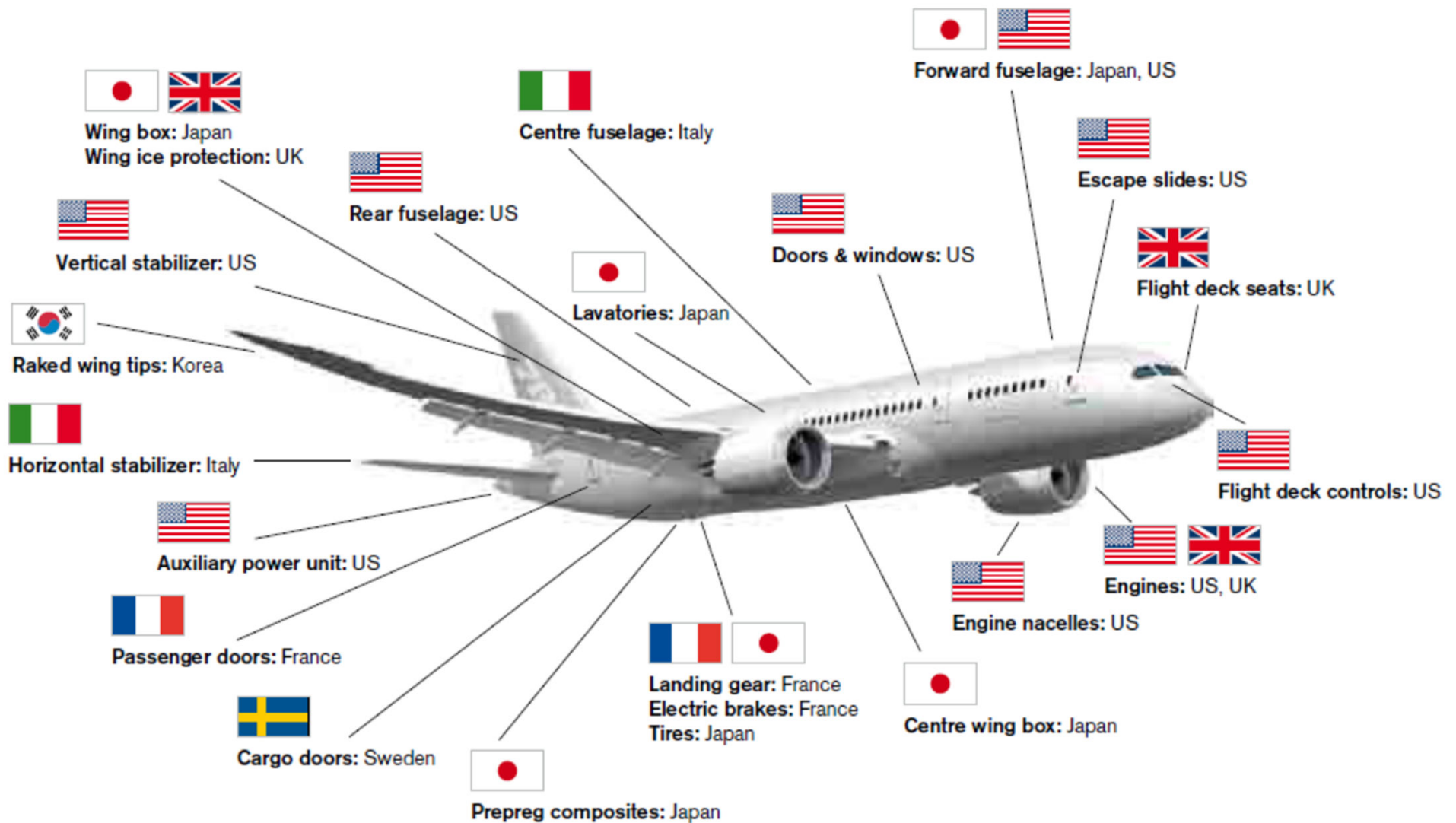
# What is Vertical Specialization?

“Trade patterns and **global value chains** in East Asia: From trade in goods to trade in tasks”

- “New trade reality...often referred to as global value chain or *vertical specialization*... deepens the interdependency of trade relations and has many implications for how we understand trade policy”

# What is Vertical Specialization?

“Fragmentation of Production”

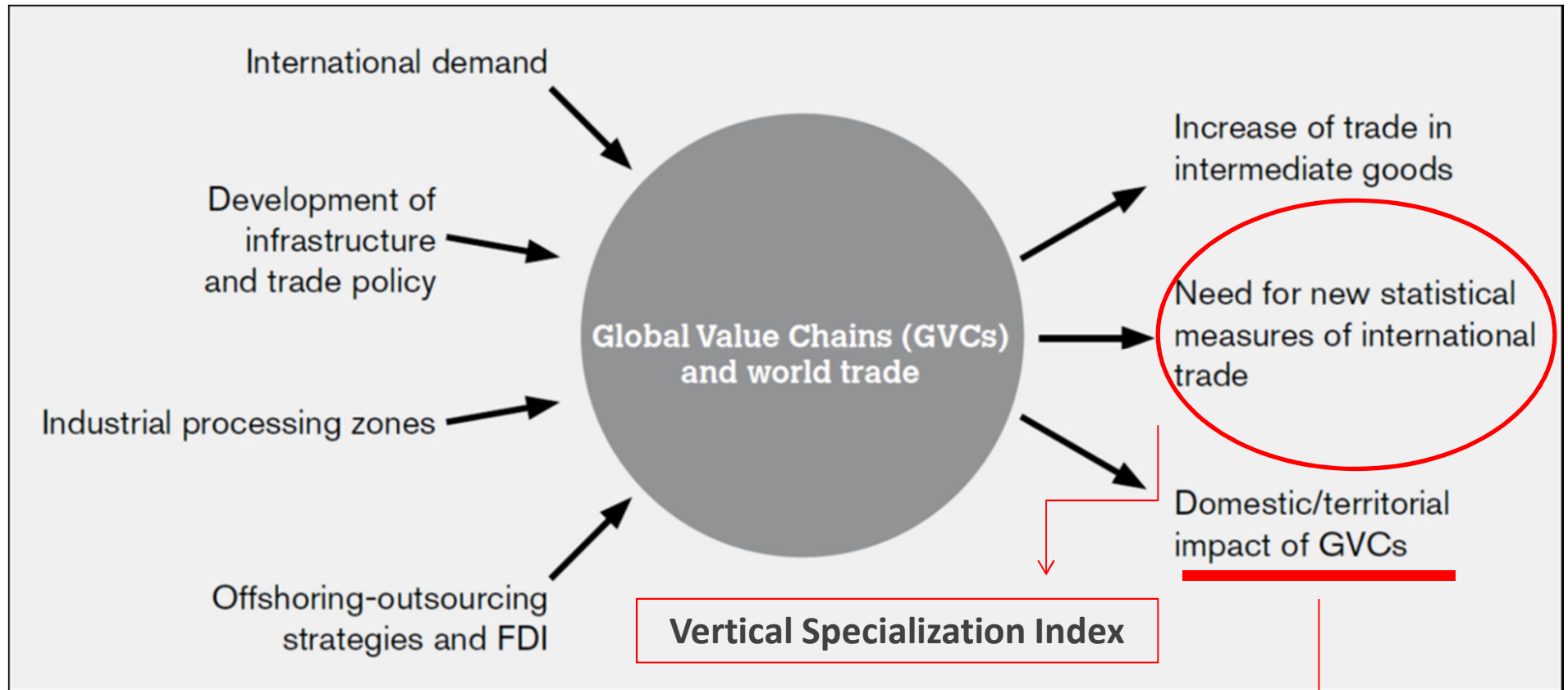


Source: Meng & Miroudot, 2011. Reproduced by WTO & IDE-JETRO, 2011, p. 95



# What is Vertical Specialization?

“New Trade Reality”



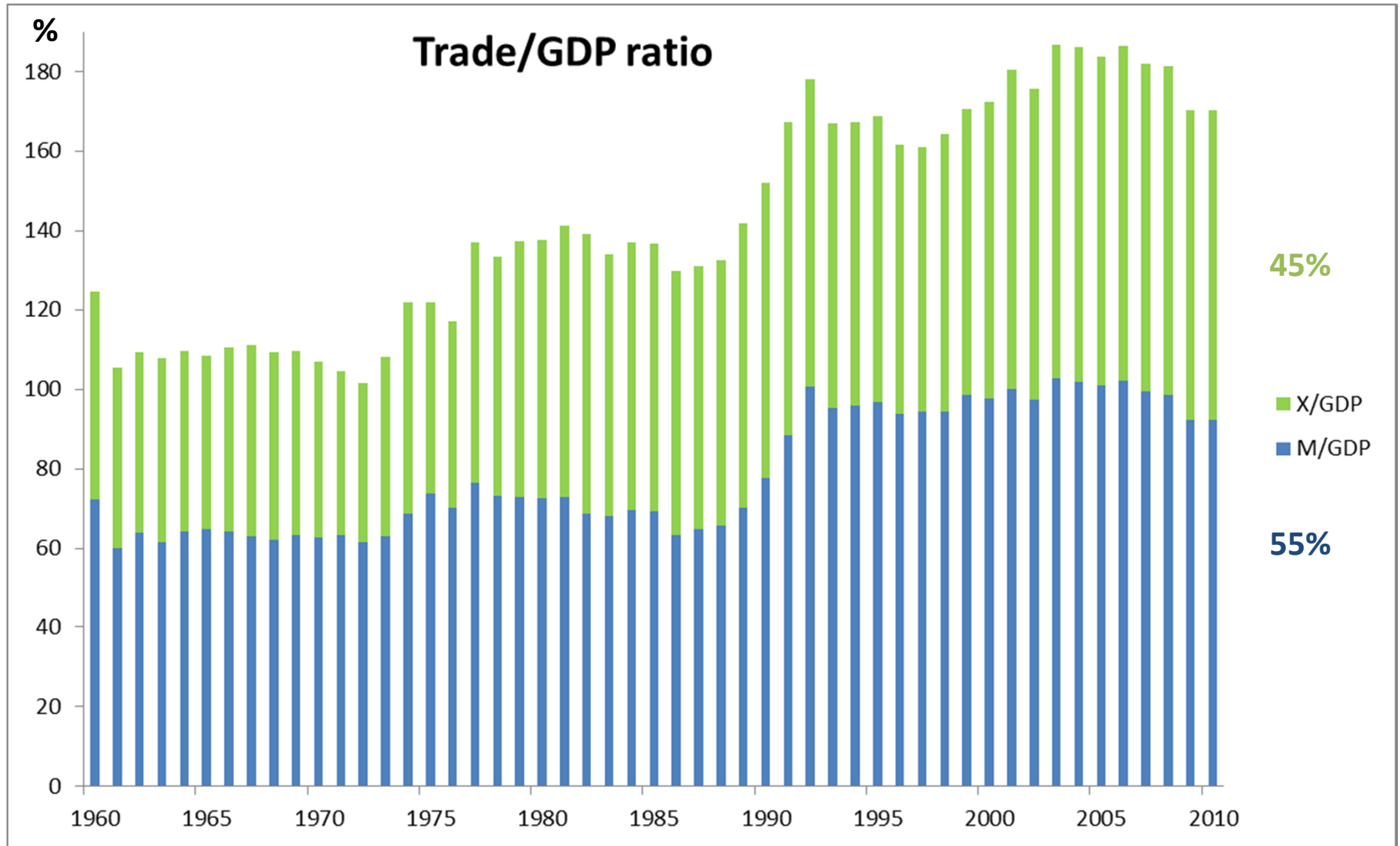
Source: Adapted From WTO & IDE-JETRO, 2011, p. 4

# Why Puerto Rico?

The vertical specialization index has never been calculated for Puerto Rico.

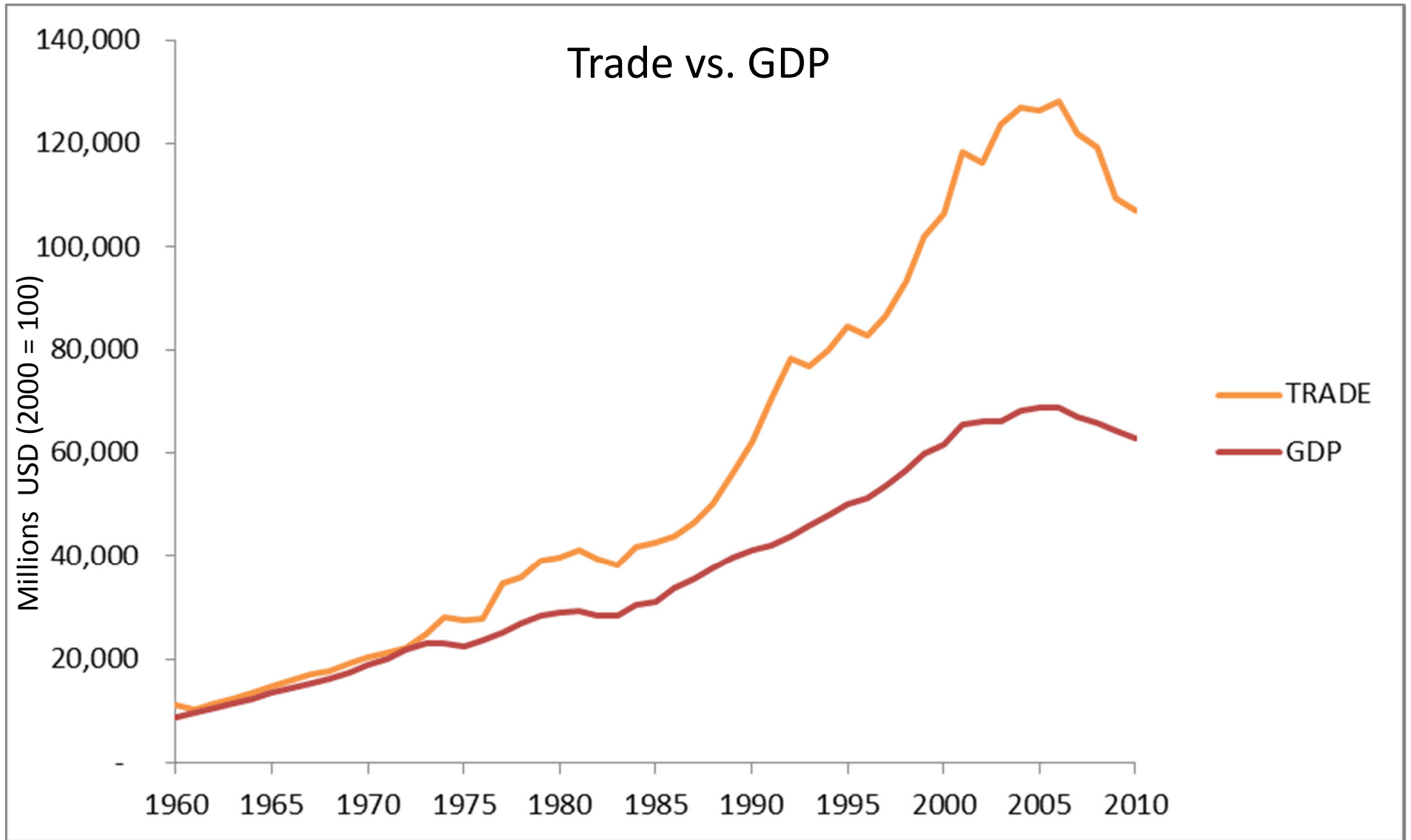


# Why Puerto Rico?



**Source:** Author's calculation with data of the World Bank. Implicit GDP deflator were applied (2000 = 100)

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**Source:** Author's calculation with data of the World Bank. Implicit GDP deflator were applied (2000 = 100)

# **LITERATURE REVIEW**

- Main Approaches
- Vertical Specialization Index
- Empirical Applications

# Main Approaches

## Global Disintegration of Production

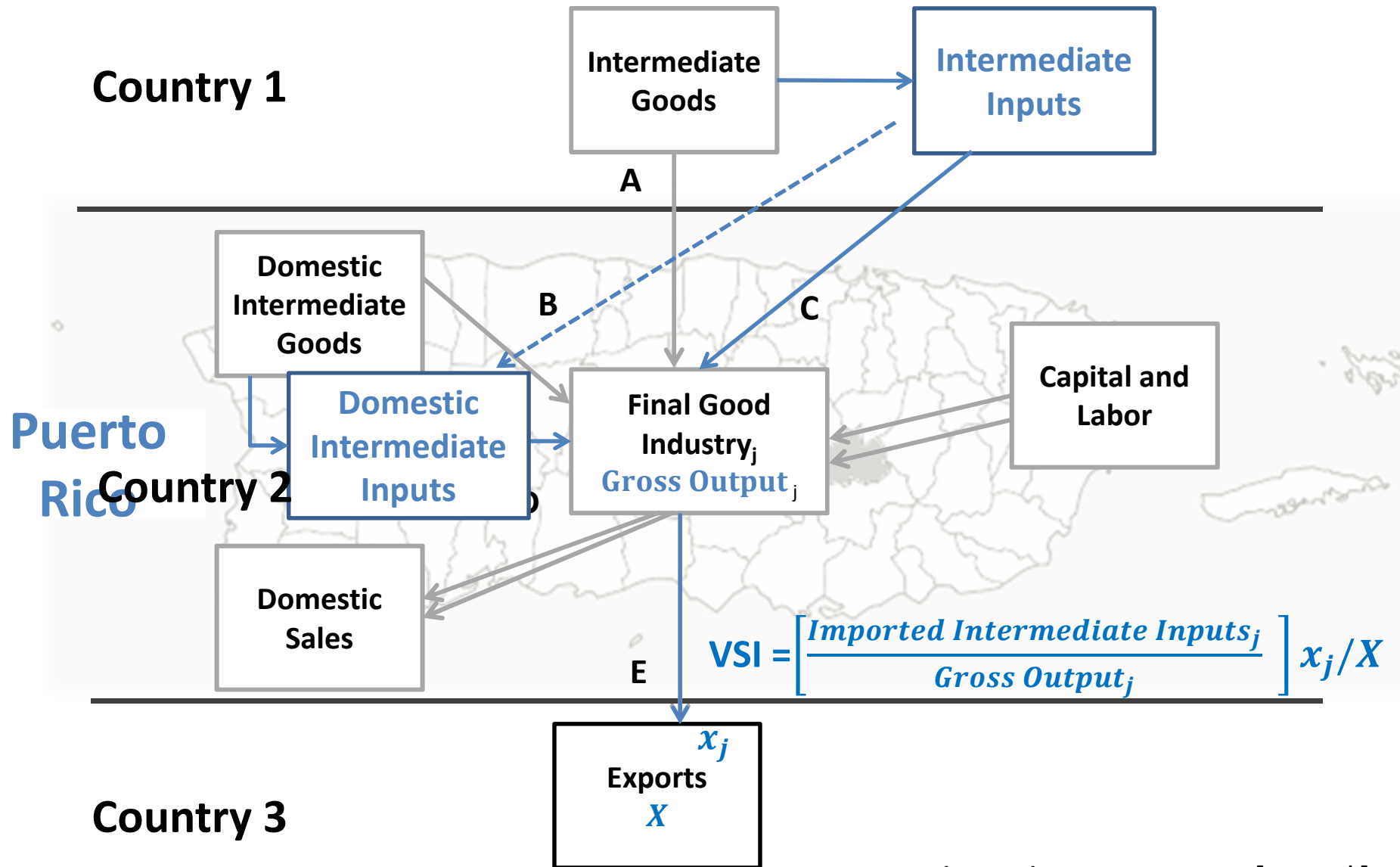
Approach	Author	Thematic	International Business (IB) & Trade (IT) Link
Labour	Fröbel et al. (1980)	New Int' Division of Labour	EPZ's: Export-oriented industrial fragmentation
Production	Dixit & Grossman (1982)	Multi-stages of production	Specialization of production and trade in intermediates goods
	Jones & Kierzkowski (1990, 2005)	Fragmentation & services	Fragmented production blocks interconnected by "services linkages"
	Leamer (1996)	De-localization	External production markets and internal labour market (Heckscher-Ohlin Theorem)
	Feenstra (1998)	Des-integration	Integration of trade and disintegration of production.
	Deardorff (1998)	Fragmentation	Fragmentation of production and patterns of specialization and trade
Global Value Chains	Gereffi & Korzeniewicz (1994)	Global Commodity Chain	Spatial patterns, strategic reorientation and transnational corporations (TNC's)
	Gereffi (1999)	Commodity Chain	International trade and industrial upgrade
	Yeats (1999)	Global Prod. Sharing	Empirical evidence (SITC, revision 2, #7)
	Sturgeon (2001)	GVC & GPN	Holistic analytical framework

**Source:** The author

# International Trade Theoretical Approach

- B. Balassa (1967) [Book]
  - “*Vertical specialization*” Vs. “Horizontal” (p.97)
- Findlay (1978) [JPE, A\*]
  - “...*Vertical* international division of labor...the less impatient country and therefore more capital abundant *specialize* in the more time-intensive earlier intermediate stages...”  
Vs. “instantaneous labor-intensive final stage” (p.1005-1006)
- Sanyal (1983) [Ec, A]
  - “...both countries are better off under *vertical specialization* provided their specialized according to their comparative advantage” (p.75)

# Vertical Specialization: Hummels, Ishii & Yi (2001)



Hummels et al., 2001, p. 78. [JIE, A\*]



# Vertical Specialization Index

1) “Backward GVC participation index...the country as a user of foreign inputs (upstream links)...”

Backer & Miroudot, 2013, p. 11 [OECD]

2) “HIY formula...method...approach...indicator”

Koopman, Wang & Wei, 2012, pp. 179,184 [JDE, A\*]

3) “The value share of imported intermediates in exports”

Upward, Wang & Zheng., 2012, p. 5, 184 [JCE, A]

4) “...vertically specialized (VS) exports as a share of merchandise exports”

Dean, Fung & Wang, 2011, p. 616 [RIE, A]

# Vertical Specialization Index: Empirical Applications

Author/[Publication]	Year	Countries-sample	I-O Tables
Minondo & Ruppert [G]	2002	Spain	1970, 1990 , 1994
Chen <i>et al.</i> [NAJEF, B]	2005	10 OECD countries	1972, 77, 85, 90, 95
Chen & Chang [OER, B]	2006	Taiwan + South Korea	1981, 84, 86, 89, 91, 94, 96
Loschky & Ritter [OECD]	2006	Germany	1995, 2000 , 2005
Amador & Cabral [G]	2008	Portugal	1980, 86, 92, 95, 99, 2002
Breda <i>et al.</i> [G]	2008	Italy + 6 EMU countries	1995 and 2000
Nôrdas [JDS, A*]	2008	75 World countries (10 LA)	2001
Miroudot <i>et al.</i> [OECD]	2009	29 OECD, BRICS + 6 Em (Ar)	1995 and 2005
Backer & Yamano [OECD]	2012	39 OECD	1995 and 2005
WTO-IDE-JETRO [WTO]	2011	9 asian countries + USA	1995 and 2008
Backer & Miroudot [OECD]	2013	30 OECD + BRICS + 16 (Ar)	2009

**Source:** The author

# Key Industries Analysis: Empirical Applications

Author/[Publication]	Year	Countries	IO-Tables
Dietzenbacher [EM, A]	1992	Netherlands	1948, 1972, 1977, 1981, 1986
EU Commission [G]	2007	EU countries	2000
Reis & Rua [G]	2009	Portugal	1980, 1986, 1992, 1999, 2002
Kelly <i>et al.</i> [wp]	2013	UK	2005
Lima <i>et al.</i> [ECLAC]	2013	Colombia	2005
Guo & Planting [US-BEA]	2013	USA	1972, 1977, 1982, 1985, 1990, 1997

**Source:** The author

# **METHODOLOGY**

- Model
- Matrix Algebra
- Concepts and Proxys
- Data

# Model

□ The Open Quantity Model of Input-Output Analysis (“Non-competitive input-output model” by Chen *et al.* 2012 [CER, A])

➤ Leontief (1936, RES, A\*), (1941, Book)

❖ Total Gross Output

$$\mathbf{y} = \mathbf{T}\mathbf{s} + \mathbf{f}$$

❖ Total Gross Outlay

$$\mathbf{y}' = \mathbf{s}'\mathbf{T} + \mathbf{v}'$$

# Matrix Algebra

- $\mathbf{y} = \mathbf{D}\mathbf{s} + \mathbf{f}$  (1) Basic material balance identity
- $\mathbf{f} = \mathbf{y} - \mathbf{D}\mathbf{s}$  (2)
- $\mathbf{A}^D = \mathbf{D}\hat{\mathbf{y}}^{-1}$  (3) Technological domestic matrix (direct)
- $\mathbf{A}^M = \mathbf{M}\hat{\mathbf{y}}^{-1}$  (4) Technological imported matrix (direct)
- $\mathbf{D} = \mathbf{A}^D\hat{\mathbf{y}}$  (5)
- $\mathbf{f} = \mathbf{y} - \mathbf{A}^D\mathbf{y}$  (6)
- $\mathbf{f} = (\mathbf{I} - \mathbf{A}^D)\mathbf{y}$  (7)
- $\mathbf{y} = (\mathbf{I} - \mathbf{A}^D)^{-1}\mathbf{f}$  (8) Leontief inverse (direct + indirect)
- $\tilde{\mathbf{y}} = \mathbf{L}^D\tilde{\mathbf{f}}$  (9)
- $\text{HIY} = \mathbf{s}'\mathbf{A}^M\mathbf{L}^D\mathbf{x}/x$  (10) Vertical Specialization Index (VSI)

# Concepts & Equations

Concept	Equations
VS index	$HIY = \mathbf{s}'\mathbf{A}^M\mathbf{L}^D \mathbf{x}/x$
VS direct index	$HIY^d = \mathbf{u}'\mathbf{A}^M \mathbf{x}/x$
VS indirect index	$HIY^i = HIY - HIY^d$
Industrial VS Intensity	$IVSI = \mathbf{s}'\mathbf{A}^M\mathbf{L}^D$
Exports linkage (Composition analysis)	$\Delta \frac{x_t}{y_{ij t}} = \Delta \frac{(HIY * x_t)}{y_{ij t}} + \frac{(x_t - (HIY * x_t))}{y_{ij t}}$
$\Delta$ VS index = $\Delta$ IVSI + $\Delta$ share of exports (Shift-share analysis)	$\Delta HIY_t = \sum_{j=1}^n \left( \Delta \beta_{\bullet j t}^m * 0.5 * (\omega_{j t} + \omega_{j t-1}) \right. \\ \left. + (\Delta \omega_{j t}) * 0.5 * (\beta_{\bullet j t}^m + \beta_{\bullet j t-1}^m) \right)$

Source: The author

# Concepts & Equations

Proxy	Concept	Equations
VS Intensity Analysis	The proportion of imported intermediates inputs (of total inputs) required for production by the import penetration in order to respond to final demand	$IA = (\mathbf{s}'\mathbf{M}\hat{\mathbf{y}}^{-1})(\mathbf{m}\hat{\mathbf{f}}^{-1}) * 100$
Backward Linkages	<ul style="list-style-type: none"> <li>- Output multiplier</li> <li>- Demand-driven input-output model</li> <li>- The interdependence on inputs</li> </ul>	$\text{Blink} = \mathbf{s}'(\mathbf{I} - \mathbf{A}^D)$ [Leontief]
Forward Linkages	<ul style="list-style-type: none"> <li>- Input multiplier</li> <li>- Supply-driven input-output model</li> <li>- The interdependence on outputs</li> </ul>	$\text{Flink} = \mathbf{s}'(\mathbf{I} - \mathbf{B}^D)$ [Gosh]

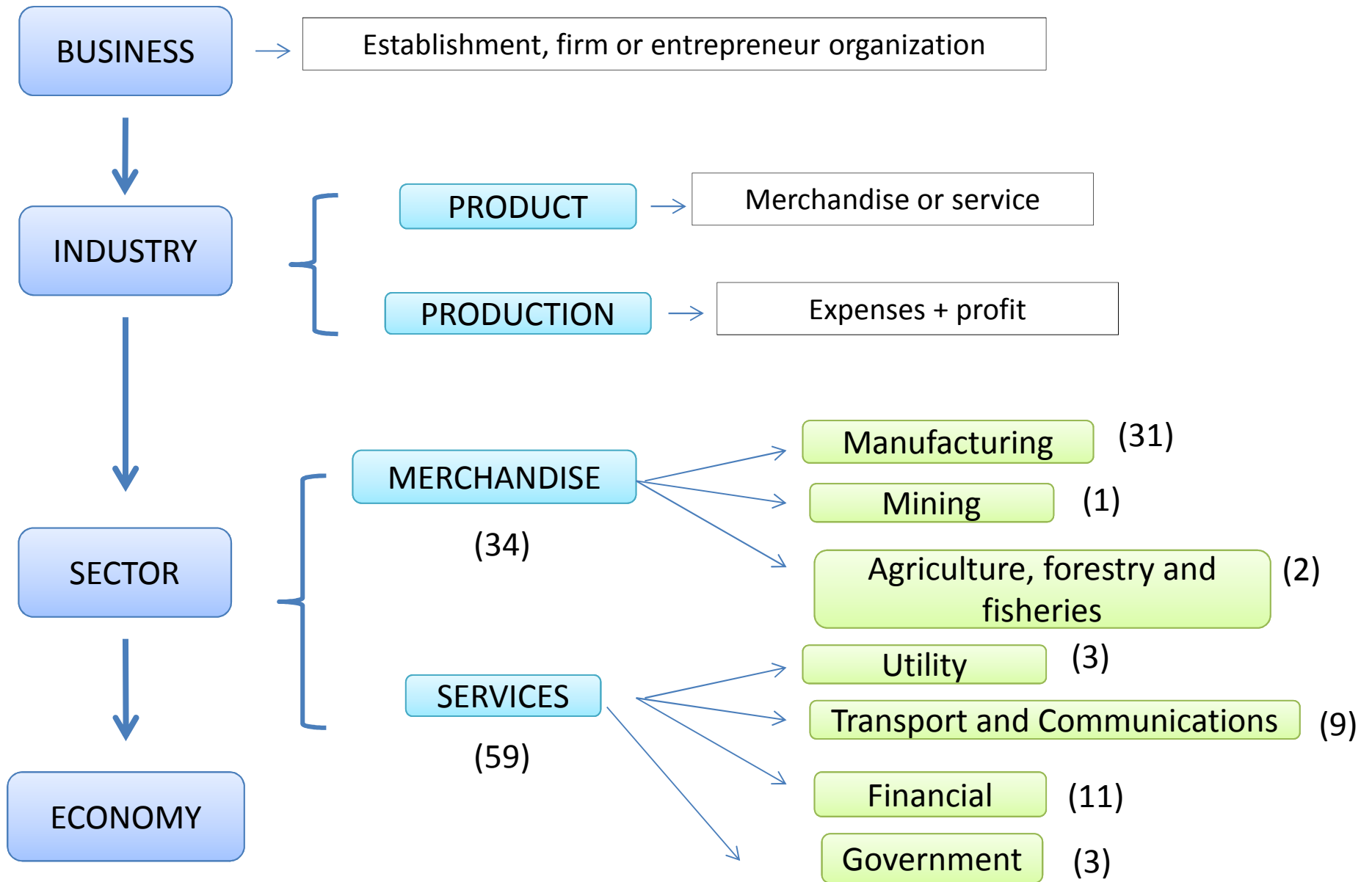
Source: The author



# Methodology: Data

- Social Accounting Matrix of Puerto Rico
  - Symmetric Transactions Matrix (IOT)
    - ✓ Years: 1976-77, 1981-82, 1986-87, 1991-92, 2001-2.
    - ✓ Industries: 92
  - Final Demand rectangular matrix
    - ✓ C, I, G, *Exports*

# Methodology: Data from Puerto Rico IOT



Source: The author

# RESULTS

# Puerto Rico Vertical Specialization Index: Applications by Scenarios and Sectors (1977-2002)\*

		Sectors	Scenario I					Scenario II				
			1977	1982	1987	1992	2002	1977	1982	1987	1992	2002
Application A	Economy	41.2	41.9	34.9	31.1	16.6	22.8	30.0	32.6	29.3	15.9	
	Services	2.8	1.1	1.0	1.1	0.5	2.2	1.0	0.9	1.0	0.5	
	Merchandise	38.4	40.8	33.9	30.0	16.1	20.7	29.0	31.7	28.2	15.5	
Application B	Services	38.8	27.7	24.8	27.7	12.4	29.9	25.2	22.8	25.3	11.4	
	Merchandise	<b>41.4</b>	<b>42.5</b>	<b>35.4</b>	<b>31.3</b>	<b>16.7</b>	22.3	30.2	33.1	29.4	16.1	

\*Data in percentage

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	Services	2.8	1.1	1.0	1.1	0.5	2.2	1.0	0.9	1.0	0.5	
	Merchandise	38.4	40.8	33.9	30.0	16.1	20.7	29.0	31.7	28.2	15.5	
	Manufacture	38.2	40.7	33.9	30.0	16.0	20.5	28.9	31.6	28.2	15.5	
Application B	Services	38.8	27.7	24.8	27.7	12.4	29.9	25.2	22.8	25.3	11.4	
	Merchandise	<b>41.4</b>	<b>42.5</b>	<b>35.4</b>	<b>31.3</b>	<b>16.7</b>	22.3	30.2	33.1	29.4	16.1	
	Manufacture	41.4	42.6	35.4	31.3	16.7	22.2	30.3	33.1	29.4	16.1	

\*Data in percentage

# Petroleum Effect on Puerto Rico's VS Index

		Share of Imported Intermediate Inputs				
<b>SIC</b>	<b>Industry</b>	<b>1977</b>	<b>1982</b>	<b>1987</b>	<b>1992</b>	<b>2002</b>
11000	Mining	0.04	0.003	0.08	0.07	0.07
29100	Petroleum Refineries	39.81	27.64	9.92	8.37	4.57
29200	Other Petroleum Products	1.70	0.63	0.46	0.46	0.54
--	The rest of Industries	58.5	71.7	89.5	91.1	94.8
<b>Total</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

## International Comparison of the Petroleum Effect on the VS Index

Application B	GE	AU	USA	CA	DE	UK	FR	NE	JA	<b>PR</b>
Scenario I	18	10	8.5	22	31	25	23	38	18	41
Scenario II	16	8	6	19	27	20	17	27	6	22
<b>Effect</b>	<b>2</b>	<b>2</b>	<b>2.5</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>11</b>	<b>12</b>	<b>19</b>
Year	1978	1974	1977	1976	1977	1979	1977	1977	1975	1977

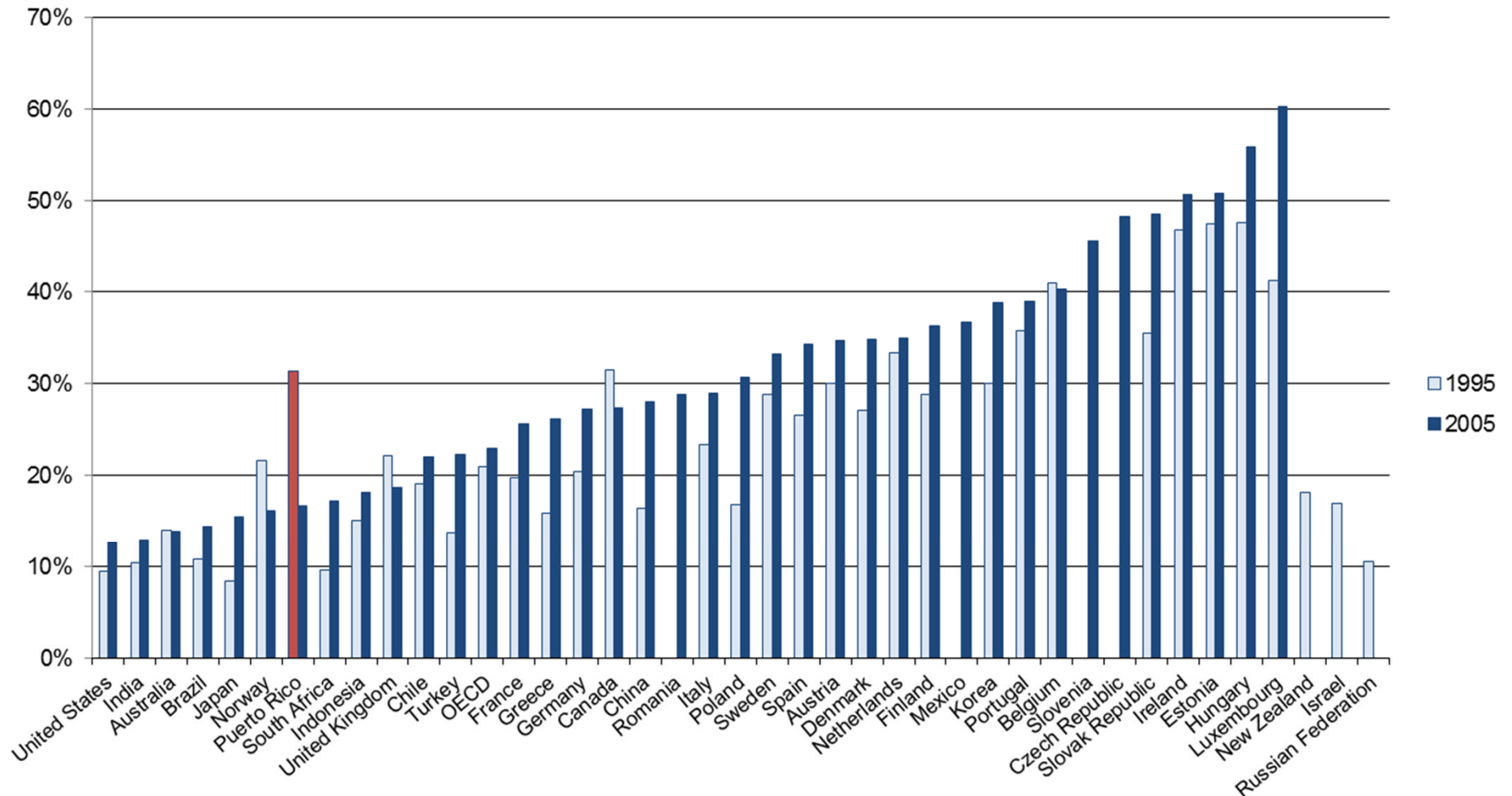
Source: Hummels et al. (2001) for OECD countries and the author for Puerto Rico.

# Puerto Rico Vertical Specialization Index as a Share of Merchandise Exports vis á vis 12 Countries\*

		AU	CA	DE	FR	GE	IT	JA	NE	PO	SP	UK	USA	PR
1977	HIY	-	21.9	31.2	22.9	18.4	-	17.7	38.1	-	-	25.3 <sup>+</sup>	8.5	41.4
	RANK	-	[6]	[3]	[5]	[7]	-	[8]	[2]	-	-	[4]	[9]	[1]
1980	HIY	-	23.1	33.6	26.1	-	-	18.7	44.6	37.8	-	-	8.8 <sup>+</sup>	42.5 <sup>+</sup>
	RANK	-	[6]	[4]	[5]	-	-	[7]	[1]	[3]	-	-	[8]	[2]
1985	HIY	11.5	27.8	33.5	26.7	19.8	26.9	13.5	36.9	33.0	31.0	24.1	9.3	35.4 <sup>+</sup>
	RANK	[12]	[8]	[3]	[7]	[10]	[6]	[11]	[1]	[4]	[5]	[9]	[13]	[2]
1990	HIY	11.2	27.0	29.5	23.9	19.6	22.5 <sup>+</sup>	11.0	-	31.1 <sup>+</sup>	25.6	25.9	10.8	31.3 <sup>+</sup>
	RANK	[10]	[4]	[3]	[7]	[9]	[8]	[11]	-	[2]	[6]	[5]	[12]	[1]
1995	HIY	15.7	-	28.2 <sup>+</sup>	27.1	22.4	-	9.5	39.2	36.3	29.0	-	12.3 <sup>+</sup>	-
	RANK	[7]	-	[4]	[5]	[6]	-	[9]	[1]	[2]	[3]	-	[8]	-
2001	HIY	16.5	31.9	29.5	22.7	25.3	27.3	10.9	34.8	28.0	26.0	20.3	11.4	16.7
	RANK	[11]	[2]	[3]	[8]	[7]	[5]	[13]	[1]	[4]	[6]	[9]	[12]	[10]

\*Data in percentage, one more or one less the indicated year. +/- means 2 years more/less. Sources: Chen et.al (2005); Minondo y Rupert (2002) for Spain; Amador y Cabral (2008) for Portugal; Nôrdas (2008) all data from 2001; the author for Puerto Rico.

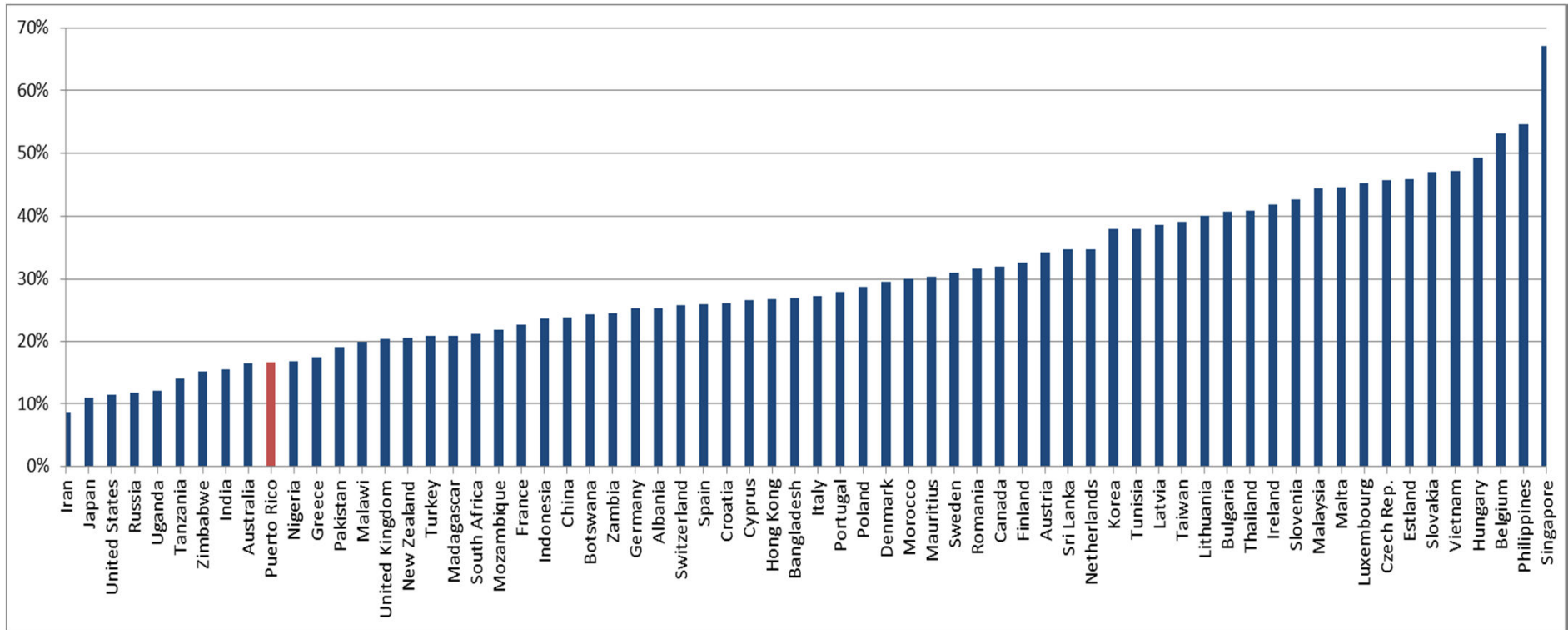
# Puerto Rico Vertical Specialization Index as a share of merchandise exports vis á vis 39 OECD countries



Source: OECD (2010); the author for Puerto Rico.

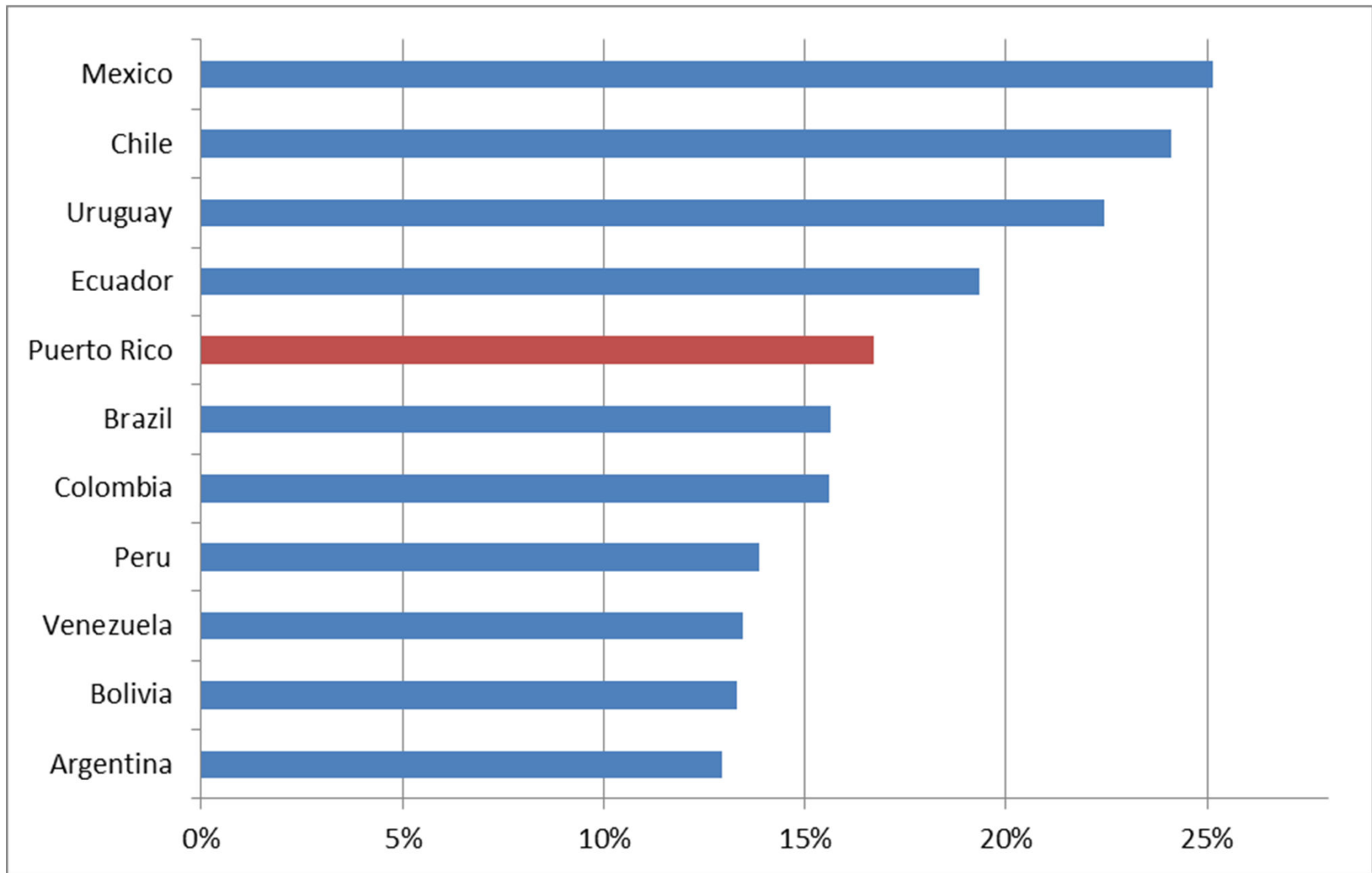


# Puerto Rico Vertical Specialization Index as a share of merchandise exports vis á vis 65 countries (2001-2)



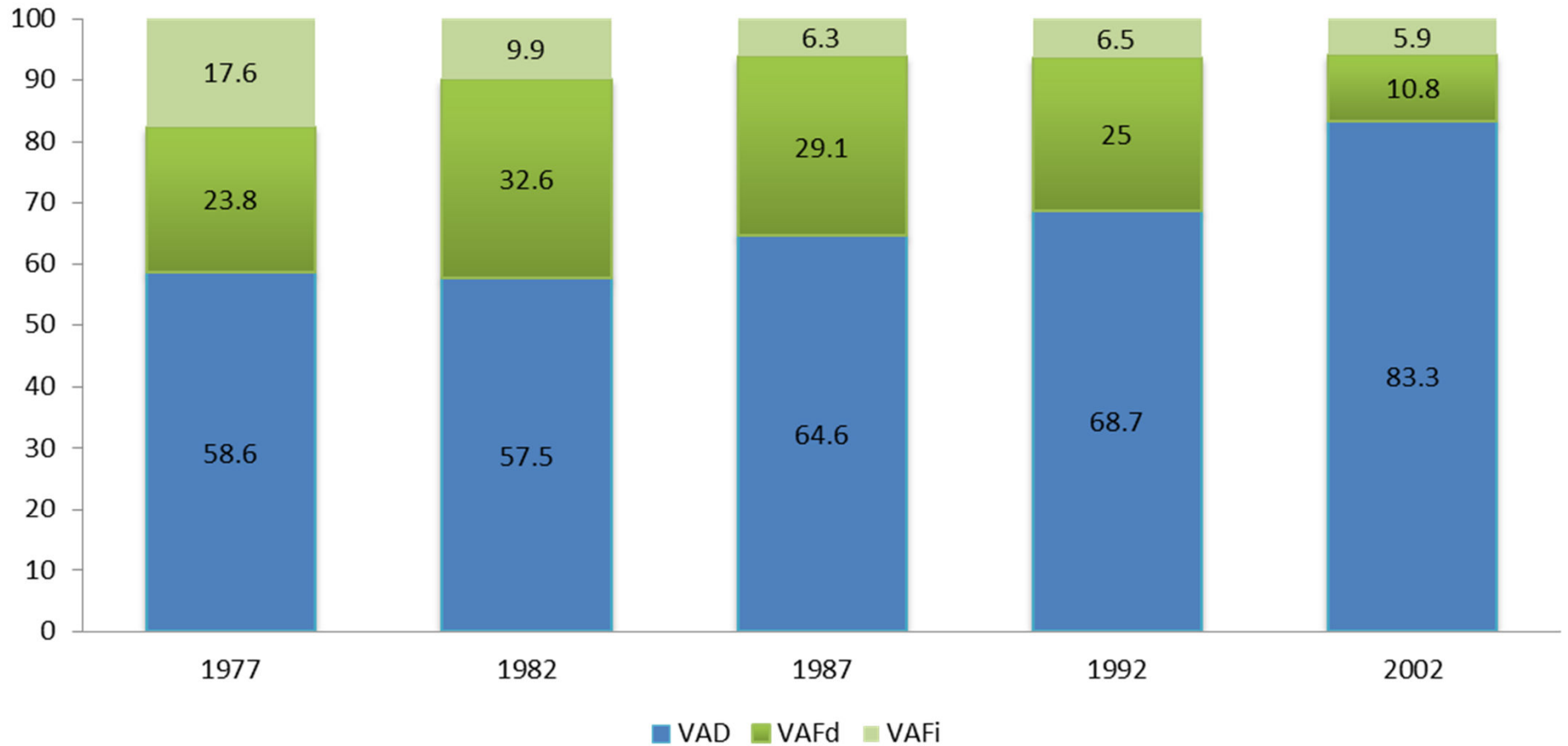
Source: Nôrdas (2008); The author for Puerto Rico

# Puerto Rico Vertical Specialization Index as a Share of Merchandise Exports vis á vis 10 LA Countries (2001-2)

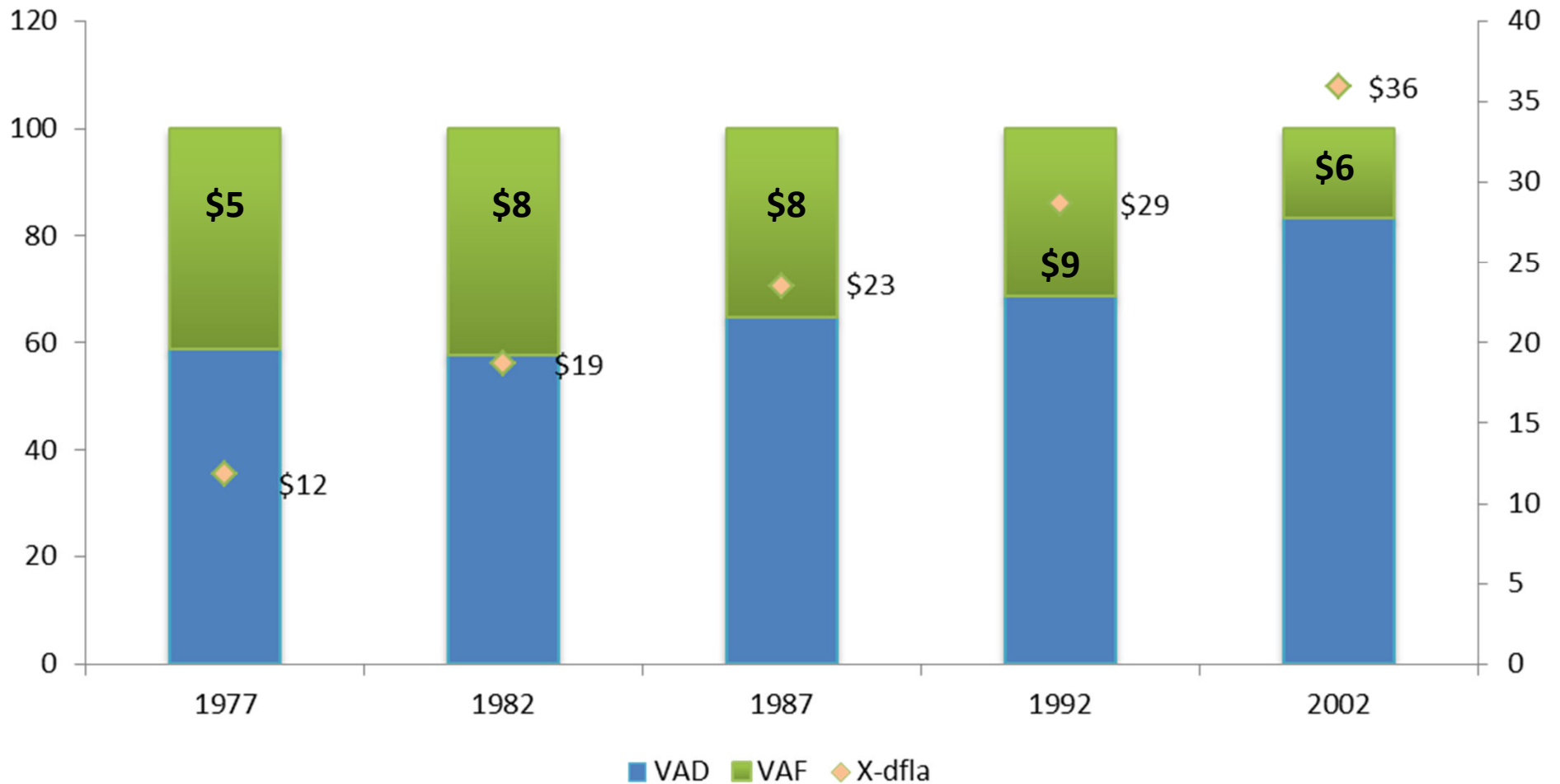


Source: Nôrdas (2008); The author for Puerto Rico``

# Share of Vertically Specialized Exports: Direct and Indirect

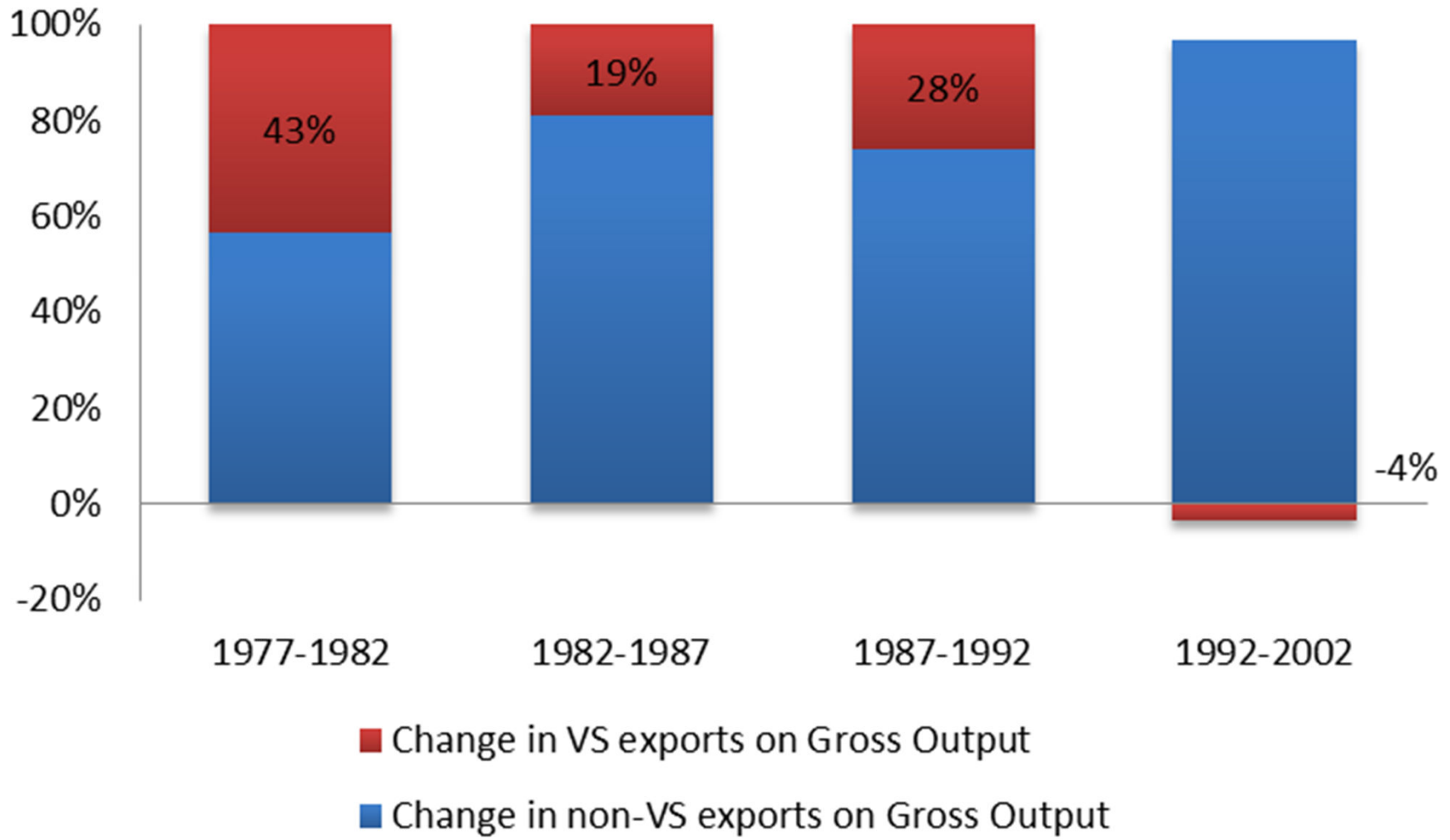


# Real Vertically Specialized Exports\*



\*Real: GDP implicit deflator using data from the Word bank, 100=2000.

# Contribution to the change of Export/Gross Output ratio



# Compared Contribution to the change of Export/Gross Output ratio

Countries	Inicial, final years	$\Delta$ In exports share of Gross Output	Change of VS exports %
Japan	1970, 1990	3	6.1
Australia	1968, 1989	6	16.2
United States	1972, 1990	7	14.1
<b>Puerto Rico</b>	<b>1977-1992</b>	<b>7</b>	<b>-49.0</b>
Canada	1971, 1990	8	50.9
Germany	1978, 1990	9	22.2
Netherlands	1972, 1986	10	48.2
France	1972, 1990	11	32.4
United Kingdom	1968, 1990	15	31.7
Denmark	1972, 1990	17	30.8

**Source:** Hummels et al. (2001) for OECD countries; Amador & Cabral (2008) for Portugal and the author for Puerto Rico

# Compared PR Vertical Specialization Contribution

## Shift-Share for Puerto Rico

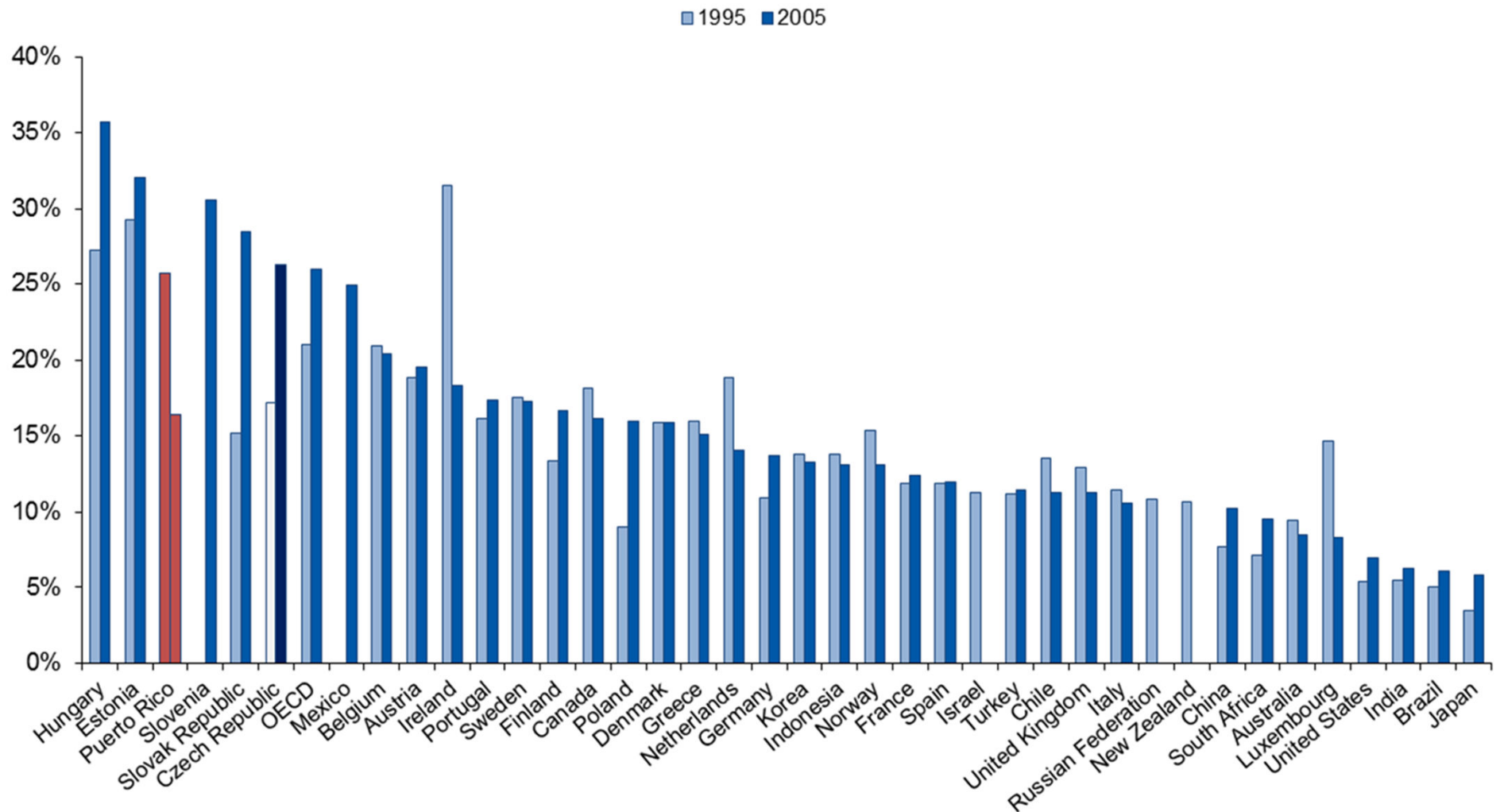
Inicial, final years	$\Delta$	$\Delta$ VS Intensity* $s'A^M L^D$	$\Delta$ Share of Exports* $x/x$
1977, 1982	6.9	6.8 <b>[99.0]</b>	0.1 <b>[1.0]</b>
1982, 1987	2.7	1.6 <b>[61.6]</b>	1.1 <b>[38.4]</b>
1987, 1992	-3.4	-2.0 <b>[59.1]</b>	-1.4 <b>[40.9]</b>
1992, 2002	-13.3	-9.1 <b>[68.3]</b>	-4.2 <b>[31.7]</b>
1977, 2002	-6.9	-1.9 <b>[-27.5]</b>	-8.8 <b>[127.5]</b>

## Shift-Share for 10 countries

Countries	Inicial, final years	$\Delta$	$\Delta$ VS Intensity*	$\Delta$ Share of Exports*
Portugal	1980, 2002	16.0	73.1	26.9
Canada	1971, 1990	7.0	73.5	26.4
France	1972, 1990	6.0	90.3	9.6
United Kingdom	1968, 1990	5.7	110.4	-10.4
United States	1972, 1990	4.9	90.3	9.7
Netherlands	1972, 1986	3.2	136.4	-36.4
Australia	1968, 1989	2.2	78.4	21.7
Germany	1978, 1990	1.2	90.3	9.6
Denmark	1972, 1990	0.7	74.1	25.8
Japan	1970, 1990	-2.4	18.2	81.9
Puerto Rico	1982, 2002	-14.0	79.9	20.1

**Source:** Hummels et al. (2001) for OECD countries; Amador & Cabral (2008) for Portugal and the author for Puerto Rico

# Relative Change of the Imported intermediates inputs as a share of total inputs 1995, 2005

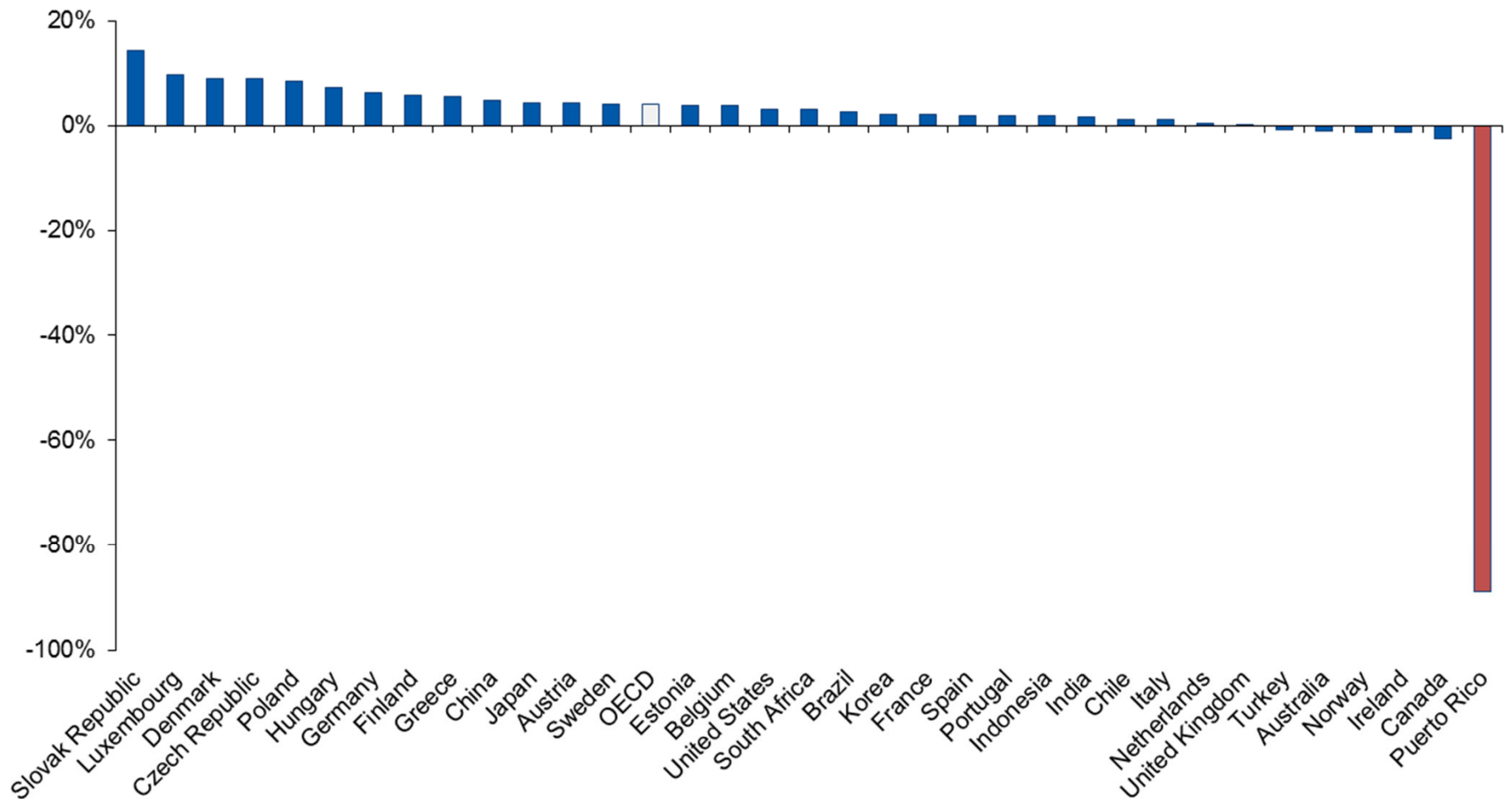


Fuente: OECD 2010 y cálculos propios para el offsh3 de Puerto Rico, 1992 y 2002



Puerto Rico Manufacturing Industry	VS Intensity (%)		Export Share (%)	
	1982	2002	1982	2002
Meat and Meat Products	25.4	52.0	0.0	0.0
Milk and Dairy Products	18.5	43.7	0.1	0.0
Canned fruits and vegetables	46.1	42.6	0.1	0.1
Grain Mill Products	54.7	46.6	0.1	0.0
Bakery Products	29.2	35.6	0.0	0.0
Sugar Mills, Refineries & Confectionery	11.4	37.6	1.6	0.2
<b>Beer, Malt &amp; Alcoholic Beverages</b>	<b>12.4</b>	<b>10.7</b>	<b>3.1</b>	<b>0.8</b>
Bottled and Canned Soft Drinks	33.2	40.7	1.5	8.0
Miscellaneous Food Products	42.2	30.7	0.1	0.3
<b>Canned and Cured Fish</b>	<b>60.4</b>	<b>44.4</b>	<b>4.3</b>	<b>0.0</b>
Tobacco Products	20.7	12.2	1.2	0.3
Textile Mill Products	23.4	29.0	0.5	0.0
<b>Apparel and Accessories</b>	<b>41.3</b>	<b>31.5</b>	<b>6.9</b>	<b>0.9</b>
Lumber and Wood products	39.9	39.4	0.0	0.0
Paper and Allied Products	50.0	55.6	0.2	0.1
Printing and Publishing	27.2	57.6	0.2	0.1
<b>Petrochemicals</b>	<b>22.9</b>	<b>48.8</b>	<b>4.7</b>	<b>0.1</b>
<b>Drugs and Pharmaceutical</b>	<b>32.0</b>	<b>11.3</b>	<b>30.1</b>	<b>70.6</b>
<b>Other Chemical Products</b>	<b>31.2</b>	<b>40.8</b>	<b>2.8</b>	<b>1.8</b>
<b>Petroleum Refining</b>	<b>10.6</b>	<b>21.4</b>	<b>8.4</b>	<b>0.1</b>
Other Petroleum Products	11.8	18.5	0.0	0.0
Rubber and Plastic products	22.2	54.1	1.4	0.2
Leather and Leather Products	38.5	48.8	1.4	0.2
Cement, Stone, Clay, Glass...	10.3	26.4	0.5	0.2
Primary Metal Products	47.7	48.4	0.2	0.1
Fabricated Metal Products	42.1	49.4	0.5	0.4
<b>Machinery, Except Electrical</b>	<b>31.2</b>	<b>22.7</b>	<b>6.8</b>	<b>7.8</b>
<b>Electrical and Electronic Machinery</b>	<b>32.4</b>	<b>22.8</b>	<b>12.9</b>	<b>3.1</b>
Transportation Equipment	19.8	29.0	0.4	0.0
Professional and Scientific Instruments	28.0	9.2	6.8	4.6
Miscellaneous Manufacturing Industries	35.4	32.2	3.2	0.1
			100.0	100.0

# Change of the Imported intermediates inputs as a share of total inputs required for production (import penetration in order to respond to final demand). 1995, 2005



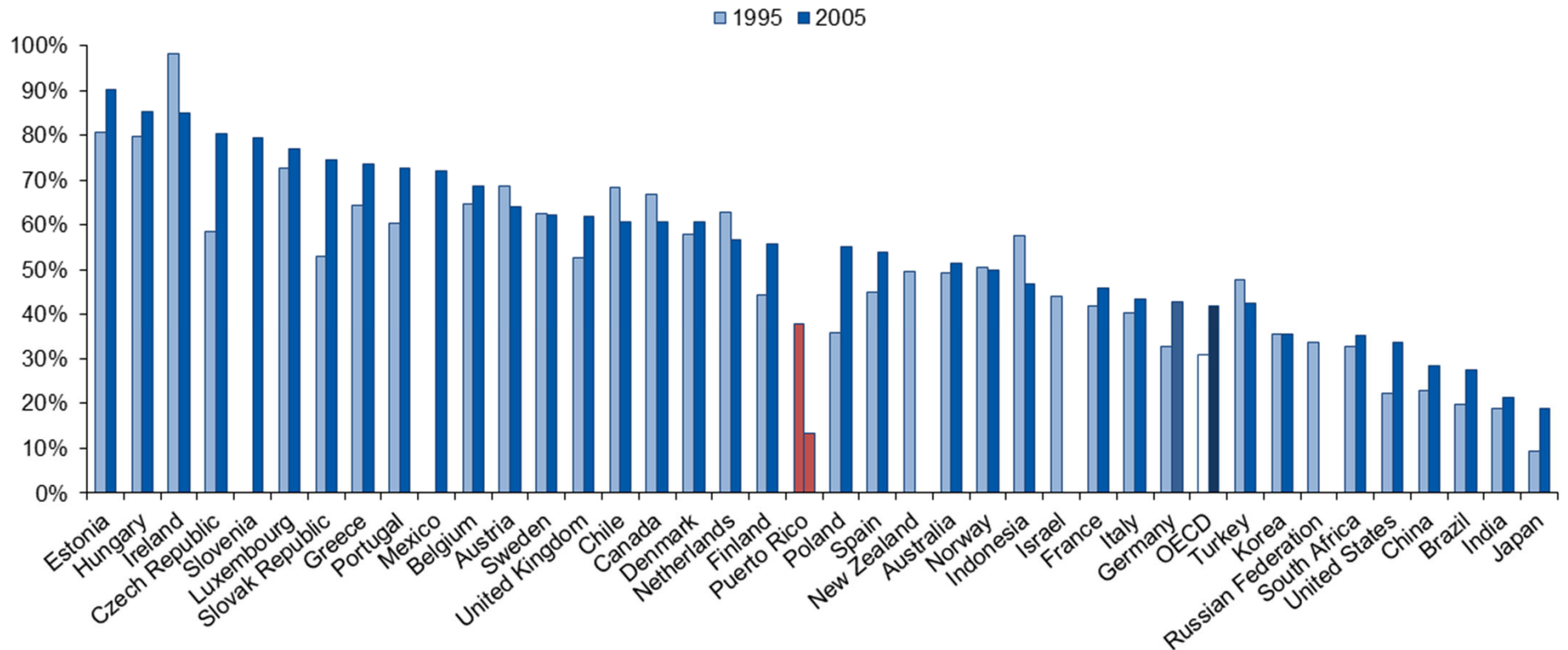
Fuente: OECD 2010 y cálculos propios para el offsh3 de Puerto Rico, 1992 y 2002

Vertically Specialized Mnf. Industries	Vertical Specialization Index*					Exports Classification**		
	1977	1982	1987	1992	2002	Category	Technology	Driven
Pharmaceutic	3.3	10.2	10.2	10.0	8.4	High Technology	Complex / Capital - Intensive	I I&D / Networks /skilled labor
Electrical Machinery	2.3	4.8	5.9	5.3	0.7			
P&C instruments	0.9	2.1	2.9	3.0	0.4			
Machinery	0.9	2.4	3.4	2.3	1.8	Medium Technology	Complex / Capital - Intensive	I I&D / Networks /skilled labor
Petrochemicals	7.6	3.0	0.1	0.0	0.1			
Other Chemicals	1.7	1.2	1.2	1.0	0.7			
Wearing & Appareal	3.1	3.0	1.8	1.4	0.3	Low Technology Baja	Simple / Labour- Intensive	Low Wages
Leather	0.6	0.6	0.7	0.7	0.1			
Goma y plástico	0.6	0.5	0.3	0.3	0.1			
Textil	0.7	0.1	0.2	0.1	0.0			
Petroleum Refineries	9.4	7.9	1.4	1.1	0.1	Resource- Based	Simple / Labour- Intensive	Natural Endowments / Low Wages
Canned Fished	4.0	2.7	2.7	1.4	0.0			
Non-Alcoholic	0.2	0.6	2.4	2.9	3.3			
Alcoholic Beverage	0.7	0.5	0.2	0.1	0.1			
Tabacco	0.9	0.3	0.0	0.1	0.0			
Total Sum	36.8	39.9	33.4	29.8	16.0			
HIY	41.4	42.6	35.4	31.3	16.7			
%	0.89	0.94	0.94	0.95	0.96			

\* In percentage

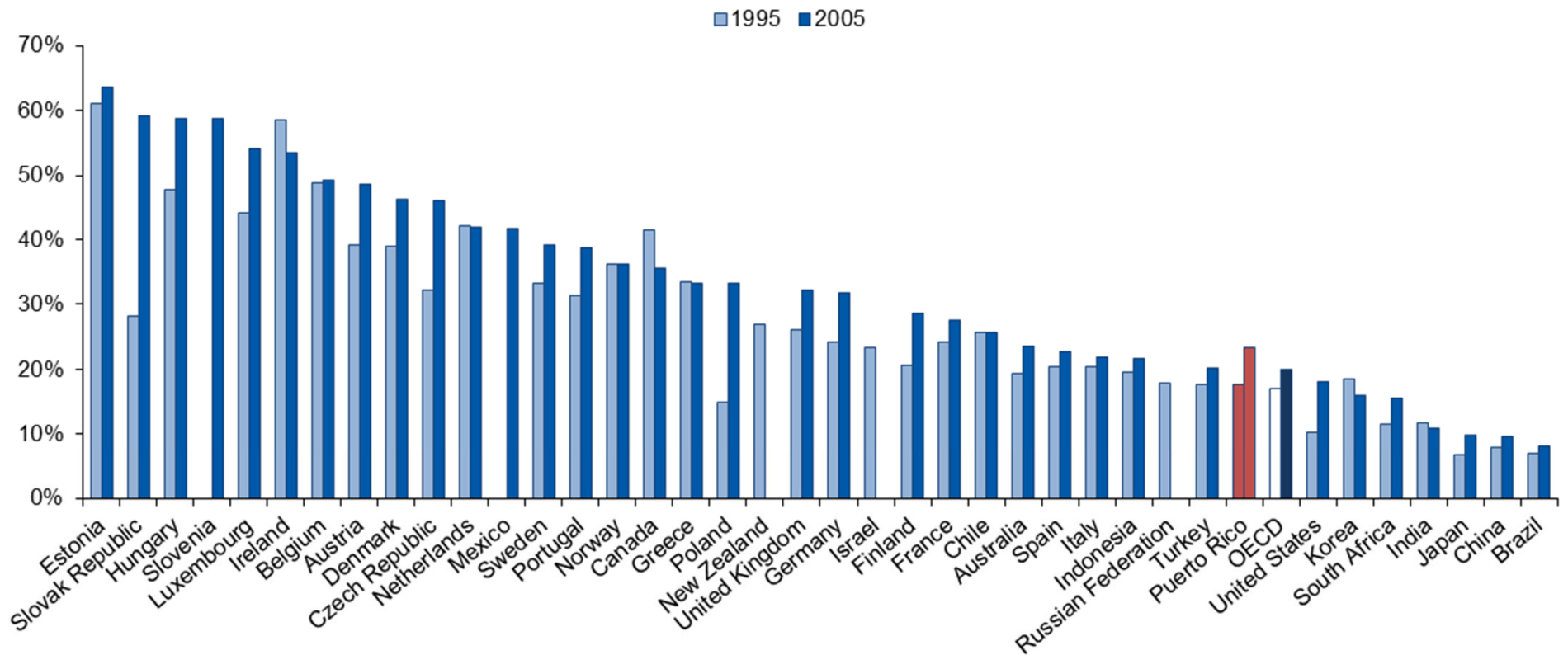
\*\*Based on Lall's technological exports classification (2000)

# Change of the Imported intermediates inputs as a share of total inputs High Technology. 1995, 2005



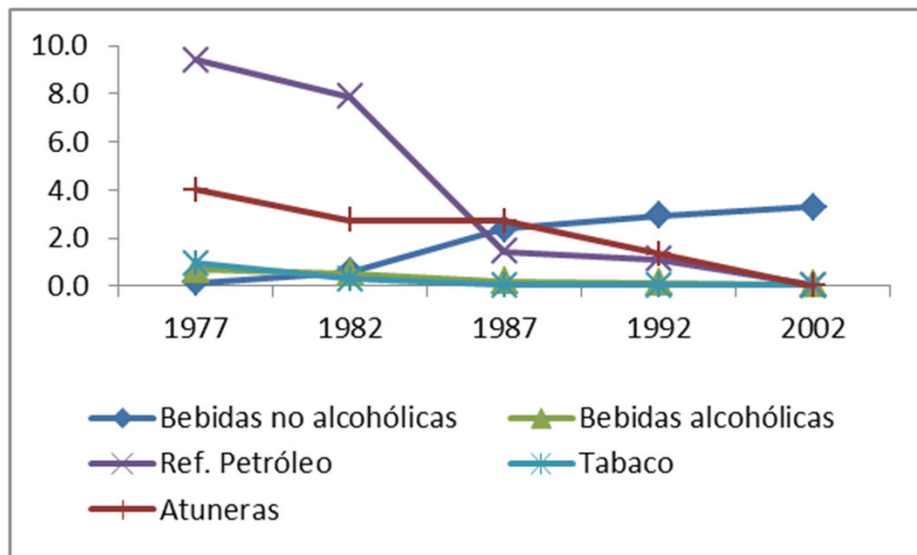
**Fuente:** OECD 2010 y cálculos propios para el offsh3 de Puerto Rico, 1992 y 2002

# Change of the Imported intermediates inputs as a share of total inputs Low Technology. 1995, 2005

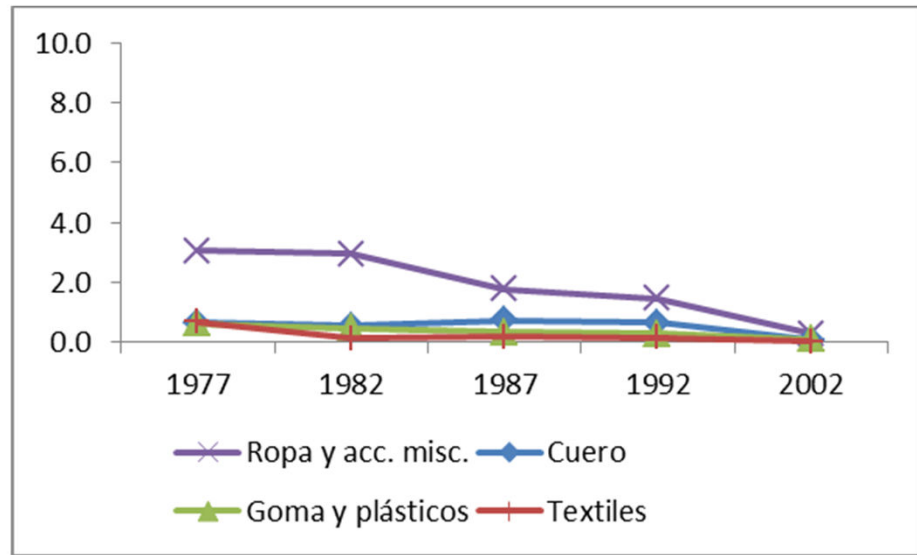


**Fuente:** OECD 2010 y cálculos propios para el offsh3 de Puerto Rico, 1992 y 2002

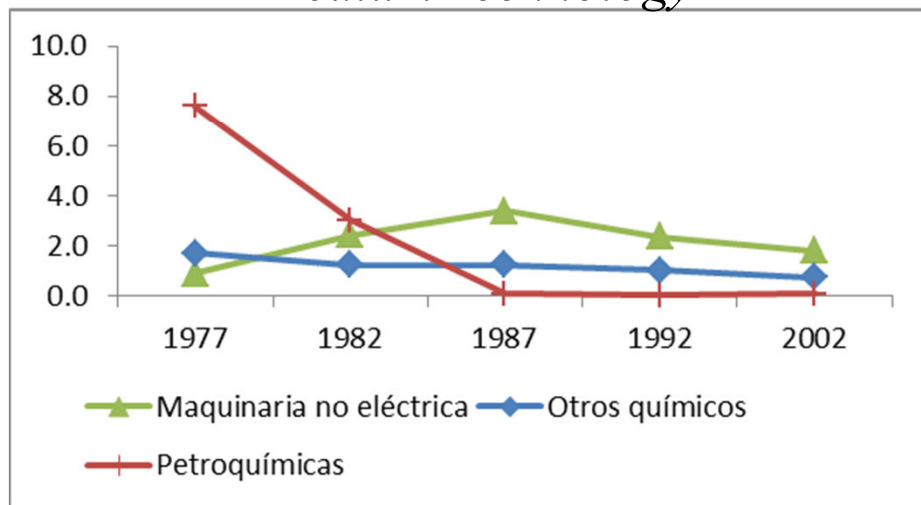
### Resource-Based



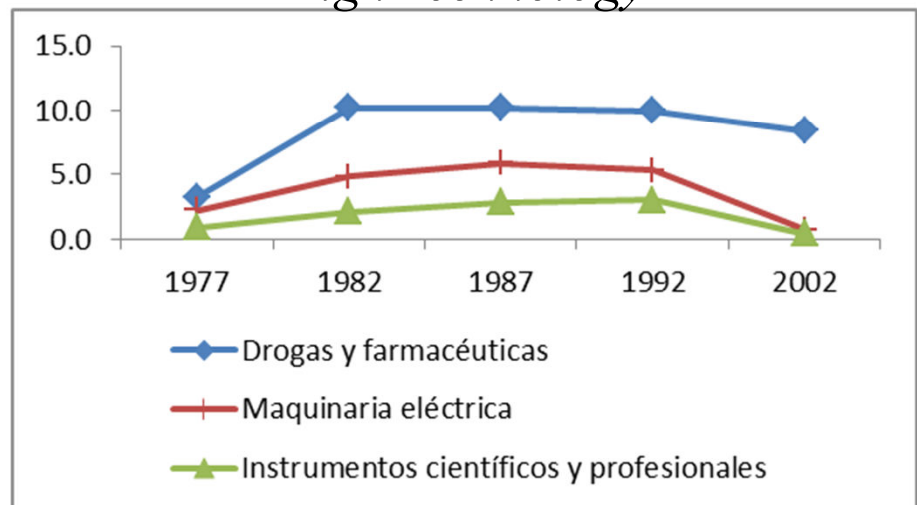
### Low Technology



### Medium Technology



### High Technology

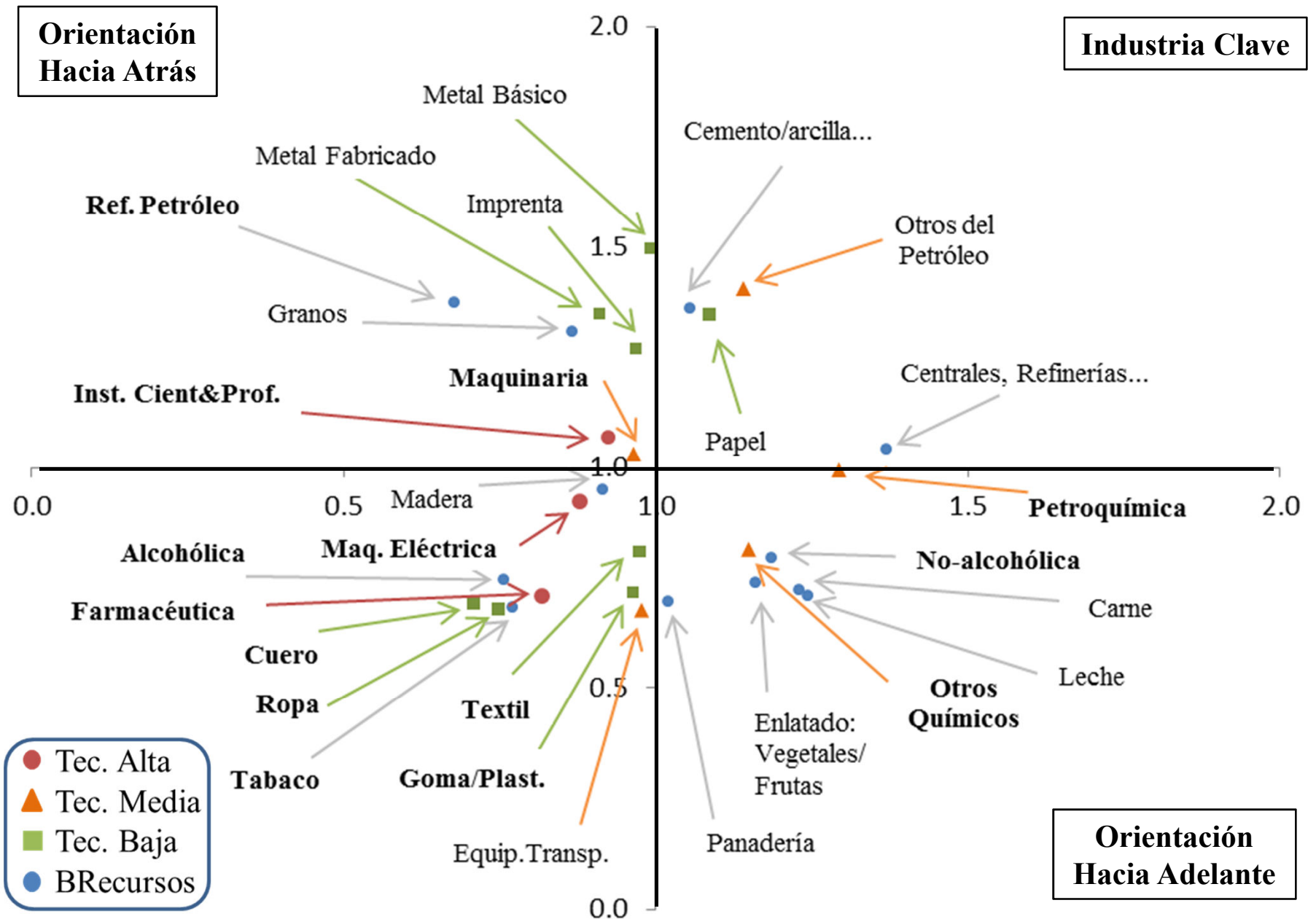


## Normalized Backward and forward linkages\*

Industria manufactura	1977		1982		1987		1992		2002	
	Atrás	Adelante	Atrás	Adelante	Atrás	Adelante	Atrás	Adelante	Atrás	Adelante
Carne	1.2	0.7	1.4	1.0	1.6	1.1	1.3	0.8	0.9	1.0
Leche	1.2	0.7	1.4	0.7	1.3	0.7	1.3	0.8	1.1	0.8
Enlatado	1.2	0.7	1.0	0.7	1.1	0.9	1.2	0.8	1.1	0.9
Granos	0.9	1.3	1.1	1.4	1.0	1.3	1.3	1.2	1.2	1.2
Panadería	1.0	0.7	1.2	0.6	1.1	0.7	1.1	0.8	1.0	0.8
Azúcares	1.4	1.0	1.2	0.8	1.0	0.9	1.1	0.8	0.9	0.9
Alcohólicas	0.8	0.7	1.0	0.7	0.9	0.6	0.9	0.7	0.7	0.8
no-alcohólicas	1.2	0.8	1.2	0.9	1.4	0.8	1.1	0.7	1.0	0.6
Alimentos Misc.	0.8	0.7	1.1	0.7	1.3	0.8	1.2	0.8	1.2	0.8
Atuneras	-	-	0.8	0.6	0.8	0.6	0.8	0.6	1.0	0.5
Tabaco	0.8	0.7	0.8	0.6	0.9	0.7	1.0	0.7	1.1	0.8
Textil	1.0	0.8	0.9	0.7	0.9	0.7	0.8	0.7	0.7	1.1
Ropa	0.7	0.7	0.7	0.7	0.8	0.6	0.8	0.6	0.8	0.6
Madera	0.9	0.9	1.0	1.0	1.0	0.9	1.0	0.9	1.0	1.2
Papel	1.1	1.3	0.9	1.3	1.2	1.5	0.9	1.4	0.7	1.5
Imprenta	1.0	1.3	1.0	1.1	0.9	1.2	1.0	1.4	0.7	1.4
Petroquim.	1.3	1.0	1.1	1.0	1.0	1.2	0.9	1.4	0.8	1.4
Famaceut.	0.8	0.7	0.8	0.6	0.8	0.6	0.8	0.6	1.0	0.8
Químicos	1.1	0.8	1.1	0.9	0.9	0.8	1.0	0.8	0.8	0.8
Petróleo	0.7	1.4	0.7	1.2	1.0	1.3	1.1	1.2	1.1	1.4
Otro petróleo	1.1	1.4	1.2	1.6	1.0	1.4	1.0	1.7	0.9	1.1
Goma/Plast.	1.0	0.7	1.1	0.9	0.9	0.9	0.9	1.0	0.6	1.3
Cuero	0.7	0.7	0.9	0.7	0.9	0.6	0.8	0.6	0.9	0.9
Cemento/rel.	1.1	1.4	1.2	1.4	1.0	1.3	1.0	1.2	1.0	1.3
Metal básico	1.0	1.5	0.9	1.4	1.4	1.3	1.0	1.1	0.9	1.6
Metal Fab.	0.9	1.3	1.0	1.2	0.8	1.2	0.9	1.3	0.9	1.2
Maquinaria	1.0	1.0	1.0	0.9	0.9	0.7	1.0	0.6	0.7	0.8
Eléctrica	0.9	0.9	0.9	0.8	1.0	0.7	1.0	0.7	0.8	1.2
Equip. Transp.	1.0	0.7	1.1	0.8	0.9	0.8	1.0	1.0	0.8	0.6
Inst. Cient&Prof.	0.9	1.1	0.8	0.8	0.9	0.7	0.9	0.6	0.7	0.9
Misc. Industrias	0.9	1.0	0.9	0.7	0.8	0.7	1.0	0.7	0.9	1.1

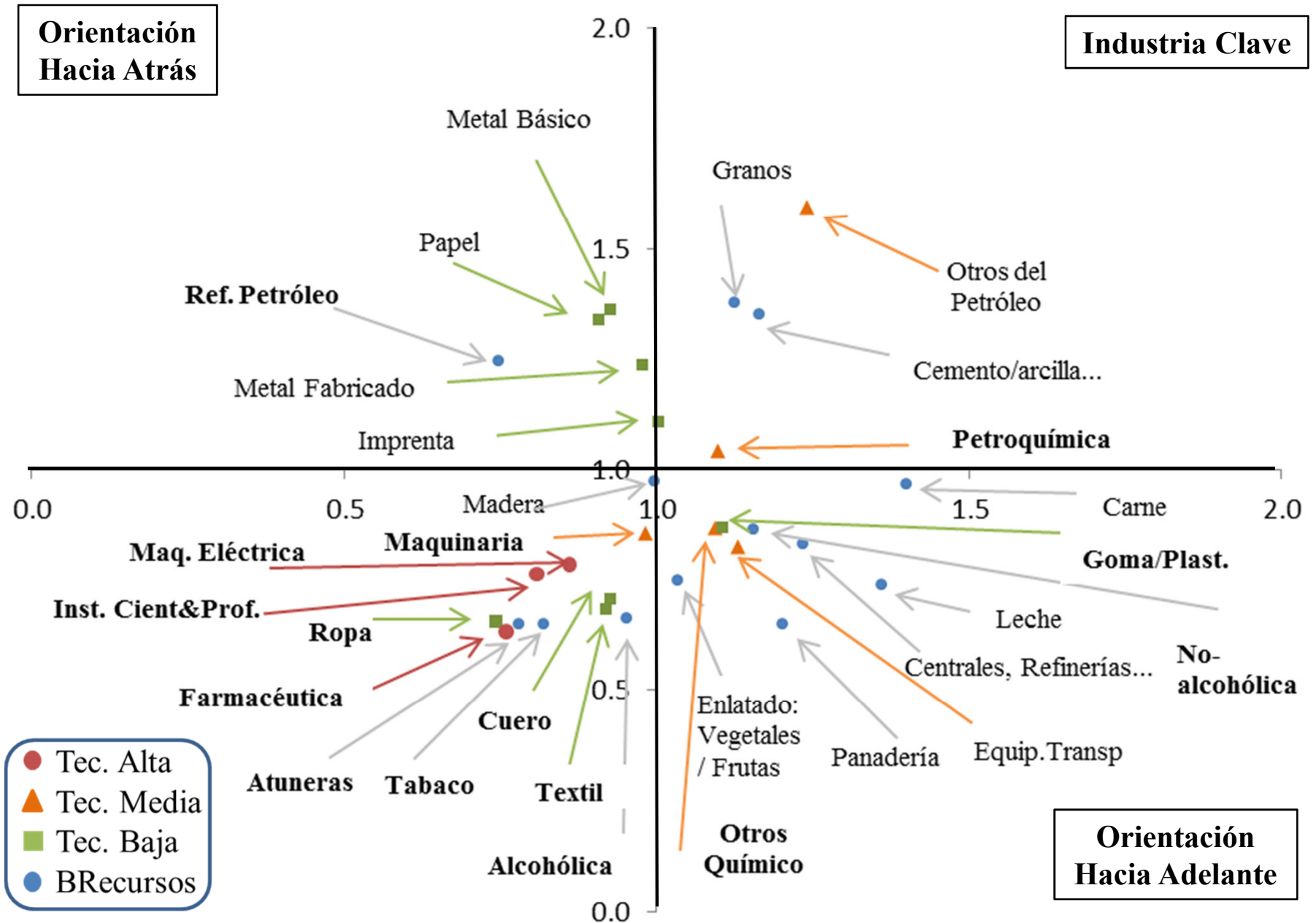
\*Normalizados por  $V/\text{mean}(V)$ ; el promedio simple de la sumatoria de toda la economía, incluyendo los servicios

# Gráfica xx: Comercio vertical y eslabonamientos: Manufactura 1977

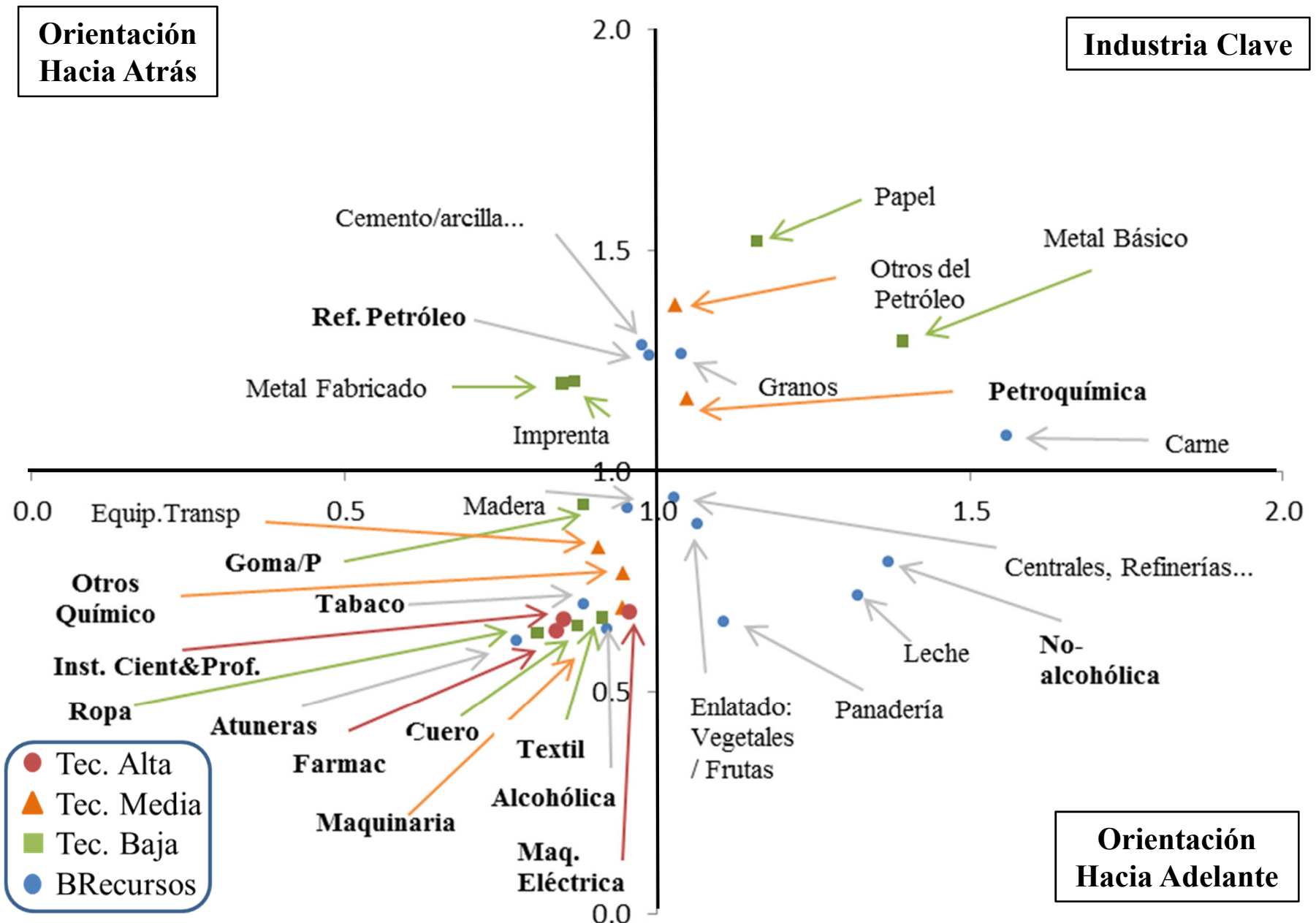




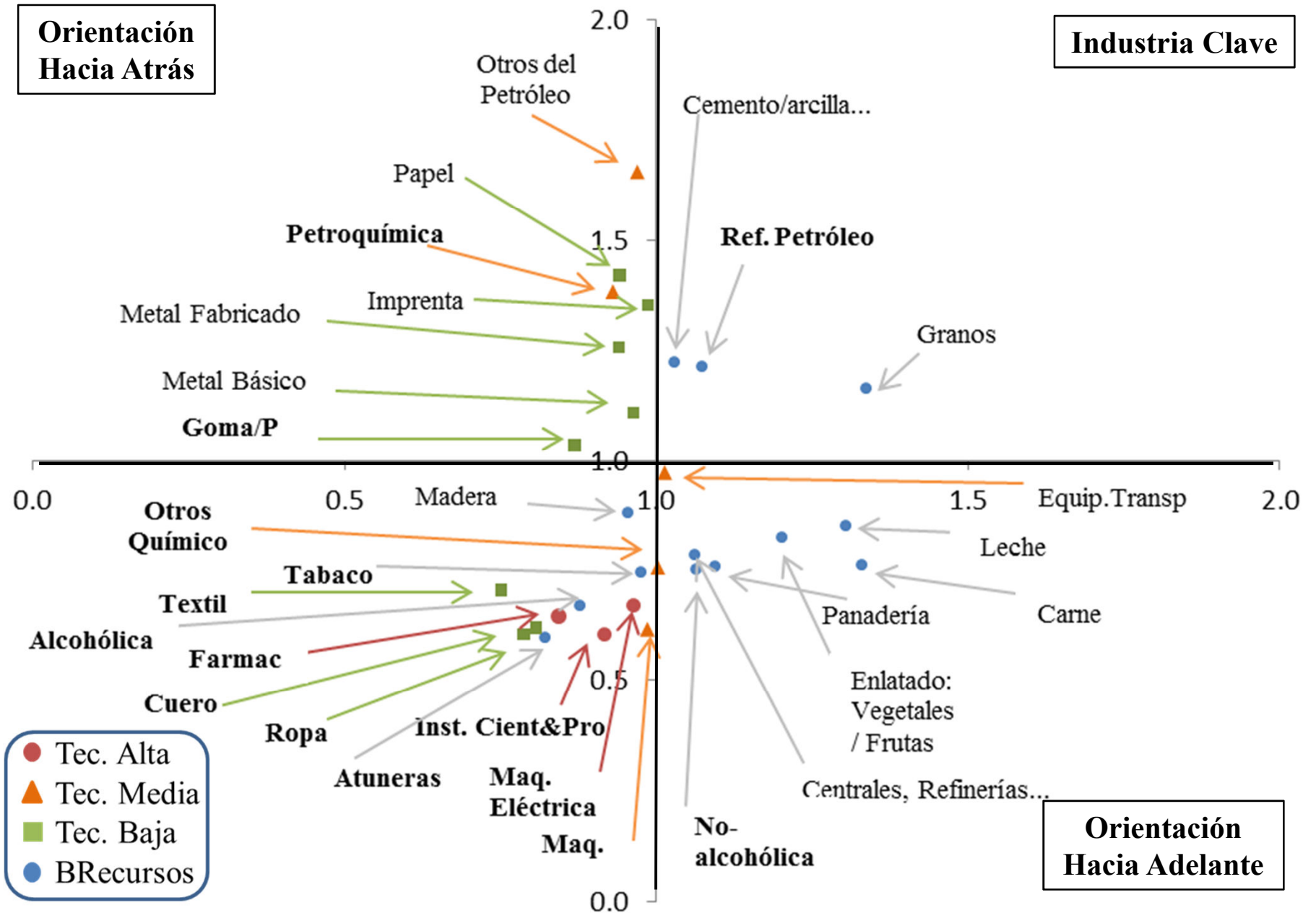
# Gráfica xx: Comercio vertical y eslabonamientos: Manufactura 1982



# Gráfica xx: Comercio vertical y eslabonamientos: Manufactura 1987



# Gráfica xx: Comercio vertical y eslabonamientos: Manufactura 1992



# **CONCLUSIONS**

- Concluding Remarks
- Limitations and Future Research
- Contributions