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Topical paper

**International comparison of The Netherlands
with respect to the decomposition of BERD intensity
and trade competitiveness**

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1 Introduction

This paper investigates the international competitiveness of economic sectors in the Netherlands by looking at two dimensions of competitiveness of sectors: R&D investments and international trade. Business enterprise R&D expenditures (BERD) are a production factor input that potentially leads to higher productivity, economic growth and higher competitiveness. Relative specialization in export of goods and services reveal international competitiveness in sectors.

This topical paper consists of two parts: one on the decomposition of the BERD intensity into intensity and structural effect and the other on international comparative advantage. In both cases, we compare and contrast the Netherlands with the group of OECD countries for which data were available.

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Key words: competitiveness, index decomposition analyses, revealed comparative advantage, The Netherlands.

2 Index decomposition analysis – international comparison of growth in R&D intensity 1995-2011

In this section, we decompose the change in the overall BERD intensity over time into the intensity and sector structure components. The former describes the change in sectoral intensities over time while the latter describes the change in sectoral composition over time. We compare and contrast the Netherlands with the other OECD countries. The sector structure component is based on BERD expenditures and value added in 32 sectors in 1995-2011. The OECD comparator group includes the sum of nine OECD countries that have data availability in this period.

We see a very slight increase in BERD intensity in the Netherlands from 1.15% in 1995 to 1.29% in 2011 thus going up by mere 0.14%; in fact, the intensity stagnated over the 16 years. The BERD intensity went from 1.96% to 2.34% during the same period in the nine comparable OECD country grouping, increasing by 0.37%. Thus the BERD intensity in the comparator group was much higher.

We apply two index decomposition methods for the for this analysis. One is the logarithmic Divisia additive index and the other is the shift-share analysis.

The logarithmic mean Divisia index method has become widely applied recently. Its advantage is that the decomposition of the change in the index-number (the BERD intensity, in our case) into the intensity and sector structure components is complete, that is, the residual component is zero (Ann and Zhang 2000 and Ang 2004).

Let's denote the percentage point change of the R&D intensity between 1995 and 2011 with D_{tot} . Then the decomposition of the change in the R&D intensity into intensity and structural components will be and formulated as:

$$D_{tot} = D_{str} + D_{int} \quad (2.1)$$

$$D_{str} = \sum_i w_i^* \ln\left(\frac{S_{i,2011}}{S_{i,1995}}\right) \quad (2.2)$$

$$D_{int} = \sum_i w_i^* \ln\left(\frac{I_{i,2011}}{I_{i,1995}}\right) \quad (2.3)$$

$$w_i^* = L(V_{i,1995}, V_{i,2011}) \quad (2.4)$$

$$\text{where } L(x, y) = \frac{y-x}{\ln\left(\frac{y}{x}\right)} \text{ and } V_{i,T} = S_{i,t} * I_{i,t}$$

Here D_{str} is the structural component and D_{int} is the intensity component of the decomposition, $S_{i,t}$ is the sector share of sector i in value added in year t and $I_{i,t}$ is the R&D intensity.

In comparison, the traditional Laspeyres index decomposition method usually produces a very large residual (interaction component) which cannot be unequivocally interpreted. The shift-share methods decomposes the index-number into three

components: the intrasectoral effect (intensity component), shift-share effect (sector structure component) and interaction effect (residual) (Donselaar et al. 2004 and Erken 2008).

According to the shift-share method, the decomposition of the growth rate of R&D intensity between 1995 and 2011, designated by G_{tot} , can be formulated with the following system of equations:

$$G_{tot} = C_{int} + C_{str} + C_{ie} \quad (2.5)$$

$$C_{int} = \sum_i S_{i,1995} * \left(\frac{I_{i,2011}}{I_{i,1995}} - 1 \right) \quad (2.6)$$

$$C_{str} = \sum_i S_{i,1995} * \left(\frac{S_{i,2011}}{S_{i,1995}} - 1 \right) \quad (2.7)$$

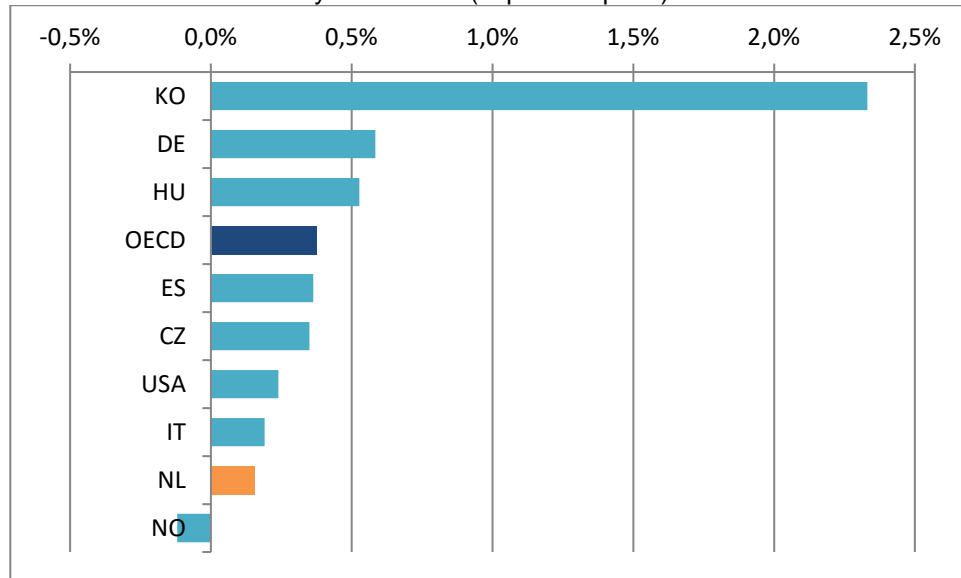
$$C_{ie} = \sum_i S_{i,1995} * \left(\frac{S_{i,2011}}{S_{i,1995}} - 1 \right) * \left(\frac{I_{i,2011}}{I_{i,1995}} - 1 \right) \quad (2.8)$$

Here C_{int} is the intra-sectoral effect, C_{str} is the net shift (structural) effect and C_{ie} is the interaction effect.

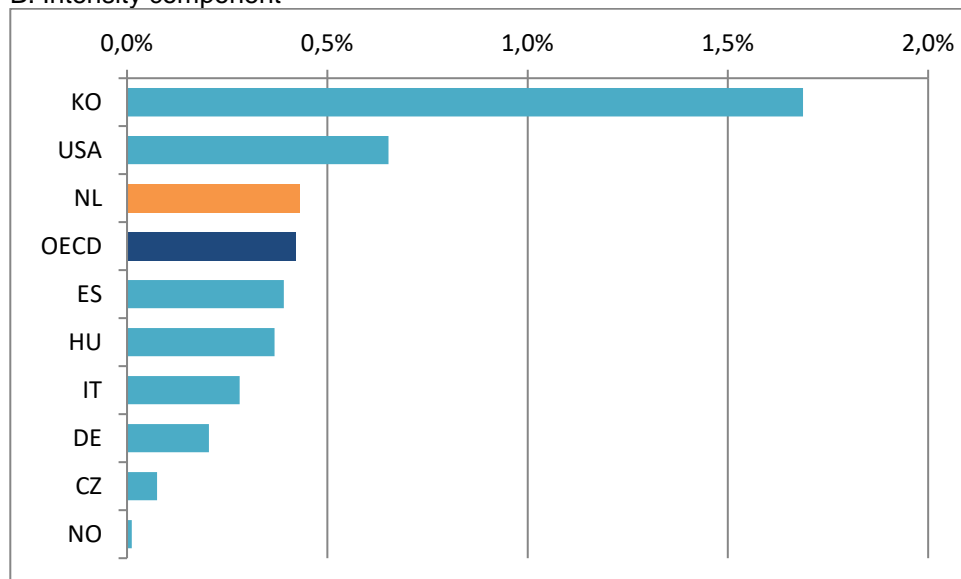
The results of these two methods are presented below.

Figure 2.1 Decomposition of the change in BERD intensity: Log mean Divisia index (additive)

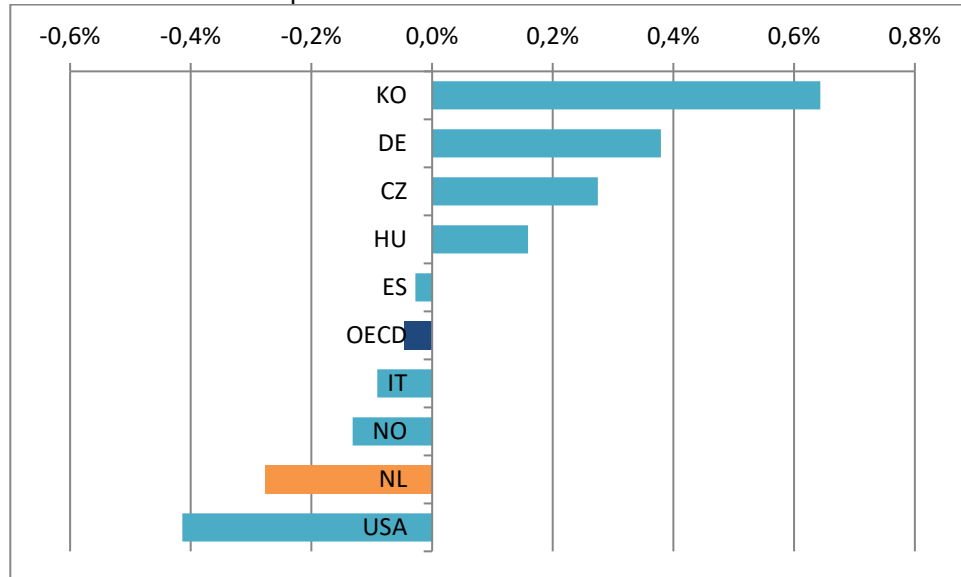
A. Growth of R&D intensity 1995-2011 (in percent point)



B. Intensity component



C. Sector structure component



Overview of results

	Total change in BERD intensity	Sector structure component	Intensity component
CZ	0.35%	0.27%	0.08%
DE	0.58%	0.38%	0.20%
IT	0.19%	-0.09%	0.28%
KO	2.33%	0.64%	1.69%
NL	0.15%	-0.28%	0.43%
NO	-0.12%	-0.13%	0.01%
USA	0.24%	-0.41%	0.65%
ES	0.36%	-0.03%	0.39%
HU	0.53%	0.16%	0.37%
OECD	0.37%	-0.05%	0.42%

Source: TNO, based on OECD/Eurostat/CBS

Figure 2.1 shows that the Netherlands is staying behind in the growth of R&D intensity in comparison to other nine OECD countries and OECD total (panel A). The growth in R&D intensity is further represented as the sum of two components: the intensity component shown in panels B and the sector structure component shown in panel C. The intensity component explains the contribution to the overall BERD intensity to the growth in sectoral BERD intensities. It is positive if the sectoral BERD intensities, on average, grew and negative otherwise. The sector structure component explains the contribution of the sectoral structure. It is positive if the BERD-intensive sectors, on average, grew faster than the BERD-extensive sectors and negative otherwise.

In the case of the Netherlands, the total change in R&D intensity of 0.15 percentage points over the time period under consideration is the sum of the intensity component of 0.43 percentage points and the (negative) sector structure component of -0.28 percentage points. The increase in R&D intensity of the OECD countries of 0.37 percentage points is the sum of the intensity component of 0.42 percentage points and the sector structure component of -0.05 percentage points (the latter is nearly zero).

The relatively low position of the Netherlands in the overall BERD intensity growth can be fully explained by the negative impact of the sector structure component. While the Netherlands scores above the OECD average on the intensity component, the sector structure component is the second worst in the sample and sharply negative. The positive contribution of the former was almost cancelled by the negative effect of the latter meaning that the sector structure shifted strongly in favor of the R&D-extensive sectors. The average OECD picture is somewhat different. The overall growth in BERD intensity was explained by the growing sectoral BERD intensities while the shift in the sectoral structure was almost nil. A pattern similar to the Netherlands is visible in the United States: A positive contribution to overall BERD intensity of the sectoral intensity component was cut short by the negative shift in sector composition. The R&D-extensive financial and business services grew relatively rapidly both in the U.S. and Netherlands causing the negative sectoral shift. The opposite pattern can be seen in countries like Korea and Germany. Both the intensity component and sector structure component show strong positive contributions thus leading to a robust increase in the overall BERD intensity.

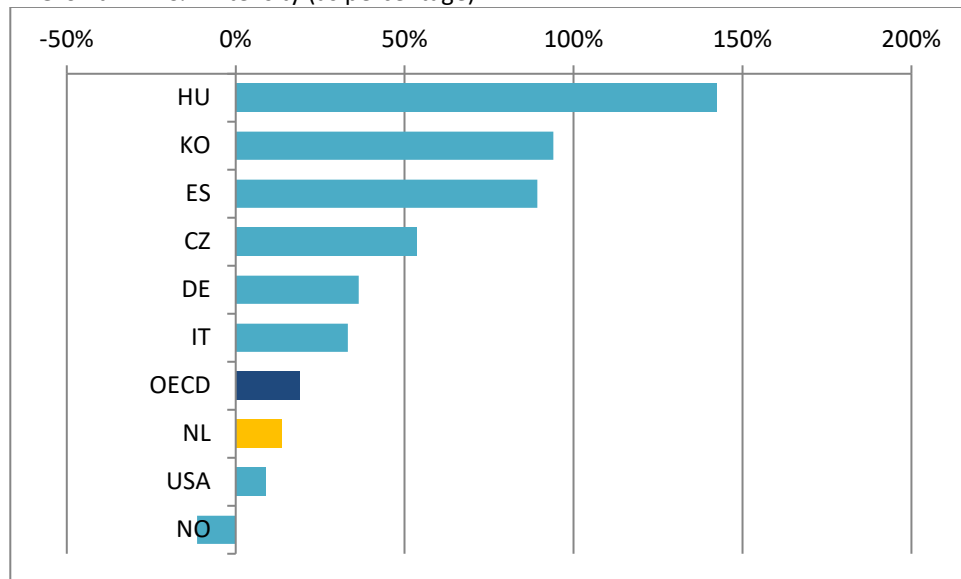
We can thus picture two distinct models of economic growth. One is based on changing the structure of economy towards R&D-intensive sectors, which is indicative for the industrial-oriented nations. The opposite growth model exhibits the shift in sectoral composition towards the R&D-extensive sectors, largely services, and is indicative for trade- and service-oriented economies. The Netherlands definitely belong to the latter model. (However, there are regional differences in the type of economic development within the Netherlands. The high-tech industrial model is located in the eastern part of the country while the trade- and service-based model is located in Randstad Holland.)

We confirmed the above conclusions using another index decomposition method, the shift-share analysis (see Figure 2.2 below). Note that the shift-share method analysed the *growth rate* of overall BERD intensity while the Divisia method decomposed the *percentage point change* in the overall BERD intensity.

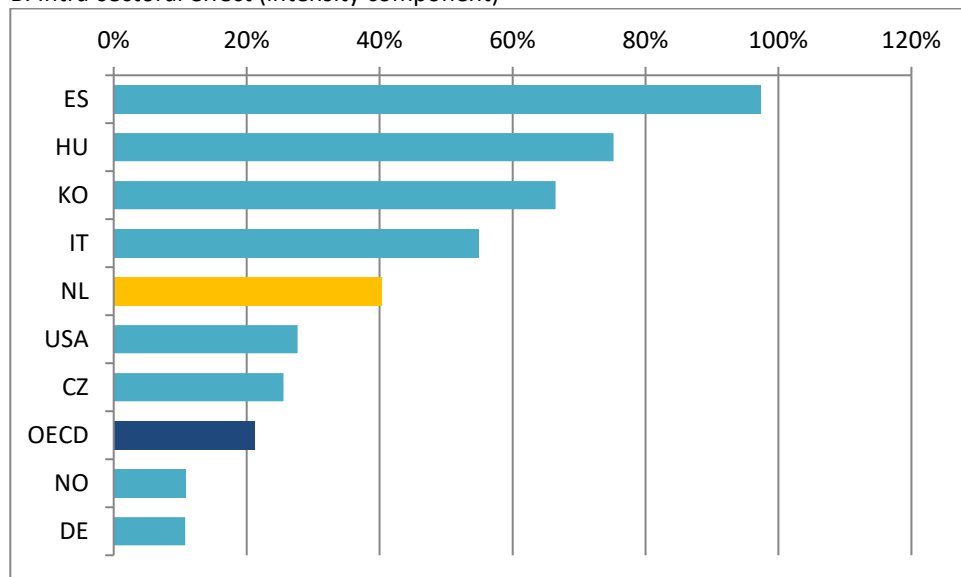
Nevertheless, using the shift-share method we observe the same situation as with the Divisia method: The positive contribution to the overall BERD intensity by the intensity component in the Netherlands was negated by the negative effect of the sector structure component. The same two models of development can be observed in this example as well: Germany and Korea belong to the industrial model while the Netherlands and U.S. belong to the trade and service model.

Figure 2.2: Decomposition of the change in BERD intensity: Shift share analysis

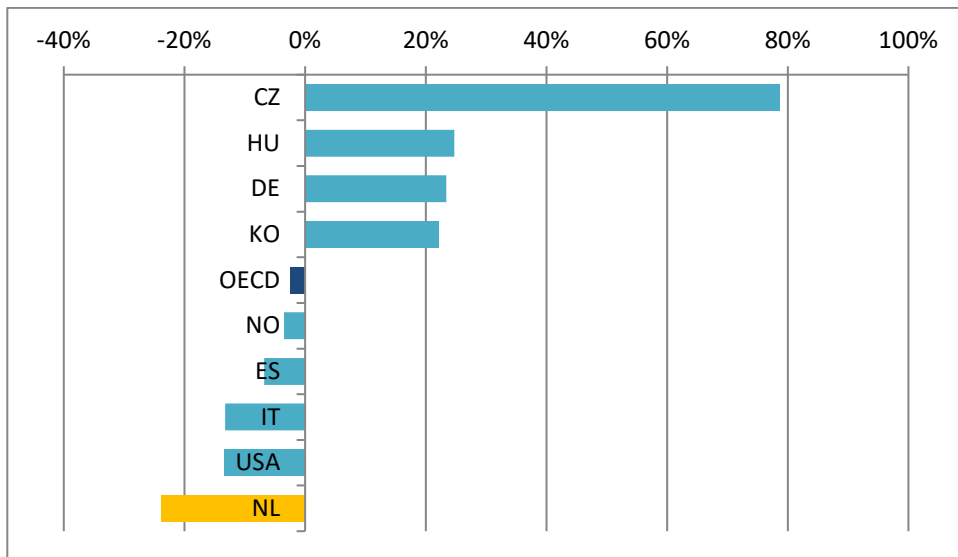
A. Growth in R&D intensity (as percentage)



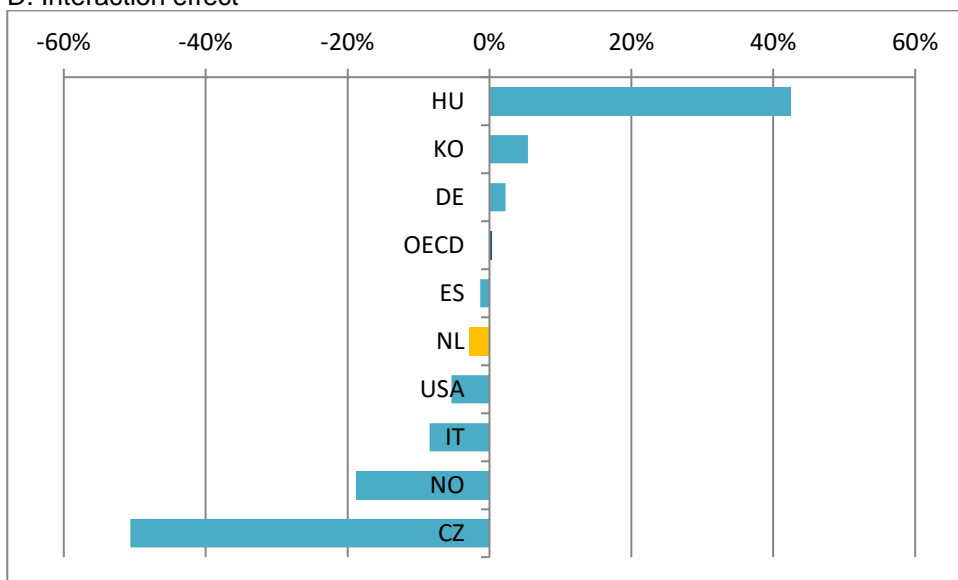
B. Intra-sectoral effect (intensity component)



C. Net shift effect (sector structure component)



D. Interaction effect



Overview of results of the shift-share method
Source: TNO, based on OECD/Eurostat/CBS

	Growth in R&D intensity	Intrasectorial effect	Net shift effect	Interaction effect
CZ	53.6%	25.6%	78.6%	-50.6%
DE	36.4%	10.7%	23.4%	2.3%
IT	33.2%	54.9%	-13.3%	-8.4%
KO	94.1%	66.5%	22.2%	5.4%
NL	13.6%	40.3%	-23.8%	-2.9%
NO	-11.4%	10.8%	-3.5%	-18.8%
USA	8.9%	27.6%	-13.4%	-5.4%
ES	89.2%	97.3%	-6.8%	-1.3%
HU	142.4%	75.2%	24.7%	42.5%
OECD	19.1%	21.2%	-2.5%	0.3%

3 Trade and comparative advantage

This chapter is concerned with the comparative advantage of the Netherlands. The relative comparative advantage can be derived from the trade patterns. There exist a number of indices for revealed comparative advantage. The original revealed comparative advantage formulated by Balassa(1965) will be called in this paper the relative export advantage index since it is based on the export specialisation. Thus the relative export advantage (RXA) index is an index of the specialization of a country i in exports of product j compared to the OECD average export share of product j :

$$RXA_{ij} = 100 * \tanh \log \left\{ \frac{X_{ij} / \sum_j X_{ij}}{\sum_i X_{ij} / \sum_{i,j} X_{ij}} \right\} \quad (3.1)$$

where X refers to export value.

This index, however, has limitations and can lead to drawing wrong conclusions about international competitiveness of a country because the import content of the exports is completely ignored. In order to mitigate this deficiency, we will use another revealed comparative advantage indicator which takes into account both exports and imports (Walz and Schleich, 2009). We will further call this index the revealed competitive advantage index (RCA). This index compares the net export balance of country i in sector j with the country's total net export balance.

$$RCA_{ij} = 100 * \tanh \log \left\{ \frac{X_{ij} / \sum_j X_{ij}}{M_{ij} / \sum_j M_{ij}} \right\} \quad (3.2)$$

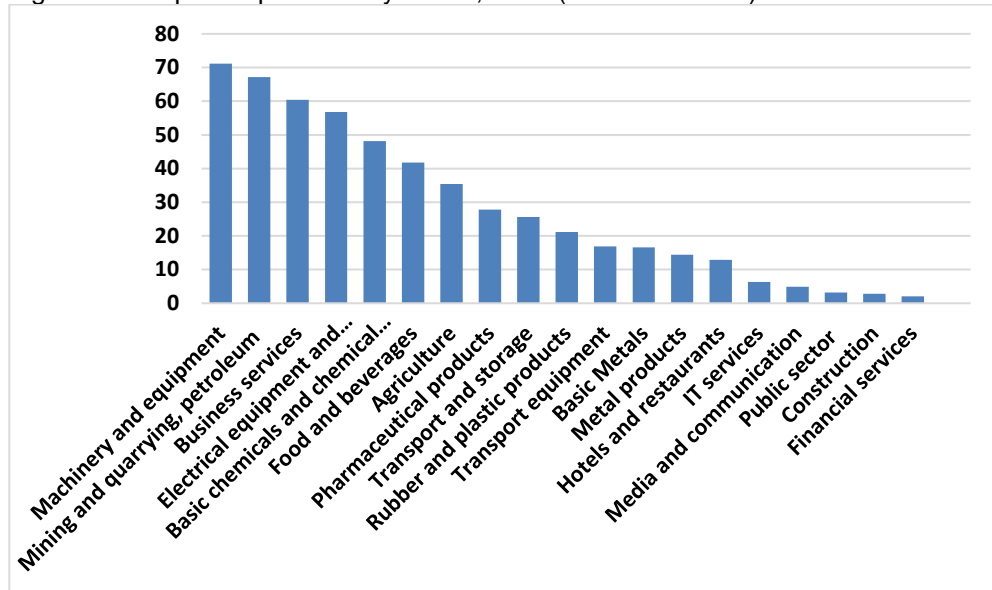
Thus the RXA (Balassa) index describes the export specialization of a country in comparison with a reference country grouping while the RCA index compares the net export balance of country i in sector j with the country's total net export balance. The next formula modifies (3.2) in order to compare refer the comparative advantage of a specific county i to that of the OECD average:

$$RCA_{ij}^* = 100 * \tanh \log \left\{ \frac{\frac{X_{ij} / \sum_j X_{ij}}{M_{ij} / \sum_j M_{ij}}}{\frac{\sum_i X_{ij} / \sum_{i,j} X_{ij}}{\sum_i M_{ij} / \sum_{i,j} M_{ij}}} \right\} \quad (3.3)$$

The hyperbolic tangent transformation used in both indices sets the range of the indices from -100 (complete disadvantage; never reached in actuality but only as a mathematical limit) to 100 (full advantage; also never reached in actuality), with 0 as neutral position (neither advantage nor disadvantage; in this case the individual country's export specialization or exports/imports ratio equal those of the comparator country group).

The next section shows results over time for the Netherlands and other OECD countries as the reference group. An overview of the data sources and methodology is given in the appendix. Figure 3.1 presents the sectoral composition of exports.

Figure 3.1 Export of products by sector, 2010 (in billion dollars)



As seen from the figure, the largest export sectors are:

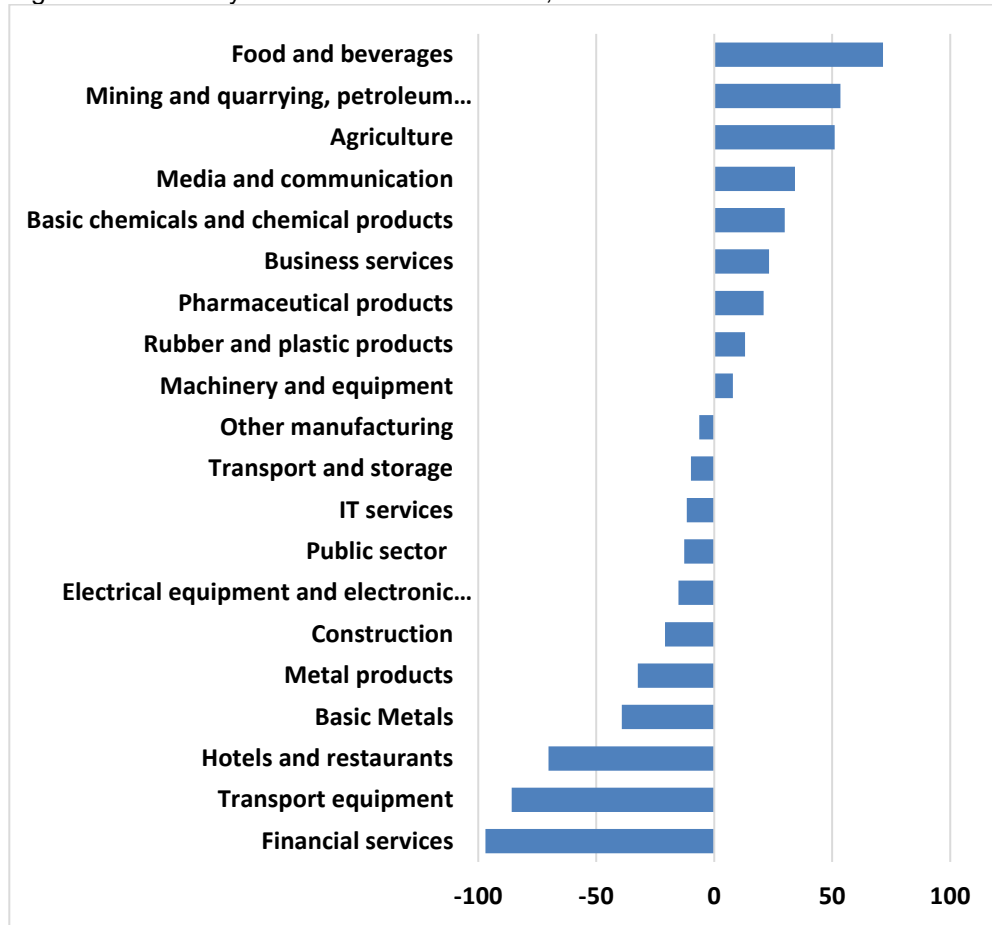
- Other manufacturing
- Machinery and equipment
- Mining (including petroleum) and
- Business services

(The annex provides the description of products that belong to the service sectors.)

The smallest export sectors are represented by the public sector (which is not surprising since this service is barely exportable), construction and financial services (banking and insurance). Despite a large financial sector in the Netherlands, the bulk of financial services are domestically oriented. Exports in financial services are worldwide concentrated in the U.S., UK, Switzerland, Germany, Belgium and Luxembourg.

The figures below present the RXA and RCA indices. The RCA index is calculated with two different methods. Formula (3.2) takes the average exports/imports ratio for the Netherlands as the reference while formula (3.3) takes the RCA indices for OECD sectors as the reference.

Figure 3.2 : RXA by sector in the Netherlands, 2010



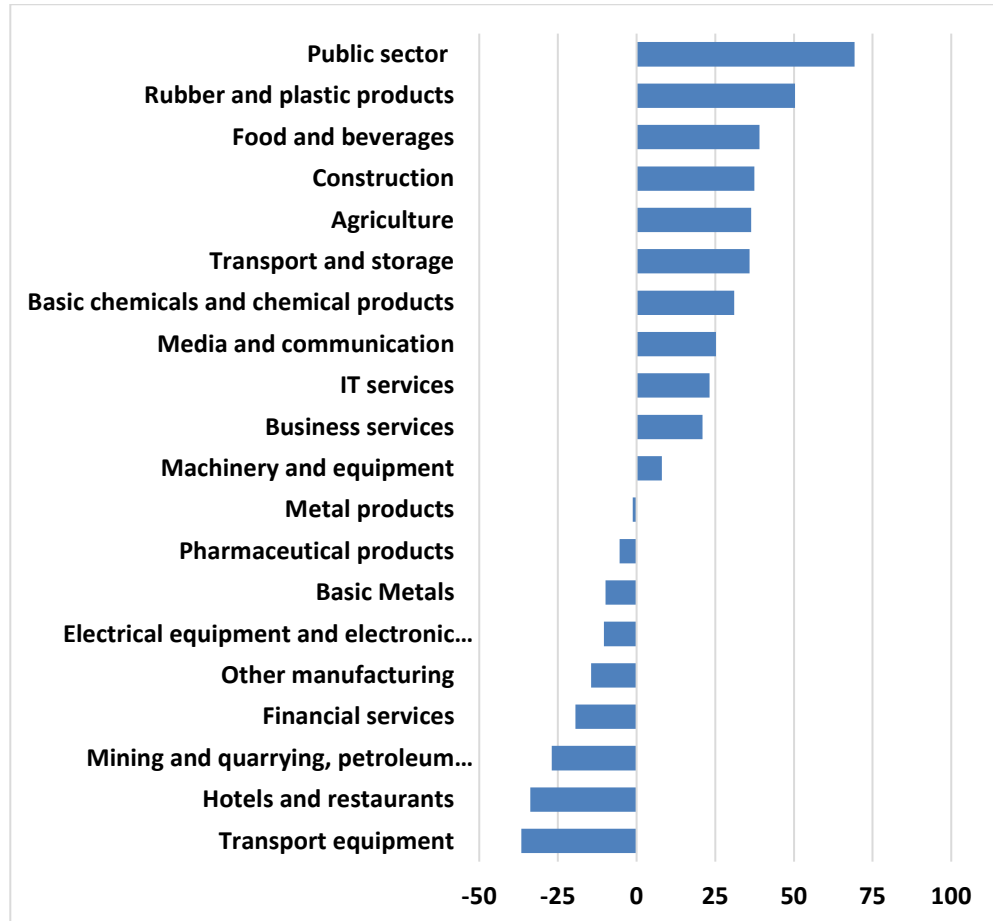
The sectors with the highest revealed export advantage are food, mining, agriculture, communications, and chemistry. These sectors are ranked slightly lower in RCA due to relative high import content (see Figure 3.3 for the RCA index with the average exports/imports ratio for the Netherlands as the reference). Interestingly, the top specialization sectors as defined as the ratio of the sectoral value added shares in GDP in the Netherlands over the sectoral shares in OECD (see the topical paper on growth and specialization) include chemistry, mining, food and agriculture. These are precisely the sectors with the highest revealed export advantage.

The sectors with the real growth advantage defined as the ratio of the sectoral growth rates in the Netherlands over the sectoral growth rates in OECD (see the above mentioned topical paper) are machinery, transport equipment, metal products and chemistry. The first two sectors show a positive RXA while the last two show a negative RXA. Thus the growth advantage in these sectors was not realized via exports but rather via domestic use.

The largest sectors in the Netherlands included trade, construction, mining, transport and storage, and business services. Mining and business services have export advantage while construction and transport and storage do not. Thus not all large sectors are export-oriented.

The high growth OECD sectors included communications, pharma, IT services, and financial services. The Netherlands have export advantage in communications and pharma and export disadvantage in the other two sectors.

Figure 3.3 RCA by sector in the Netherlands, 2010



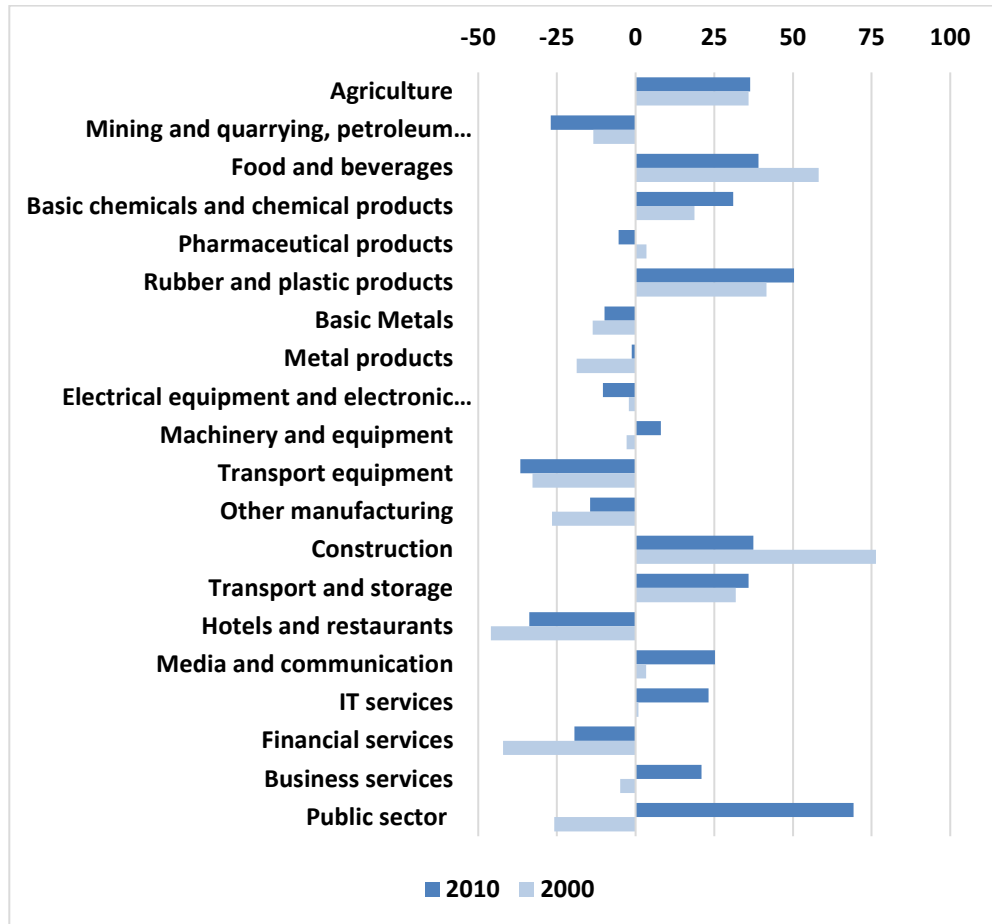
The top sectors with a relatively high RCA are public sector (namely governmental services to the rest of the world, such as NATO, embassies, and cultural services), rubber and plastics, food, agriculture and chemistry. Products produced by these sectors have a relatively high net trade balance, with exception for public sector, where exports are trivial.

The highest specialization sectors (chemistry, mining, food and agriculture) are sectors with the highest RCA, except for mining which has a very high import content. Among the sectors with the real growth advantage (chemistry, machinery, transport equipment, metal products), the first two sectors show a positive RCA while the last two show a negative RCA.

Only mining exhibits a positive revealed comparative disadvantage of the largest Dutch sectors (trade, construction, mining, transport and storage, business services). Other largest sectors exhibit comparative advantage. Among the high growth OECD sectors, the Netherlands possesses comparative advantage, albeit quite modest, in

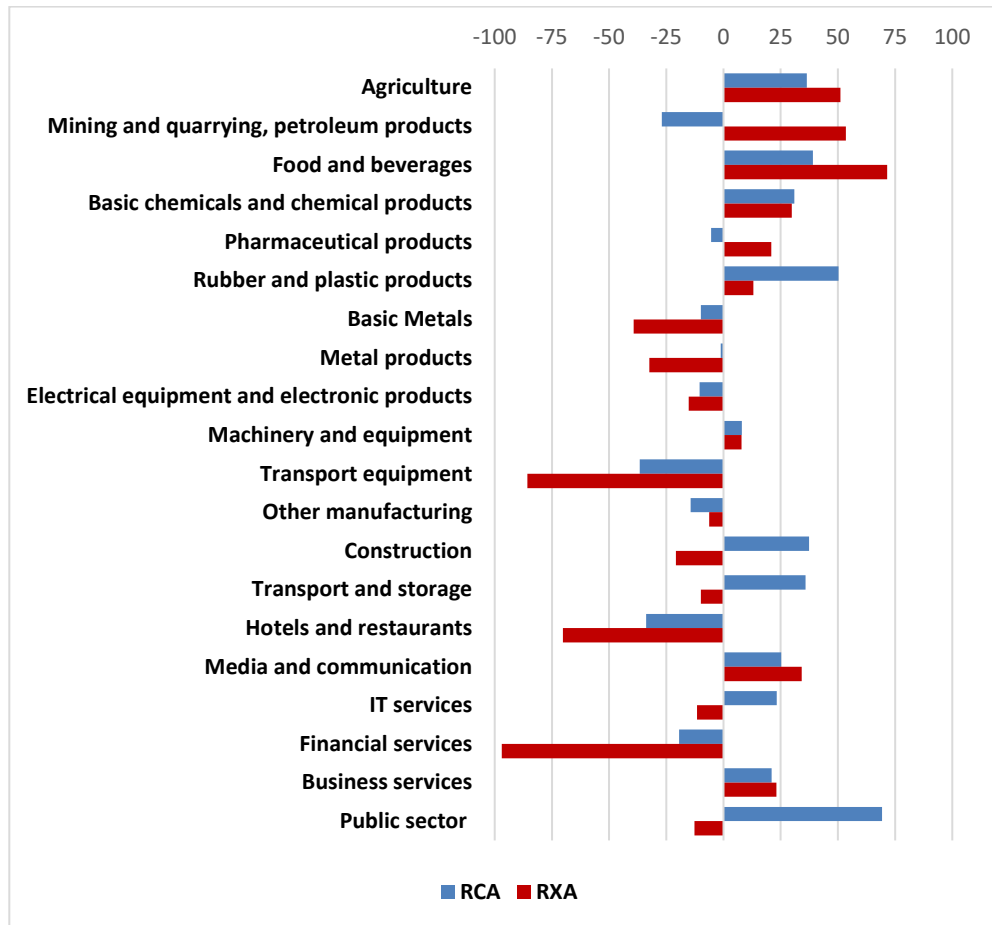
communications and IT services and comparative disadvantage in pharma and, especially, financial services.

Figure 3.4: RCA by sector in the Netherlands, 2000 and 2010



This figure presents the change in RCA from 2010 to 2010. In industry, we can observe the growth in chemistry, rubber and synthetics, metal products, and machinery. In the service sectors, growth occurred in knowledge intensive sectors such as communication, IT, finance and business services. At the same time, construction services registered a decline in RCA. The Annex includes charts with the annual dynamics of RXA and RCA for the Dutch sectors and RCA for the OECD sectors from 1995 to 2010.

Figure 3.5: RCA (with average national exports/imports ratio as reference) and RXA by sector in the Netherlands, 2010

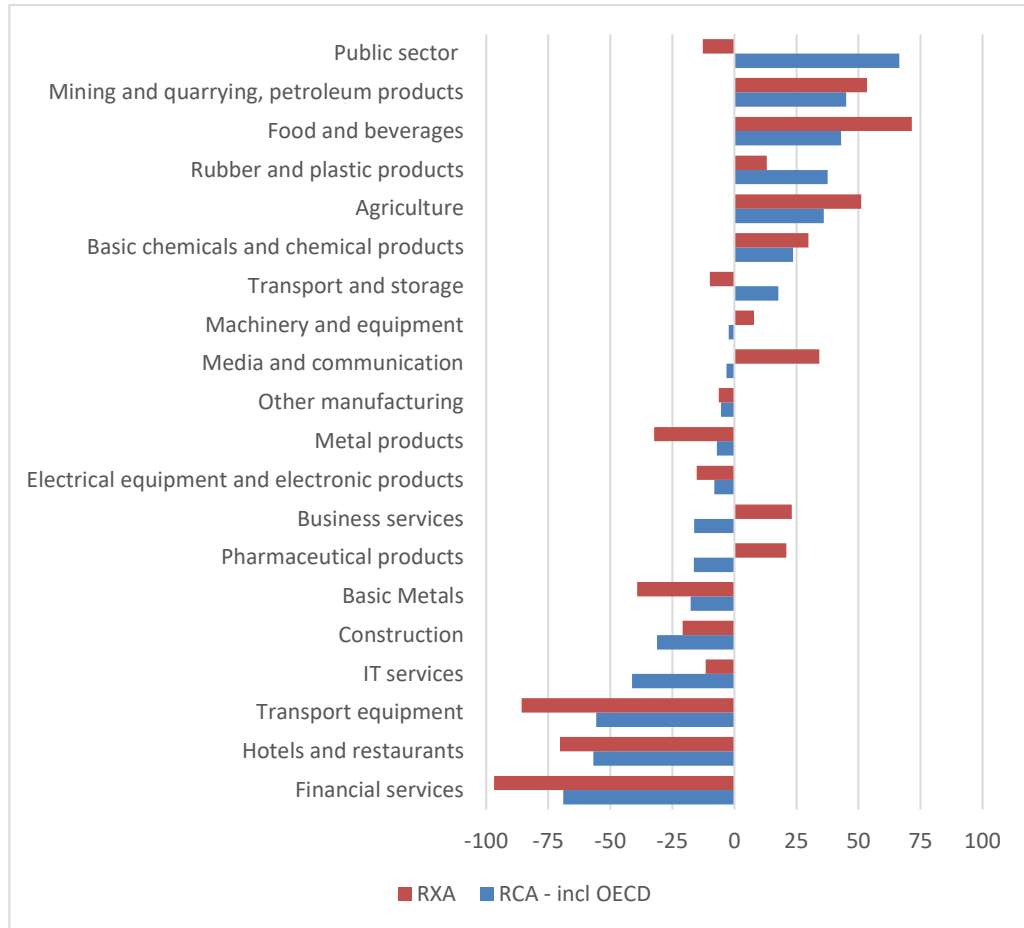


This figure puts into perspective the difference between the RCA and RXA indices. In general, both indices have similar signs (advantage or disadvantage) but with some exception, such as mining and petroleum, pharma, IT (all with high import content) or construction, transport and storage, public sector (with low import content).

Another representation of the RCA taking the sectoral RCA indices for OECD as the reference. Figure 3.6 compares and contrasts the RXA index (formula 3.1) and the RCA index with the OECD as the reference (formula 3.3).

The difference in the two indicators comes from the relative difference of import content of the sectoral exports. The two indicators give similar results in general. One important observation though is that the RCA index is somewhat smaller in the absolute value than the RXA index. This means that the RXA index exaggerates the export advantage somewhat due to a high import content of exporters and also exaggerates the export disadvantage due to a low import content of leading import sectors. There are some exceptions although. The sectors Rubber and plastics and Public sector show higher RCA than RXA due to a relatively low import content. The sectors Construction and IT show a higher negative RCA than RXA due to a relatively high import content.

Figure 3.6: RCA (with the sectoral RCA indices for OECD as the reference) and RXA by sector in the Netherlands, 2010



4 Conclusions

1. The relatively low position of the Netherlands in the overall BERD intensity growth in comparison to OECD peers can be elucidated with the means of index decomposition analysis. We used two methods – the Divisia index decomposition and shift-share method, which produced the same outcome. While the Netherlands scores above the OECD average on the BERD intensity component, the sector structure component is the second worst in the OECD country sample and sharply negative. The positive contribution of the former was almost cancelled by the negative effect of the latter meaning that the sector structure shifted strongly in favour of the R&D-extensive sectors. A pattern similar to the Netherlands is visible in the United States. The R&D-extensive financial and business services grew relatively rapidly both in the U.S. and Netherlands causing the negative sectoral shift. The opposite pattern can be seen in countries like Korea and Germany. Both the intensity component and sector structure component show strong positive contributions thus leading to a robust increase in the overall BERD intensity.
2. We can thus picture two distinct models of economic growth. One is based on changing the structure of economy towards R&D-intensive sectors, which is indicative for the industrial-oriented nations and another model exhibits the shift in sectoral composition towards R&D-extensive sectors indicative for trade- and service-oriented economies. The Netherlands definitely belong to the latter model. However, we can observe regional differences in the type of economic development within the Netherlands with the high-tech industrial model is located in the eastern part of the country and the trade- and service-based model in Randstad.
3. The international trade advantage of the Netherlands is concentrated in relatively small sectors with high specialization, namely, chemistry, mining, food and agriculture. This refers both to the revealed export advantage and revealed comparative advantage. Other sector categories, such as the largest sectors and the high growth OECD sectors have varying degrees of international trade advantage.

5 References

- Ang, B.W. and F.Q. Zhang (2000). A survey of index decomposition analysis in energy and environmental studies. *Energy* 25 (12), 1149-1176.
- Ang, B.W. (2004). Decomposition analysis for policymaking in energy:: which is the preferred method?. *Energy policy* 32 (9), 1131-1139.
- Balassa, B. (1965), Trade Liberalisation and Revealed Comparative Advantage, the Manchester School, 33, 99-123.
- Donselaar, P., Erken, H. and S. Raes (2004). An international comparison of productivity performance: the case of the Netherlands. In: G.Gelauff, L.Klomp, S.Raes and T.Roelandt (red.), *Fostering productivity: Patterns, Determinants and Policy Implications*. Amsterdam: Elsevier Science, p.9-28.
- Erken (2009). *Productivity, R&D and Entrepreneurship*. Rotterdam: Erasmus University Rotterdam
- Walz, R and J. Schleich (2009), *The Economics of Climate Change Policies: Macroeconomic Effects, Structural adjustments and technological change*, Physica-Verlag.
- World Trade Organization (2010), *Measuring trade in services – a training module for the World Bank*, WTO. www.oecd.org

Annex

Data on Business Enterprise Research and Development (BERD) expenditures by sector is based on OECD STAN database in the NACE Rev2 classification for years 1995 to 2011 for 32 sectors. Table A.1 gives an overview of the 32 sectors in the index decomposition analysis. In total nine countries have data availability for 32 sectors in 1995-2011: CZ, DE, IT, KO, NL, NO, USA¹, ES, and HU. OECD total is the sum of the nine countries

Table A.1: Overview of 32 sectors

- 1 Agriculture
- 2 Mining and quarrying
- 3 Petroleum products
- 4 Food and beverages
- 5 Basic chemicals and chemical products
- 6 Pharmaceutical products
- 7 Rubber and plastic products
- 8 Basic Metals
- 9 Metal products
- 10 Electronic and optical products
- 11 Electrical equipment
- 12 Machinery and equipment
- 13 Motor vehicles
- 14 Other transport equipment
- 15 Textile and leather products
- 16 Paper and paper products
- 17 Other non-metallic mineral products
- 18 Other manufacturing
- 19 Electricity, gas and water supply
- 20 Waste management
- 21 Construction
- 22 Trade
- 23 Transport and storage
- 24 Hotels and restaurants
- 25 Media and publishing
- 26 Telecommunications
- 27 IT services
- 28 Financial services
- 29 Research
- 30 Real estate services
- 31 Other business services
- 32 Public sector

¹ RTD data for USA in 2011 is based on 2010 and the sectoral growth rate of value added in 2010-2011.

Trade statistics and methodology

For the trade analysis two data sources are used: OECD Statistics on International Trade by Commodity and OECD Statistics on International Trade in Services.

International Trade by Commodity

Data are classified at a very detailed level (~ 5000 products) according to the Standard International Trade Classification (SITC) or the Harmonised System (HS). We have assigned the chapters of SITC to the most relevant aggregate sector classification of this study (see table A.2).

Table A.2 Mapping of commodity groups to 24 sectors

Commodity group (SITC)	Sector	
	No.	SectorName
0: Food and live animals		
00: Live animals other than animals of division 03	1	Agriculture
01: Meat and meat preparations	3	Food and beverages
02: Dairy products and birds' eggs	1	Agriculture
03: Fish, crustaceans, molluscs and preparations thereof	1	Agriculture
04: Cereals and cereal preparations	1	Agriculture
05: Vegetables and fruits	1	Agriculture
06: Sugar, sugar preparations and honey	1	Agriculture
07: Coffee, tea, cocoa, spices, and manufactures thereof	3	Food and beverages
08: Feedstuff for animals (excluding unmilled cereals)	3	Food and beverages
09: Miscellaneous edible products and preparations	1	Agriculture
1: Beverages and tobacco	3	Food and beverages
2: Crude materials, inedible, except fuels		
21: Hides, skins and furskins, raw	12	Other manufacturing
22: Oil seeds and oleaginous fruits	3	Food and beverages
23: Crude rubber (including synthetic and reclaimed)	6	Rubber and plastic products
24: Cork and wood	12	Other manufacturing
25: Pulp and waste paper	12	Other manufacturing
26: Textiles fibres and their wastes	12	Other manufacturing
27: Crude fertilizers other than division 56, and crude minerals	4	Basic chemicals and chemical products
28: Metalliferous ores and metal scrap	8	Metal products
29: Crude animal and vegetable materials, n.e.s.	3	Food and beverages
3: Mineral fuels, lubricants and related materials		
		Mining and quarrying,
32: Coal, coke and briquettes	2	petroleum products

Commodity group (SITC)	Sector	
	No.	SectorName
33: Petroleum, petroleum products and related materials	2	Mining and quarrying, petroleum products
34: Gas, natural and manufactured	2	Mining and quarrying, petroleum products
35: Electric current	2	petroleum products
4: Animal and vegetable oils, fats and waxes		
41: Animal oils and fats	3	Food and beverages
42: Fixed vegetable oils and fats, crude, refined or fractionated	3	Food and beverages
43: Processed Animal and vegetable oils and fats	3	Food and beverages
5: Chemicals and related products, n.e.s.		
51: Organic chemicals	4	Basic chemicals and chemical products
52: Inorganic chemicals	4	Basic chemicals and chemical products
53: Dyeing, tanning and colouring materials	4	Basic chemicals and chemical products
54: Medicinal and pharmaceutical products	5	Pharmaceutical products
55: Essential oils for perfume materials and cleaning preparations	4	Basic chemicals and chemical products
56: Fertilizers other than group 272	4	Basic chemicals and chemical products
57: Plastics in primary forms	6	Rubber and plastic products
58: Plastics in non-primary forms	6	Rubber and plastic products
59: Chemical materials and products, n.e.s.	4	Basic chemicals and chemical products
6: Manufactured goods		
61: Leather, leather manufactures and dressed furskins	12	Other manufacturing Rubber and plastic
62: Rubber manufactures, n.e.s.	6	products
63: Cork and wood manufactures (excluding furniture)	12	Other manufacturing
64: Paper and paper manufactures	12	Other manufacturing
65: Textile yarn and related products	12	Other manufacturing
66: Non metallic mineral manufactures, n.e.s.	12	Other manufacturing
67: Iron and steel	7	Basic Metals
68: Non-ferrous metals	7	Basic Metals
69: Manufactures of metal, n.e.s.	8	Metal products
7: Machinery and transport equipment		

Commodity group (SITC)	Sector	
	No.	SectorName
71: Power generating machinery and equipment	10	Machinery and equipment
72: Specialised machinery	10	Machinery and equipment
73: Metal working machinery	10	Machinery and equipment
74: Other industrial machinery and parts	10	Machinery and equipment
75: Office machines and automatic data processing machines	10	Machinery and equipment
76: Telecommunication and sound recording apparatus	9	Electrical equipment and electronic products
77: Electrical machinery, apparatus and appliances, n.e.s.	9	Electrical equipment and electronic products
78: Road vehicles	11	Transport equipment
79: Other transport equipment	11	Transport equipment
8: Miscellaneous manufactured articles		
81: Prefabricated buildings, sanitary, heating and lighting fixtures, n.e.s.	12	Other manufacturing
82: Furniture and parts thereof	12	Other manufacturing
83: Travel goods, handbags, etc.	12	Other manufacturing
84: Articles of apparel & clothing accessories	12	Other manufacturing
85: Footwear	12	Other manufacturing
87: Professional and scientific instruments, n.e.s.	9	Electrical equipment and electronic products
88: Photo apparatus, optical goods, watches and clocks	9	Electrical equipment and electronic products
89: Miscellaneous manufactured articles, n.e.s.	12	Other manufacturing
9: Commodities and transactions, n.e.s.		
91: Postal packages not classified according to kind	12	Other manufacturing
93: Special transactions & commodities not classified	12	Other manufacturing
96: Coin (other than gold coin), not being legal tender	12	Other manufacturing
97: Gold, non-monetary (excluding gold ores & concentrates)	12	Other manufacturing

International Trade in Services

The measurement of trade in services is more complex and therefore separated from the trade by commodities. Statistics on trade in services are available from 2000 onwards. A general characteristic of services is that consumption and production take place at the same place. International trade in services can take place through four modes of supply: cross-border supply, consumption abroad, commercial presence in another country of service suppliers, and presence of natural persons (temporarily) abroad. Source data are also broken down by type of service according to the EBOPS 2002 classification (Extended

Balance of Payments Services Classification). The data includes twelve main components which are listed below in detail in table A.2.

Table A.2: Detailed description of components of the EBOPS services classification
(Source: WTO 2010)

- **Manufacturing services on physical inputs owned by others** includes activities such as processing, assembly, labelling, packing, etc., undertaken by enterprises that do not own the goods (e.g. oil refining, assembly of clothing, cars, electronics). *
- **Maintenance and repair services not included elsewhere (n.i.e.)** includes those on transport equipment as well as other maintenance and repair of products, performed at the site of the repairer or elsewhere. *
- **Transport** covers all transport services performed by residents of one economy for those of another and that involve the carriage of passengers, the movement of goods (freight), rentals (charters) of carriers with crew, related supporting and auxiliary services. In addition, EBOPS 2010 distinguishes nine modes of transport – sea, air, space, rail, road, internal waterway, pipeline, electricity transmission and other supporting and auxiliary transportation services. Transport also covers post and courier services.
- **Travel** differs from most categories listed in that it is the consumer of these products that gives *travel* its distinctive characterisation. *Travel* does not refer to a particular product and covers expenses for goods and services (including accommodation, food, souvenirs, etc.) acquired by a person during his/her visit in a country other than his/her own. If the stay of persons is for more than one year, they are considered to be residents of the visited economy. This guideline does not apply to students studying abroad and patients receiving health care abroad, who remain residents of their economies of origin even if they stay longer than one year. With respect to the purpose of the trip, travel is subdivided into *business travel*, and *personal travel*. The latter can be further divided into – *health-related* expenditure, *education-related* expenditure, and all *other* personal travel expenditure.
- **Construction** covers work performed on construction projects and installation by employees of an enterprise in locations outside the territory of residence of an enterprise. *Construction* is further disaggregated into *construction abroad* and *construction in the compiling economy*.
- **Insurance and pension services** covers the provision of various types of insurance and pension services. They are further subdivided into four components – *direct insurance*, *reinsurance*, *auxiliary insurance services* and *pension and standardized guarantee services*. Information on *gross premiums* and *gross claims*, which may be the basis for estimating the service charge, is included in the supplementary items.
- **Financial services** covers financial intermediation and auxiliary services, provided by banks, stock exchanges, factoring enterprises, credit card enterprises etc. It also covers *financial intermediation service charges indirectly measured (FISIM)*.
- **Charges for the use of intellectual property, n.e.c.** is divided into *franchises and trademarks licensing fees* and licenses referring to *the use of outcomes of research and development*, or for the reproduction/distribution of *computer software* or *audio-visual*

and related products. Given the complexity of certain arrangements, some of the payments for the use of these rights (other than licenses to reproduce and/or distribute) may be included with the services item (or goods) to which they relate.

□ **Telecommunications, computer and information services** are subdivided into *telecommunications services*, *computer services* (of which computer software), *news agency services* (provision of news, photographs, and feature articles to the media), and *other information services* (database services and web search portals).

□ The coverage of **other business services** is identical to that of BPM6 but it provides much more detail. This category includes; *research and development services*, *professional and management consulting services* (*legal services*; *accounting*, *auditing*; *business and management consulting and public relations services*; *advertising*); and *technical, trade-related and other business services* (*architectural*, *engineering*, *waste treatment and de-pollution*, *agriculture*, *mining*; *operational leasing services*; and *trade-related services*).

□ **Personal, cultural, and recreational services** comprises *audio-visual and related services* and *other personal, cultural, and recreational services*. The first component covers *audio-visual services* (production of motion pictures, radio and television programs, and musical recordings) and *artistic related services*. *Other personal, cultural, and recreational services* includes services such as those associated with *education services*, *health services*, *heritage and recreational services*, and *other personal services*.

□ **Government goods and services, n.e.c.** covers all government and international organizations' transactions not contained in other EBOPS 2010 items. It can be subdivided into services transacted by *embassies and consulates*, by *military units and agencies*, and all *other* transactors. Note that GATS does not cover services supplied in the exercise of governmental authority.

* Not part of EBOPS 2002

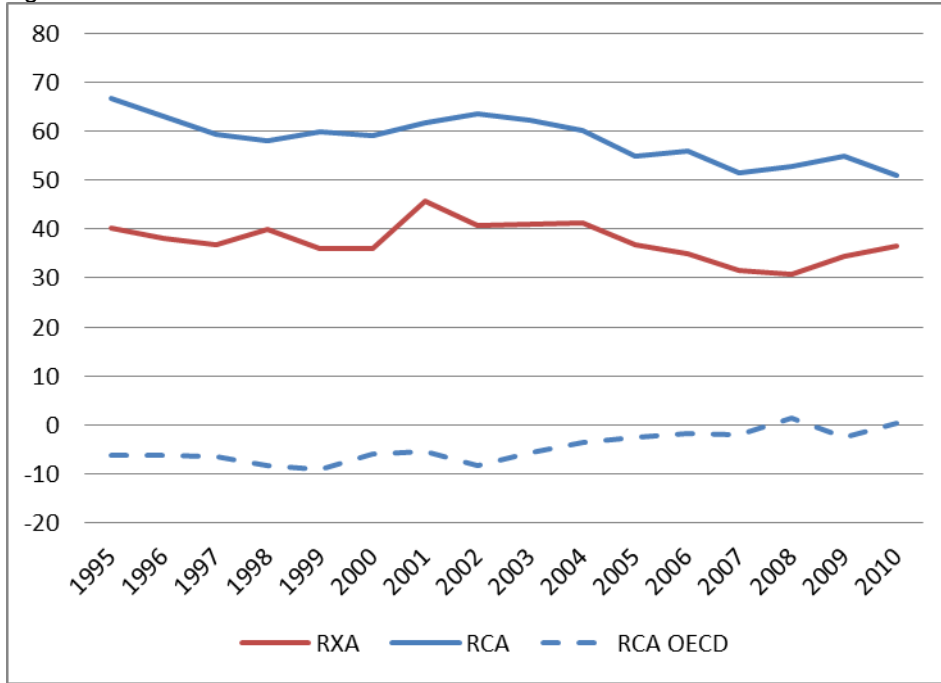
The EBOPS components are assigned to the most relevant economic sector of the sector classification of this study (see table A.3). In some cases a component of the EBOPS service classification is in fact a mix of outputs of different economic sectors. Two sectors -- "public utilities" and "wholesale trade" -- do not have data on trade in services. The first can be explained because this sector mainly operates on the domestic market. The second because in international standards of economic statistics the trade sector does not produce products (an output quantity) but only trade costs (pricing of outputs of other sectors).

Table A.3 Mapping of EBOPS services to 24 sectors

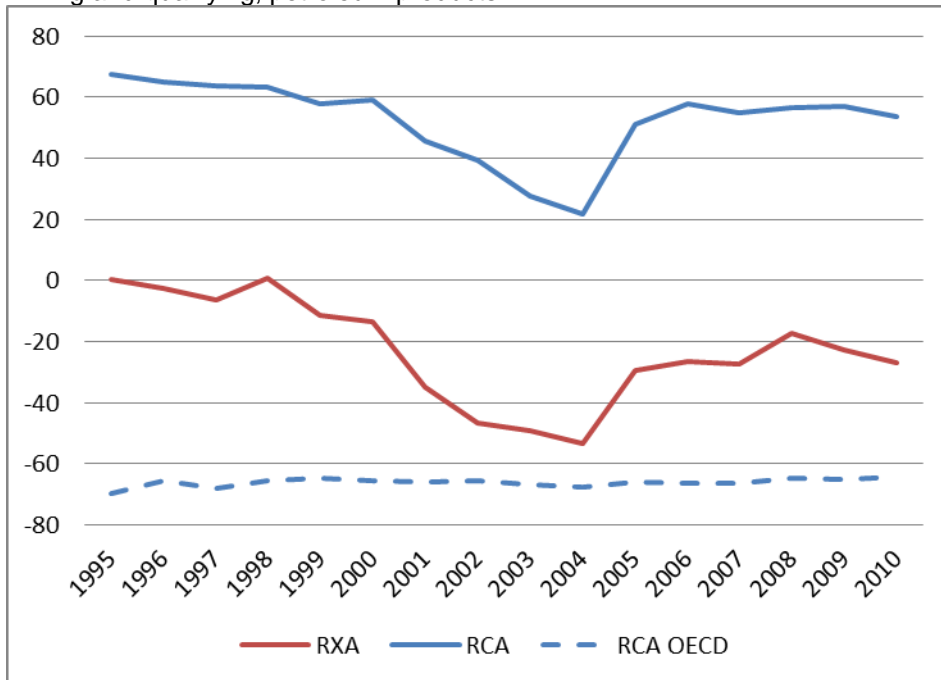
Component of EBOPS services	SectorNr	Sectorname
1 Transportation	16	Transport and storage
2 Travel	17	Hotels and restaurants
3 Communications services	18	Media and communication
4 Construction services	14	Construction
5 Insurance services	20	Financial services
6 Financial services	20	Financial services
7 Computer and information services	19	IT services
8 Royalties and license fees	21	Business services
9 Other business services	21	Business services
10 Personal, cultural, and recreational services	24	Public sector
11 Government services, n.i.e.	24	Public sector
Compensation of employees	21	Business services
Direct investment	21	Business services
Migrants' transfers	21	Business services

Annual dynamics of RXA and RCA

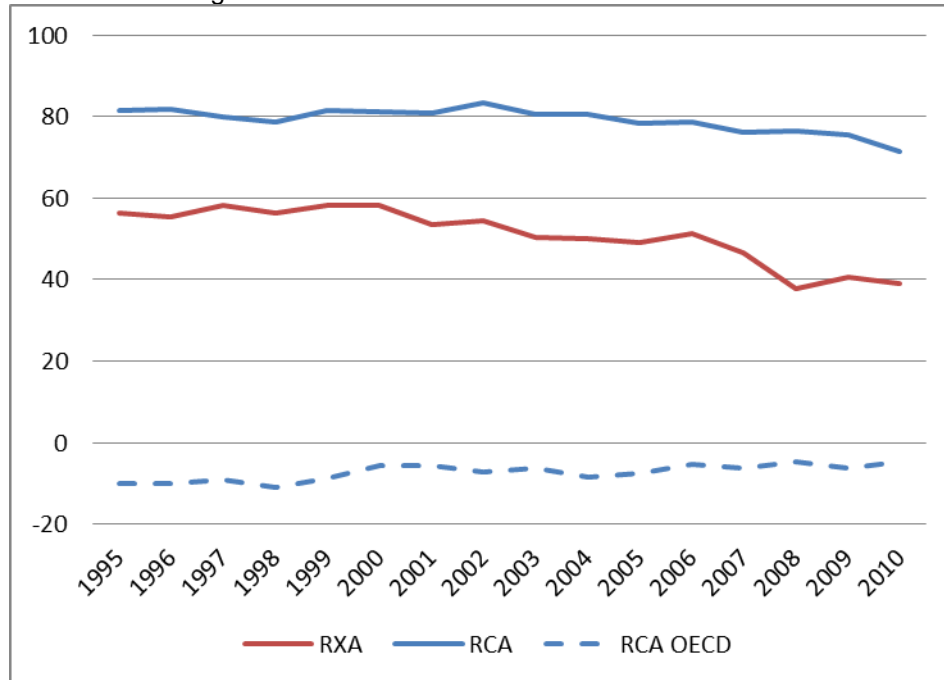
Agriculture



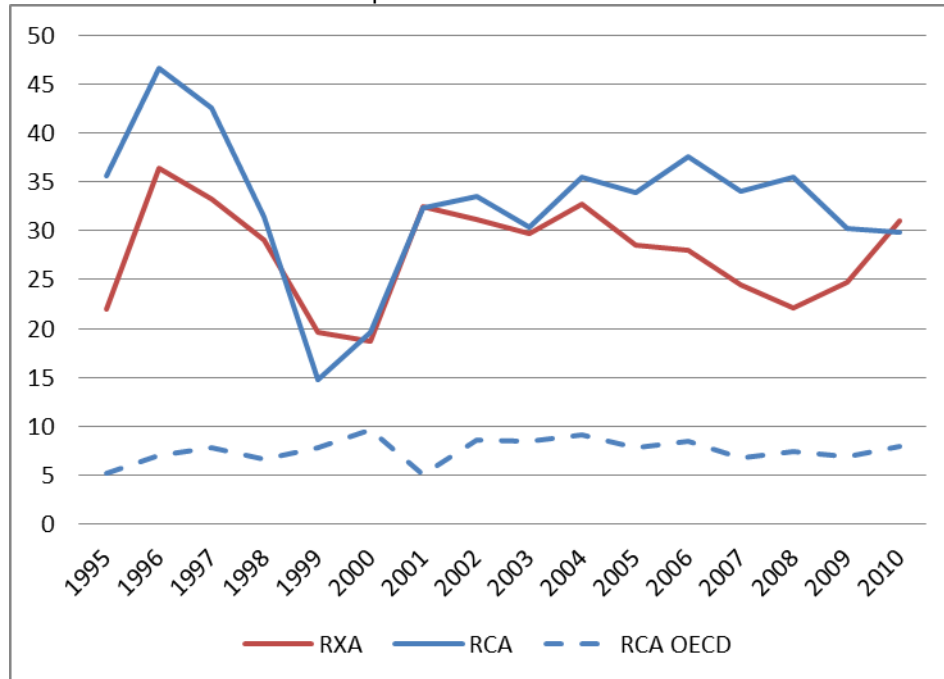
Mining and quarrying, petroleum products



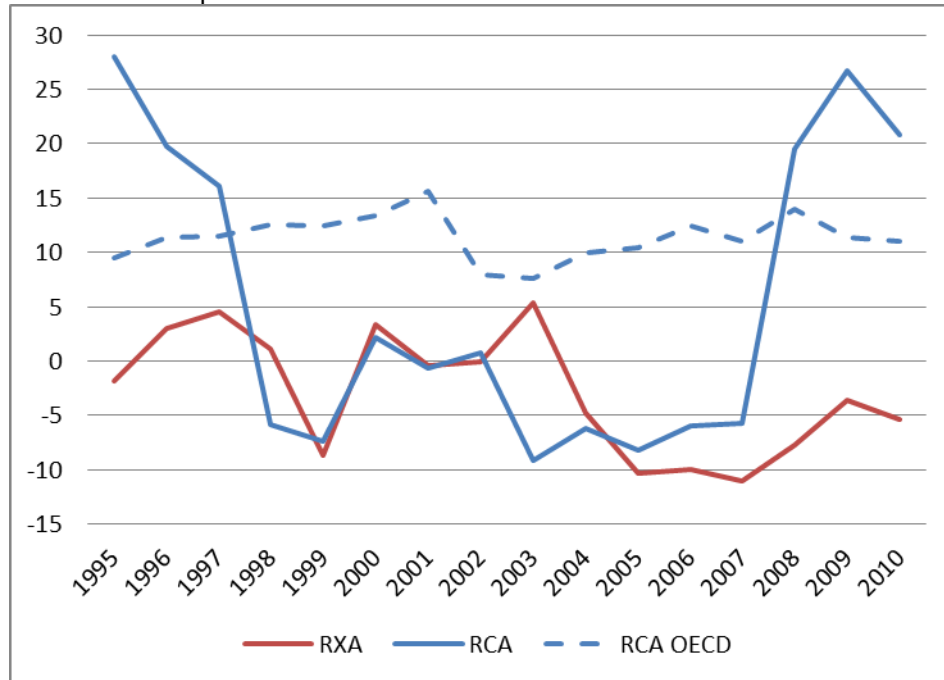
Food and beverages



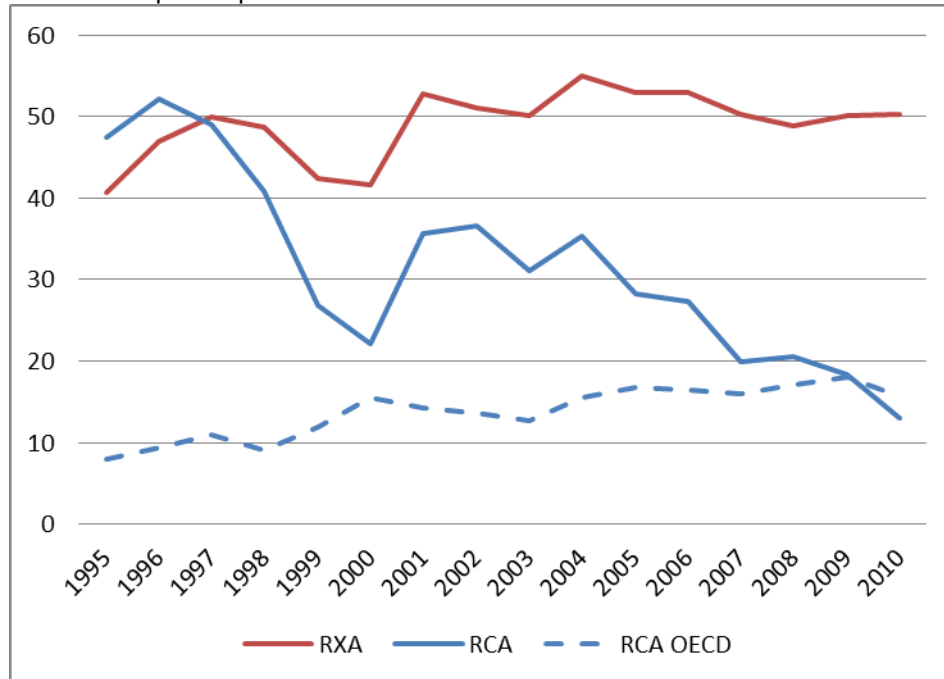
Basic chemicals and chemical products



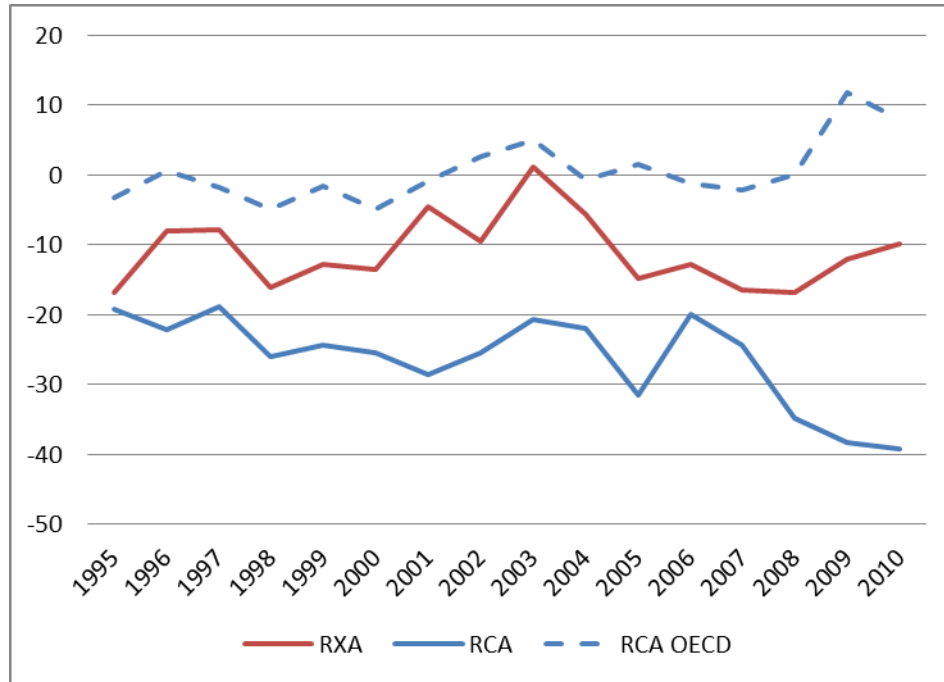
Pharmaceutical products



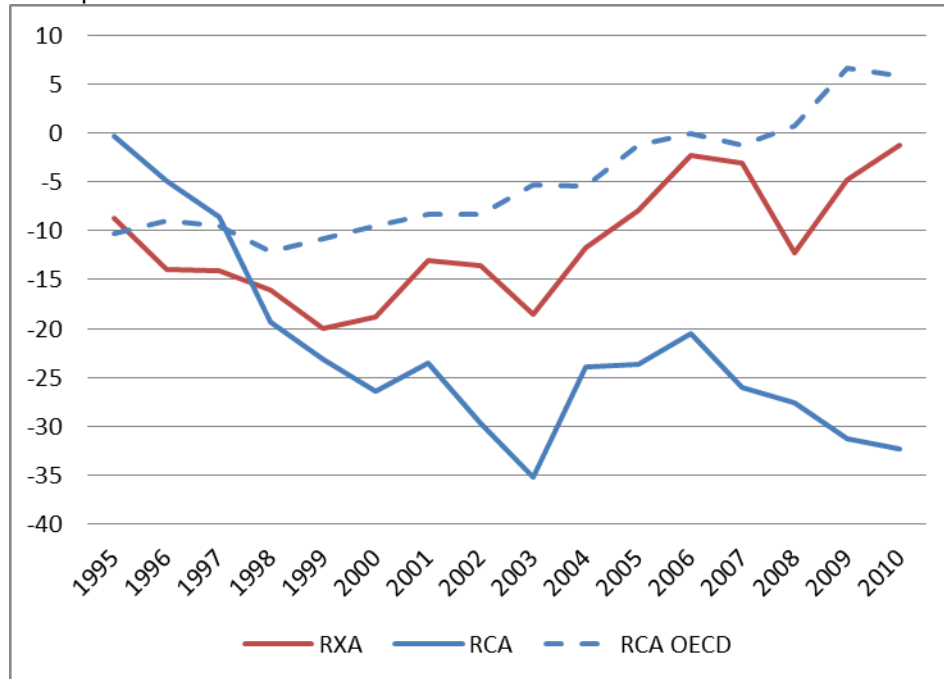
Rubber and plastic products



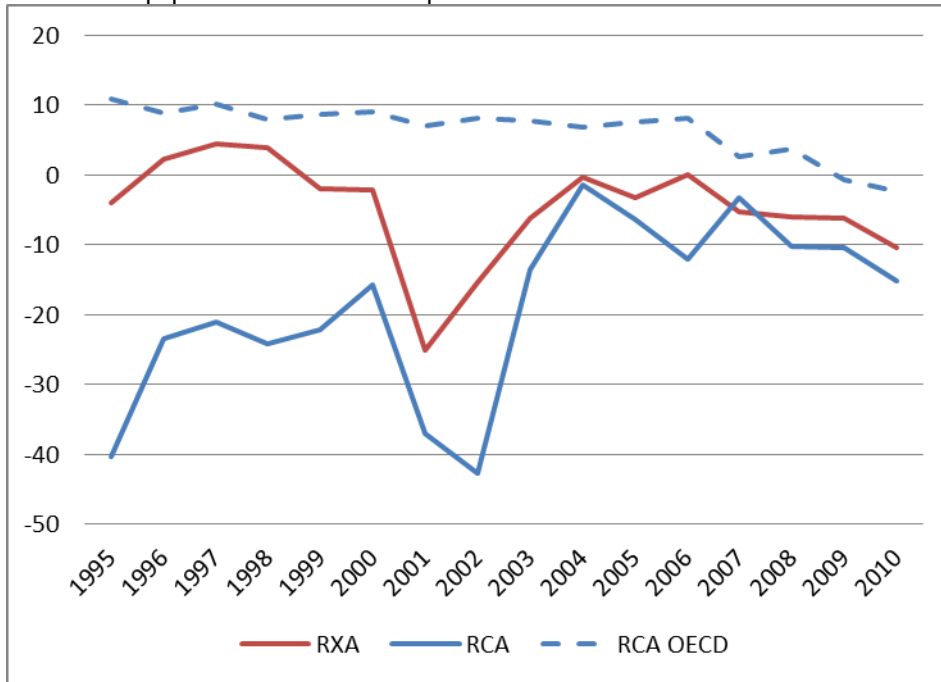
Basic Metals



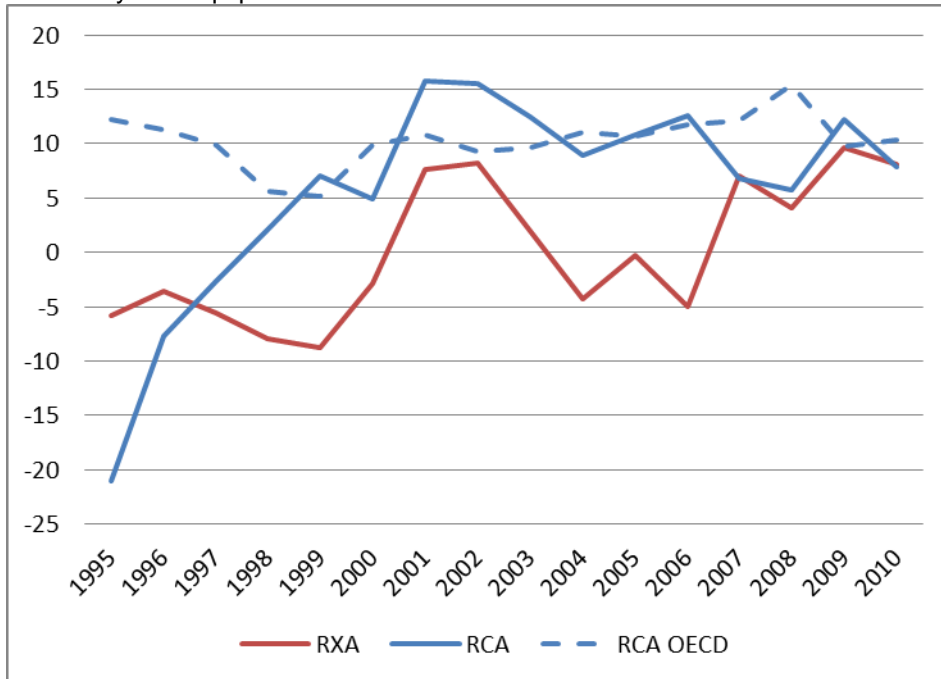
Metal products



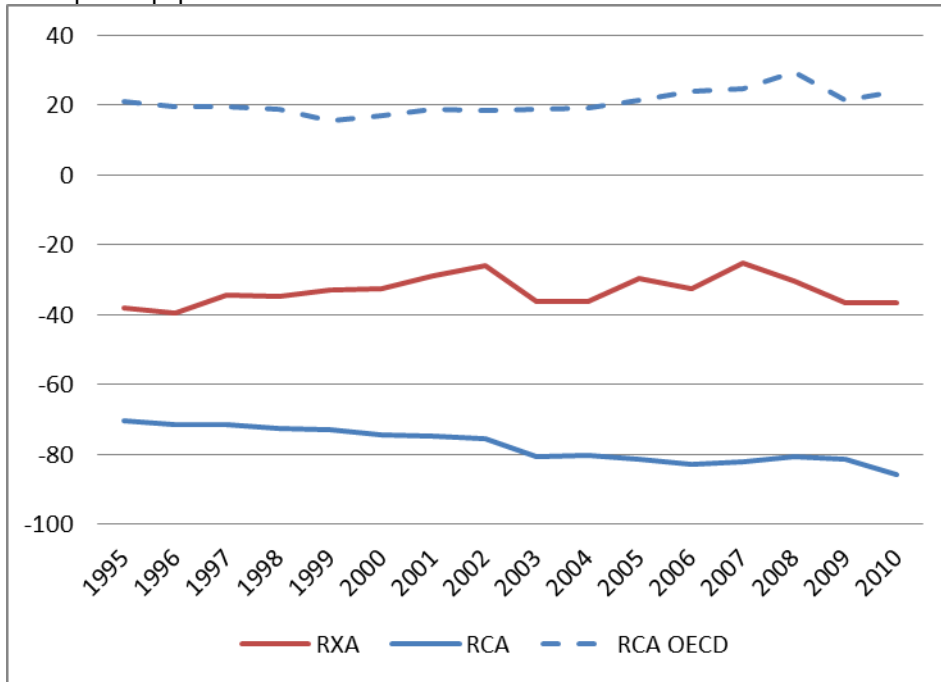
Electrical equipment and electronic products



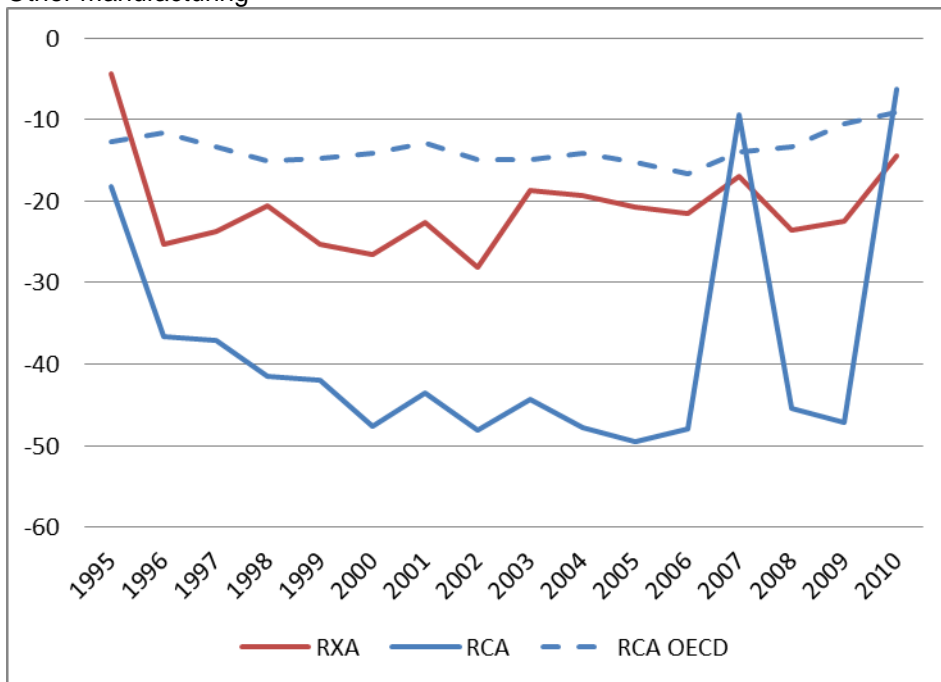
Machinery and equipment



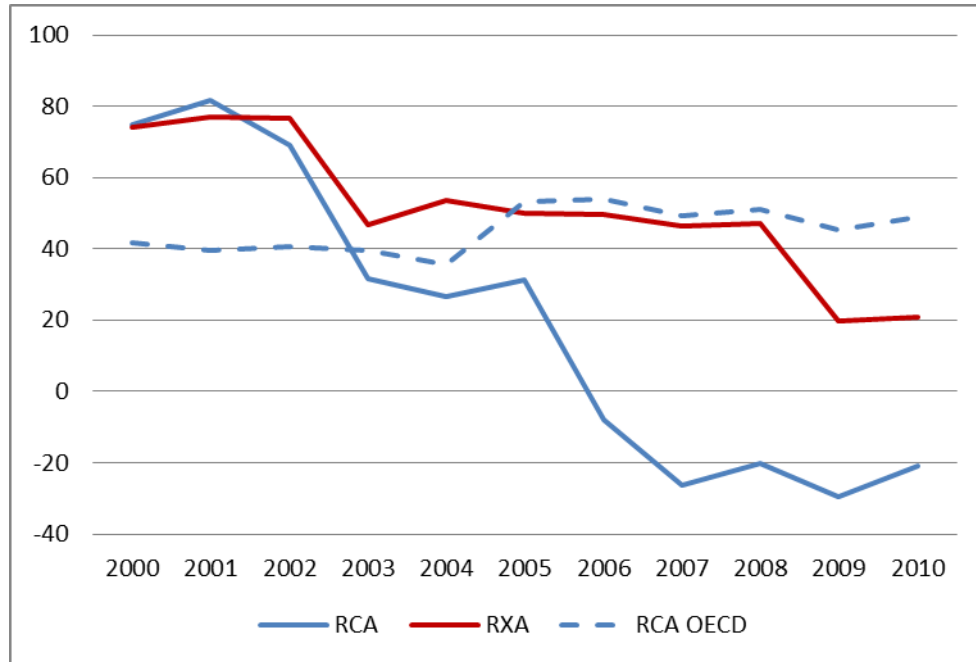
Transport equipment



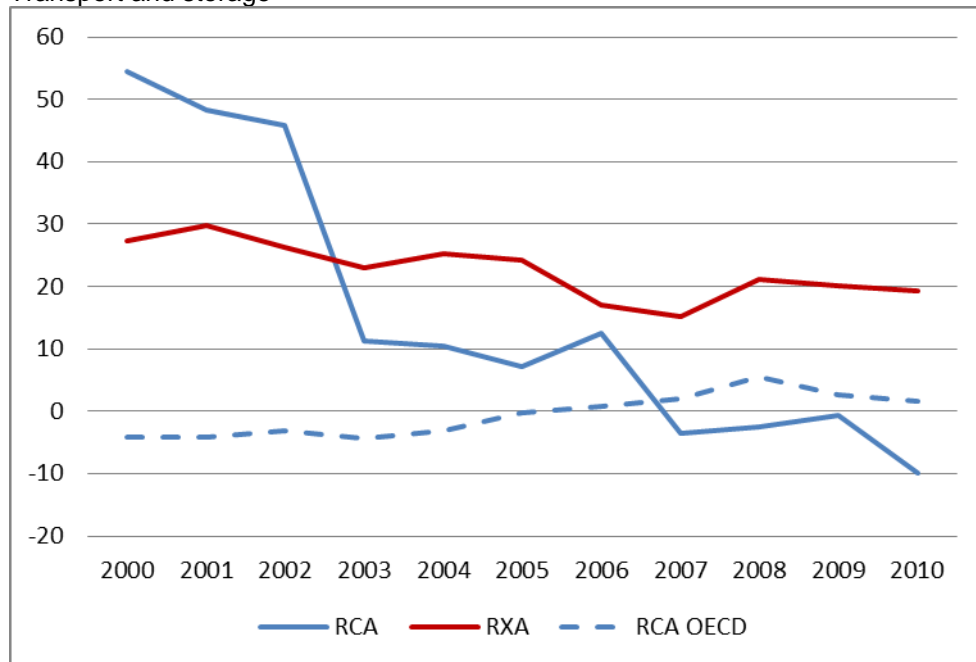
Other manufacturing



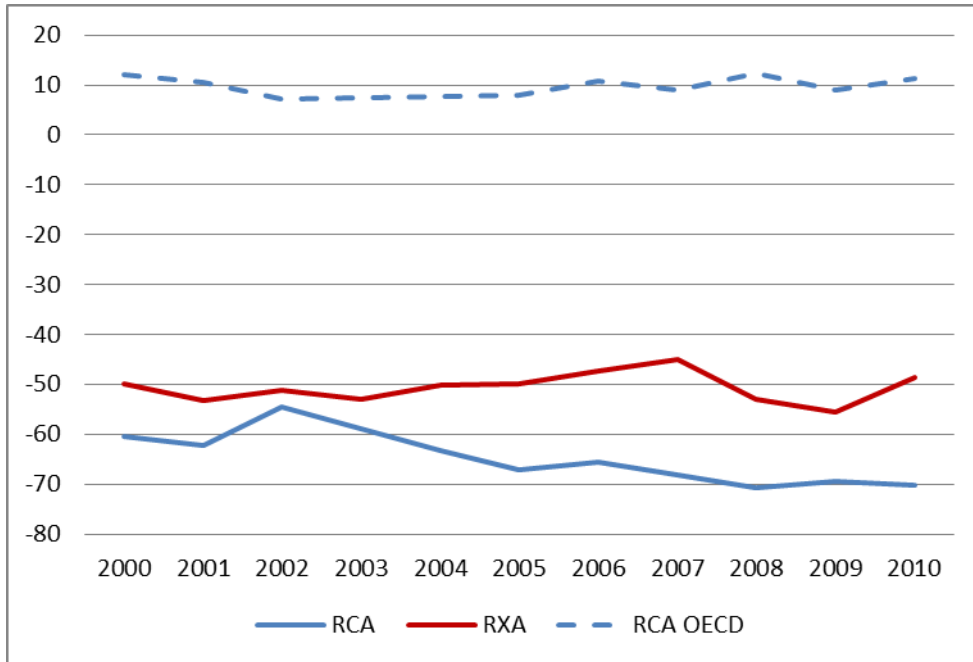
Construction



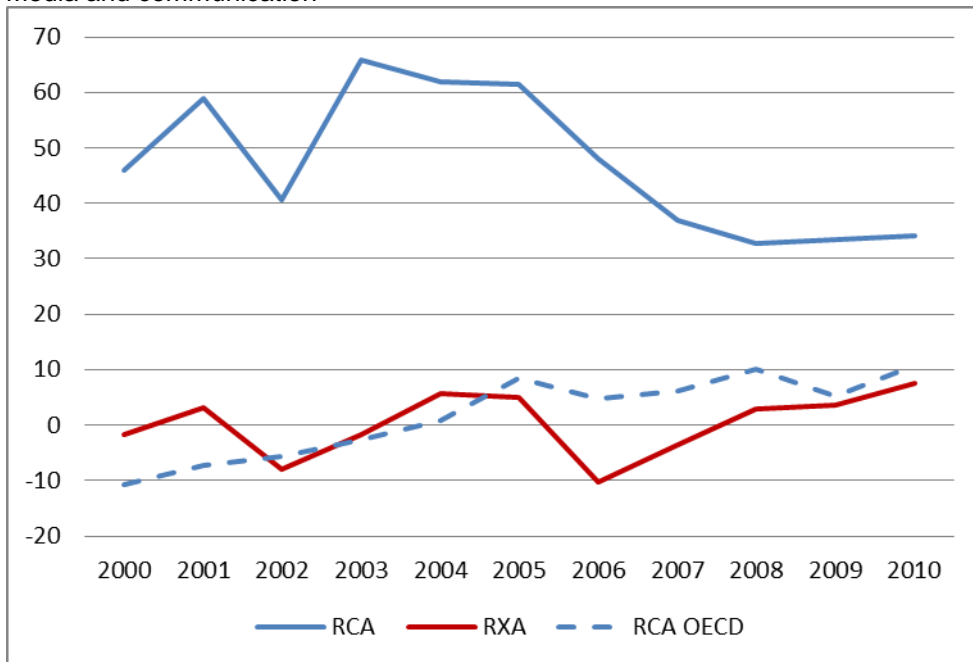
Transport and storage



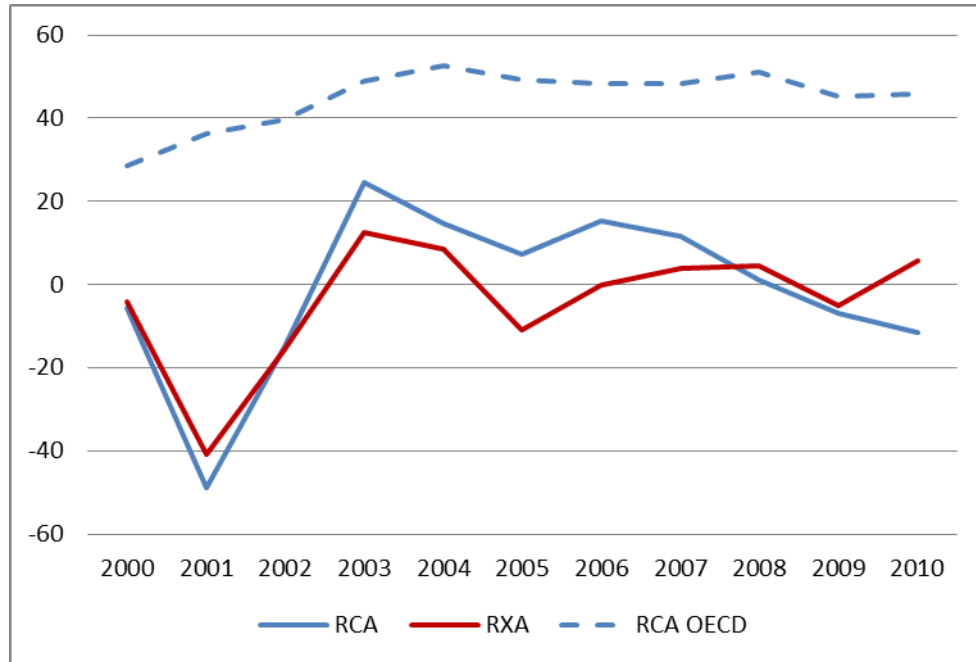
Hotels and restaurants



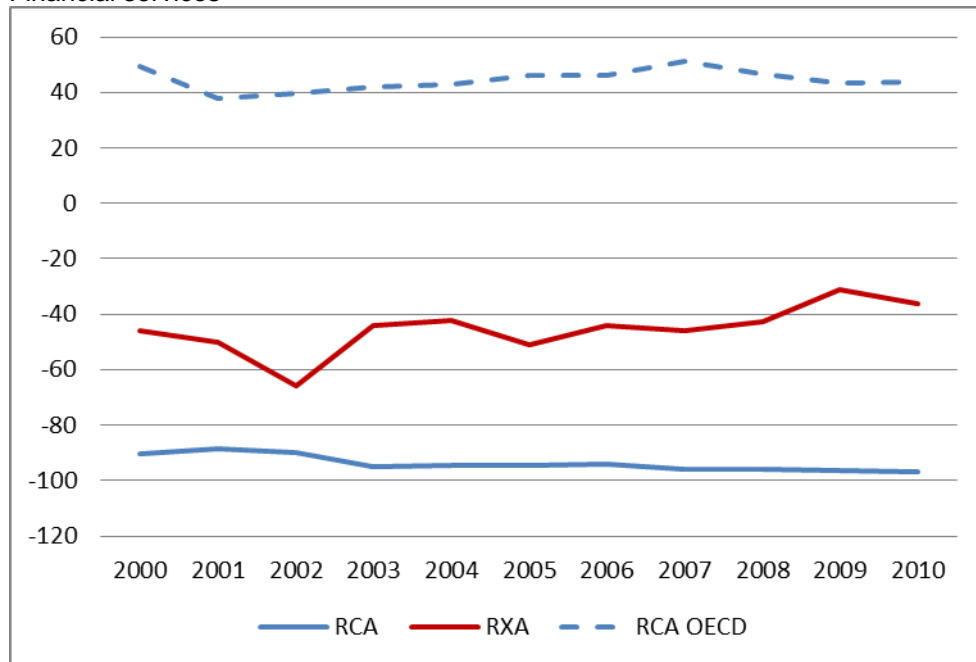
Media and communication



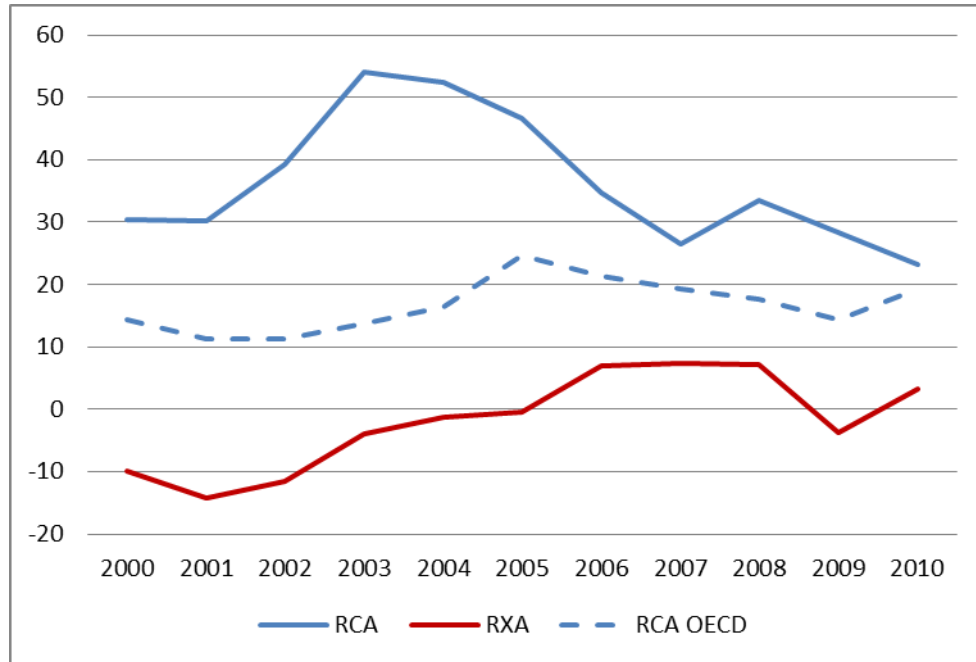
IT services



Financial services



Business services



Public sector

