

“Capacity Building and Strengthening Institutional Arrangement / Data Yearbook”

Workshop: “Environmental Indicators and their use for
indicator-based reporting activities”

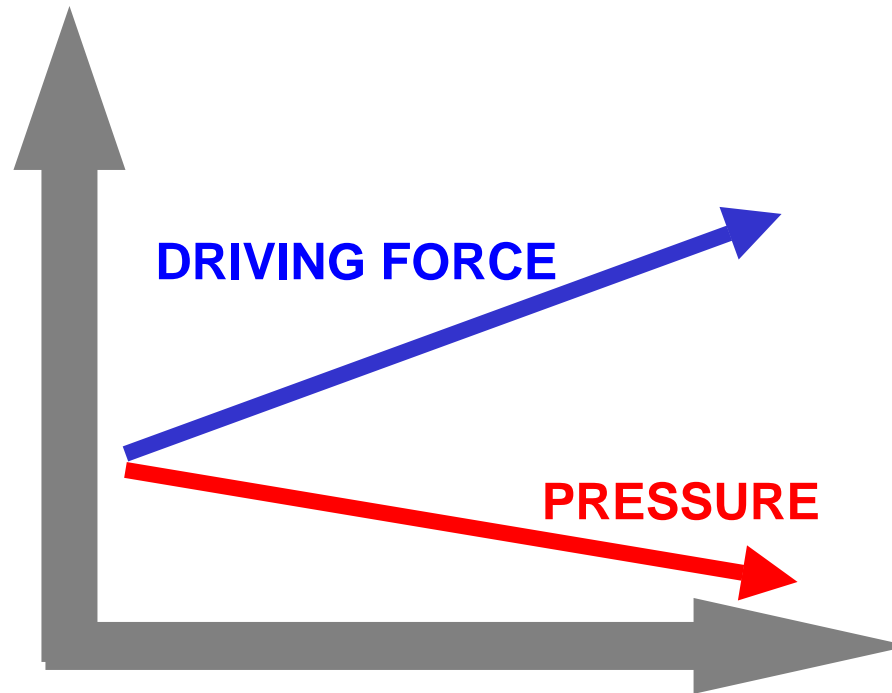
DECOUPLING MODEL

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Decoupling Model



Institutional Reference Framework

- ✓ OECD Environmental Strategy
- ✓ Ministers of the environment of the member countries
- ✓ indicators to measure the sustainable development
- ✓ decoupling indicators

Motivations

Decoupling strategy involves an address change in the consumptions and production habits.

Start of Scientific Debate

The first report, based on the use of the decoupling indicators, was published by the OECD in May of 2002, and it is entitled: ***“Indicators to measure decoupling of environmental pressure from economic growth”***.

Concept Of Decoupling

The term “decoupling” has often been used to refer to breaking the link between “*environmental bads*” and “*economic goods*.”

Decoupling & Dpsir

Decoupling indicators describe the relationship between the first two components of the DPSIR model, i.e. *a change in environmental pressure as compared to the change in driving force over the same period.*

Decoupling indicators describe the relationship between two of the five components of the DPSIR framework. Which? *Check the right answer (boxer).*

- Driving force
- Pressure
- State
- Impact
- Response

Hypothesis

Decoupling occurs when there is an economic development and the growth rate of the environmentally relevant variable is less than the correspondent economic driving force over a given period.

$$\frac{\Delta (D)}{\Delta t} > 0$$

$$\frac{\Delta (D)}{\Delta t} > \frac{\Delta (P)}{\Delta t}$$

Typologies Of Decoupling



Relative decoupling

Absolute decoupling

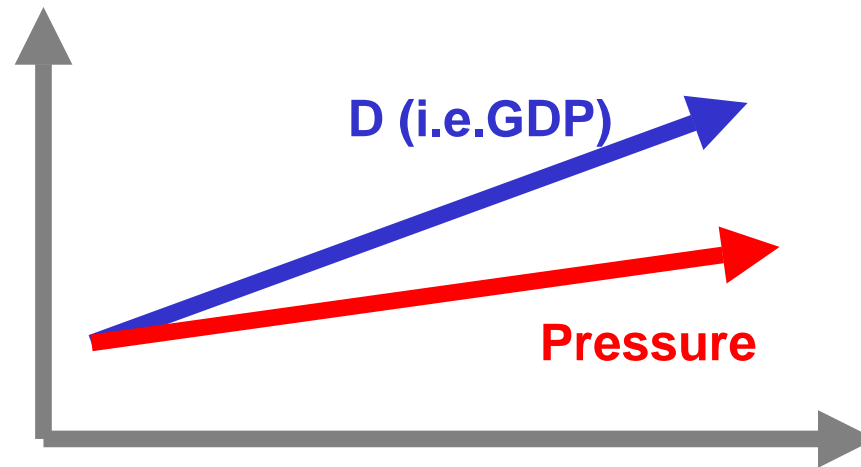


Relative Decoupling

“Relative decoupling” is said to occur when the growth rate of the environmentally relevant variable is positive, but less than the growth rate of Driving force (i.e. GDP).

Relative Decoupling

$$\frac{\Delta (D)}{\Delta t} > \frac{\Delta (P)}{\Delta t} > 0$$

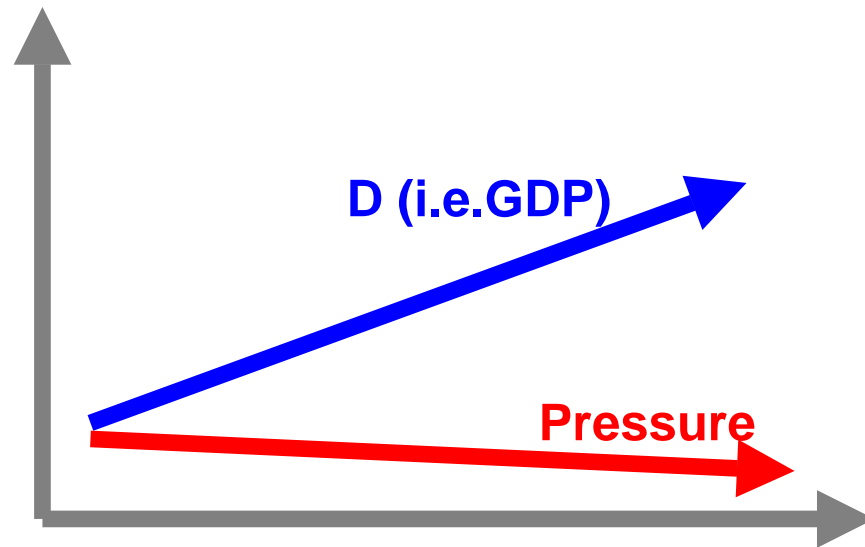


Absolute Decoupling

If driving force (i.e. GDP) displays positive growth, "absolute decoupling" is said to occur when the growth rate of the environmentally relevant variable is zero or negative — i.e. pressure on the environment is either stable or falling.

Absolute Decoupling

$$\frac{\Delta (D)}{\Delta t} > 0 \cap \frac{\Delta (P)}{\Delta t} \leq 0$$



Concept of Decoupling

In general a decoupling indicator is realized as a relationship between an indicator of pressure and the correspondent indicator of the more directly correlated determinant with that specific pressure.

$$I_{dec} \equiv \frac{P}{D}$$

Example

Economy-wide Decoupling Indicators

Climate change

- Total greenhouse gas (GHG) emissions per unit of GDP and per capita

Air pollution

- Total emissions of fine particulate matter PM10 per unit of GDP
- Total VOC emissions per unit of GDP

Natural resources

- Total freshwater abstraction per unit of GDP

Waste Management

- Municipal waste going to final disposal versus private final consumption (PFC)
- Amount of glass NOT collected for recycling versus PFC

Example

Decoupling indicators for specific sectors

Energy

- **CO₂, SO_x, and NO_x emissions from energy use per unit of GDP**

Transport

- **Emissions of CO₂, NO_x, VOCs from passenger cars and freight vehicles (combined) per unit of GDP**

Agriculture

- **Soil surface nitrogen surplus versus agricultural output**

Manufacturing

- **Freshwater abstraction by manufacturing industry versus manufacturing value-added**

Main Limitations of The Decoupling Concept

- ✓ decoupling concept doesn't give, directly, any information about the different capacities of natural environments to answer to the pollution agents (resilience, absorption) or to the environmental factors.

- ✓ relationship between Driving Forces and Environmental Pressures is often not so direct and simple to understand.

Presentation of Decoupling Information

The most direct manner of displaying decoupling between an environmental pressure and an economic driving force is to plot two indexed (i.e. 1980=100) time-series on the same graph.

Presentation of Decoupling Information

The ratio of the value of the decoupling indicator at the end and at the start of a given time period is defined as follows:

$$\text{Decoupling Ratio} = \frac{\text{(EP/DF) at the end of study period}}{\text{(EP/DF) at the beginning of study period}}$$

Decoupling Ratio < 1 → Decoupling Exist

*where EP = Environmental Pressure
 and DF = Driving Force.*

Decoupling Factor = 1 – decoupling ratio

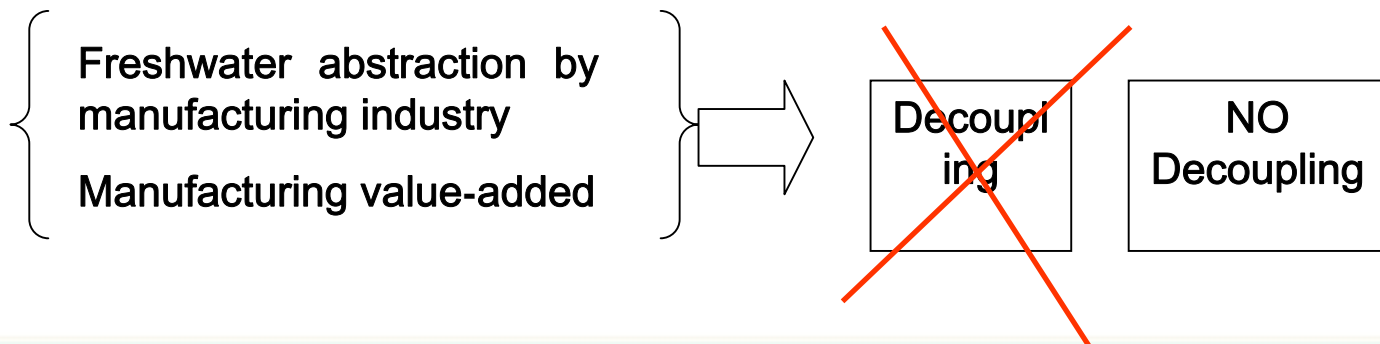
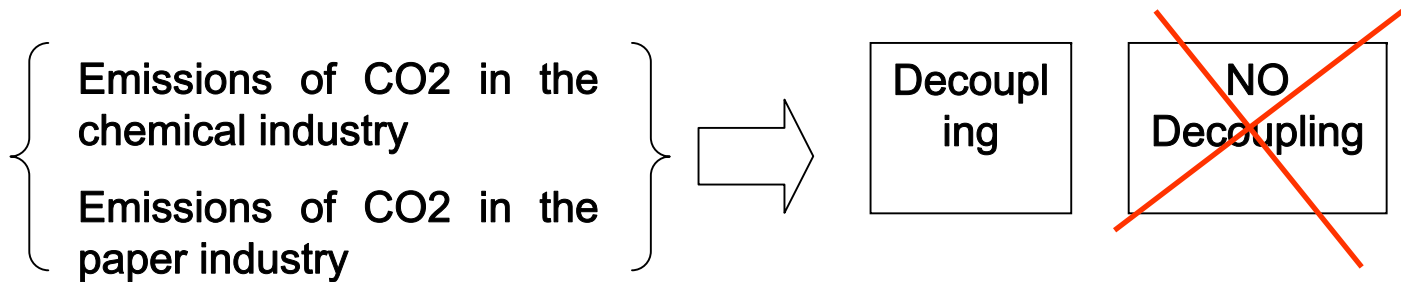
14. Which is the correct decoupling *ratio* “definition”? *Check the right answer (boxer).*

a) Decoupling *Ratio* =
$$\frac{(\text{EP/DF})\text{at the end of study period}}{(\text{EP/DF})\text{at the beginning of study period}}$$

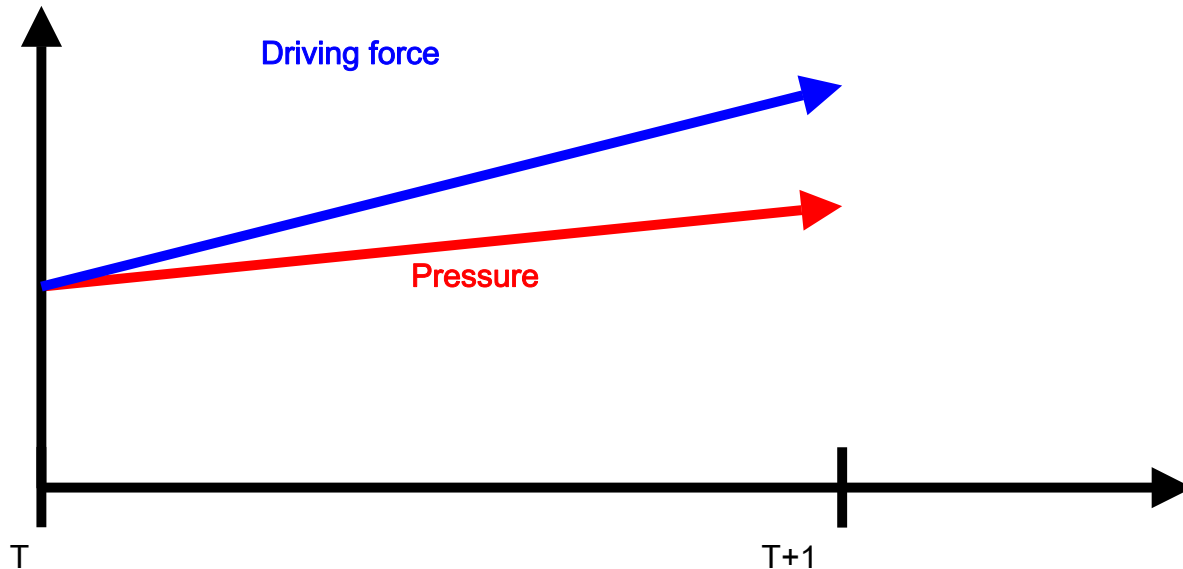
b) Decoupling *Ratio* =
$$\frac{(\text{EP/DF})\text{at the beginning of study period}}{(\text{EP/DF})\text{at the end of study period}}$$

Other start test solution

12. Recognize the correct couples of variables useful to evaluate the decoupling: *Check the right answer (boxer).*

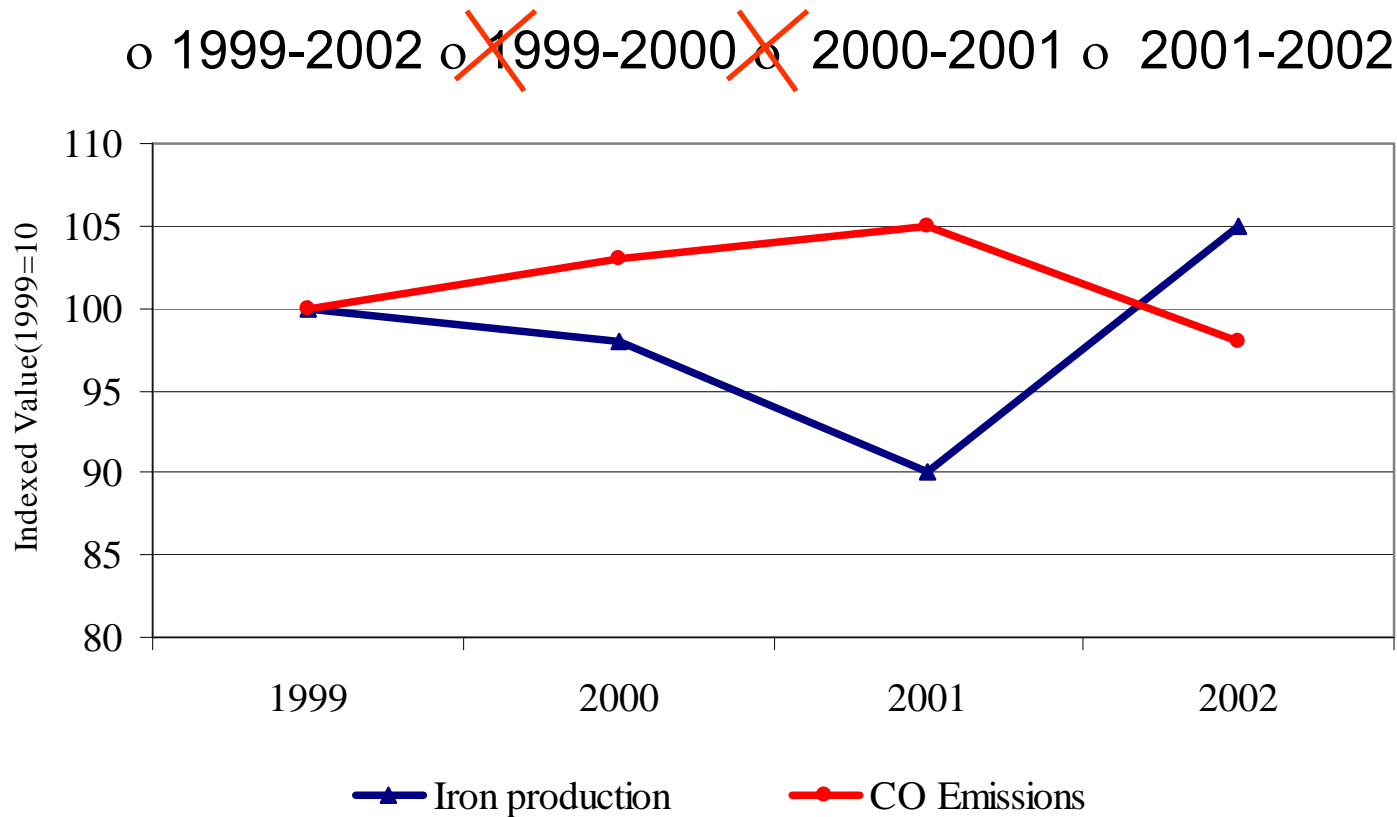


13. Establish if the decoupling is present in the period [T – T+1] and qualify it (absolute or relative decoupling) by the only graphic help. *Check the right answer (boxer).*



- A) ~~Decoupling~~ NO Decoupling
- B) Absolute ~~Relative~~

15. Based on the following graph, for what periods does not have sense investigate the decoupling presence and why? *Check the right answer (boxer).*



The decoupling model as a tool for the monitoring of
the environmental *performances* of the principal
national productive sectors
(*an APAT application*)

The Aim of Work

The purpose of the APAT study is to introduce an application of the OECD methodology useful to the analysis of the environmental performances of some important productive sectors at ATECO (NACE) level.

Data Set

- ✓ the “optimal” decoupling indicator
- ✓ the limits of reality
- ✓ analysis of different data sources
- ✓ ATECO classification economic activities

Data Set

In detail, the data related to the economic components and to the atmospheric emissions originate from source ISTAT (for the National Account Matrix including Environmental Accounts - NAMEA); those related to the hazardous wastes originate from source APAT (Environmental data Yearbook 2004).

Matrix of data analyzed (economic data, atmospheric emissions and special wastes) for the principal economic activities [1990-2002]

ECONOMIC ACTIVITY			DRIVING FORCES		PRESSURES										
			CURRENT PRICES		ATMOSPHERIC EMISSIONS									WASTES	
Classification ATECO of the economic activities			Production	Value Added	CO2	N2O	CH4	NOx	SOx	NH3	NMVOC	CO	PM10	Pb	HAZARDOUS WASTES
A	01-02	AGRICULTURE, HUNTING AND FORESTRY	4	4		4	4			4					4
B	05	FISHING AND CONNECTED SERVICES		4				4					4		
C	10-14	EXTRACTION OF MINERAL		4			4				4				
D	15-37	MANUFACTURING	4	4							4	4	4	4	4
DA	15-16	Alimentary industries, of the drinks and of the tobacco		4			4								4
DF	23	Manufacture of coke, oil refineries, treatment of the nuclear fuels		4					4						
DG	24	Manufacture of chemical products and synthetic and artificial fibers	4	4		4									4
OF		Manufacture of products of the workmanship of mineral not metalliferi	4	4	4		4								4
DJ	27-28	Production of metal and manufacture of products in metal	4	4								4	4	4	4
E	40-41	PRODUCTION AND DISTRIBUTION OF ELECTRIC ENERGY, GAS AND WATER	4	4	4		4	4							
F	45	CONSTRUCTIONS	4	4				4			4				4
H	55	HOTELS AND RESTAURANTS	4	4								4		4	4
I	60-64	TRANSPORTS, STORAGE AND COMMUNICATIONS	4	4				4					4		

The Steps for the Construction of the Decoupling Indicators

- 1) Selection of dataset
- 2) Selection of pollutants
- 3) Selection of economic variables
- 4) Costruction of decoupling indicators

Selection of Pollutants

The pollutants has been selected evaluating the contribution of every economic activity to the general atmospheric emissions.

This result has been obtained calculating the mean value of the emissions of every pollutants, in the long period, then the percentage distribution of every pollutant for economic activity.

It has been chosen, to compare the economic variable individualized for every productive sector, with the only more relevant atmospheric emissions.

Selection of Economic Variables

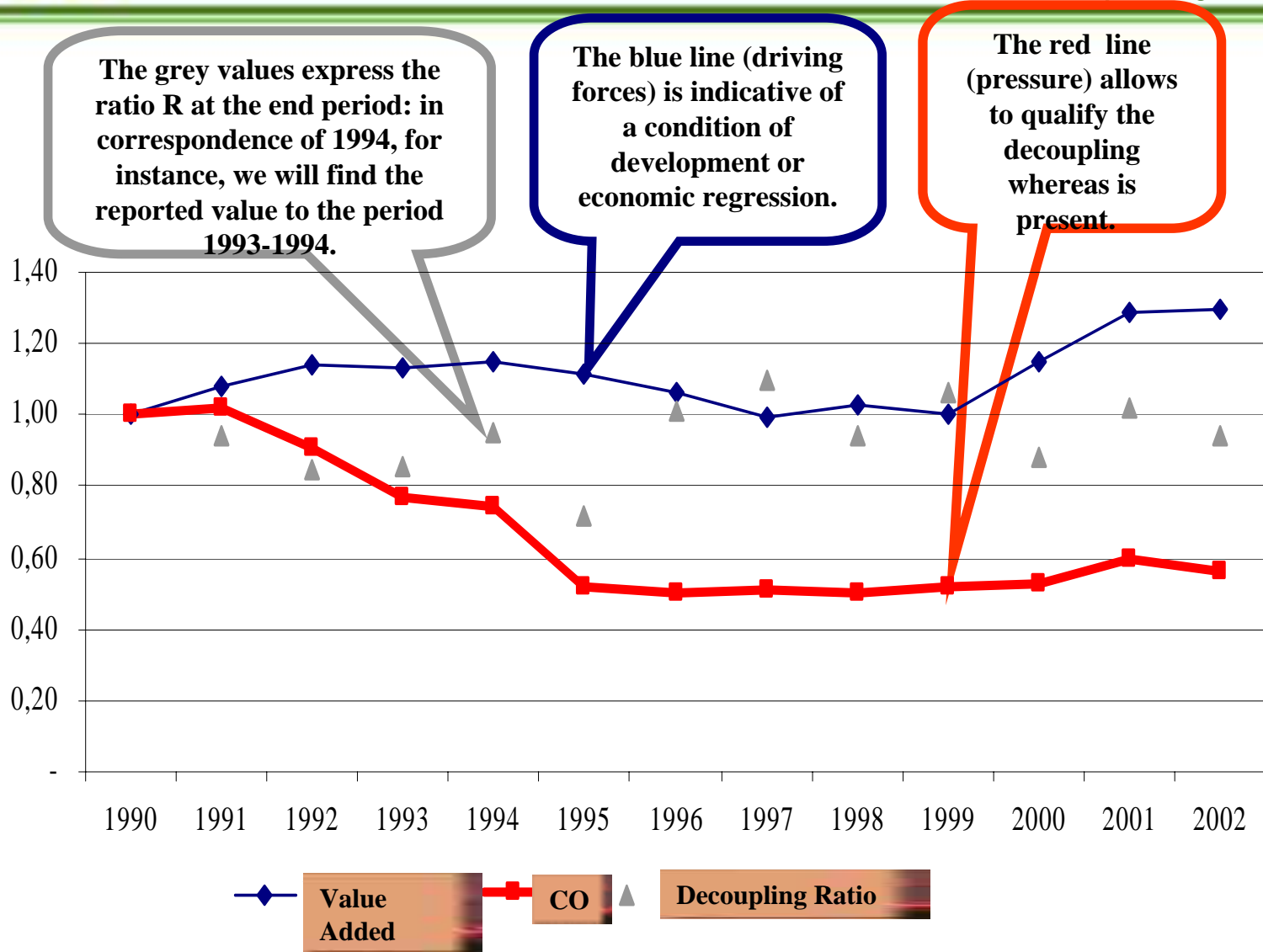
The dataset, organized according to the structure of NAMEA, offered: the production, the value added and the consumptions for every economic activity.

Thinking that the value added could represent a synthesis measure between the others variable ($VA = P - C$), we chose it almost always as a driving-force for every economic activity.

Construction of the Indicators and Formality of Representation

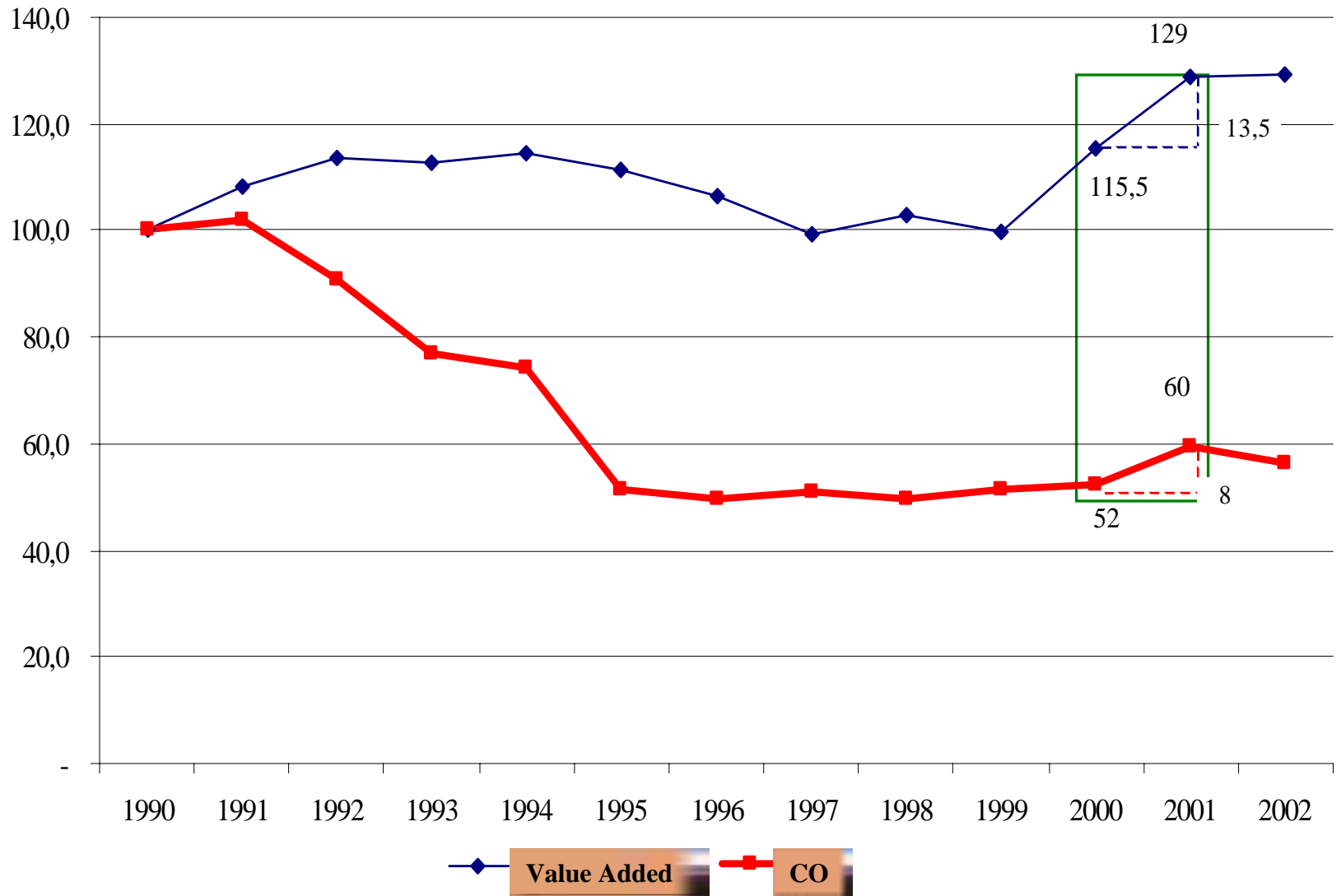
All the introduced indicators are built simply comparing the trend of the economic variable with the environmental ones. The values have been indexed with base line 1990. The chosen historical series has gone since 1990 to 2002.

The select representation allows an immediate reading of the absence, presence and typology of the decoupling.



Example: Indexed Distribution of the value added and of the monoxide of carbon emissions (CO) (1990-2002)

Warning



Warning

Evaluating the described increases to the light of the respective values of beginning period, we get:

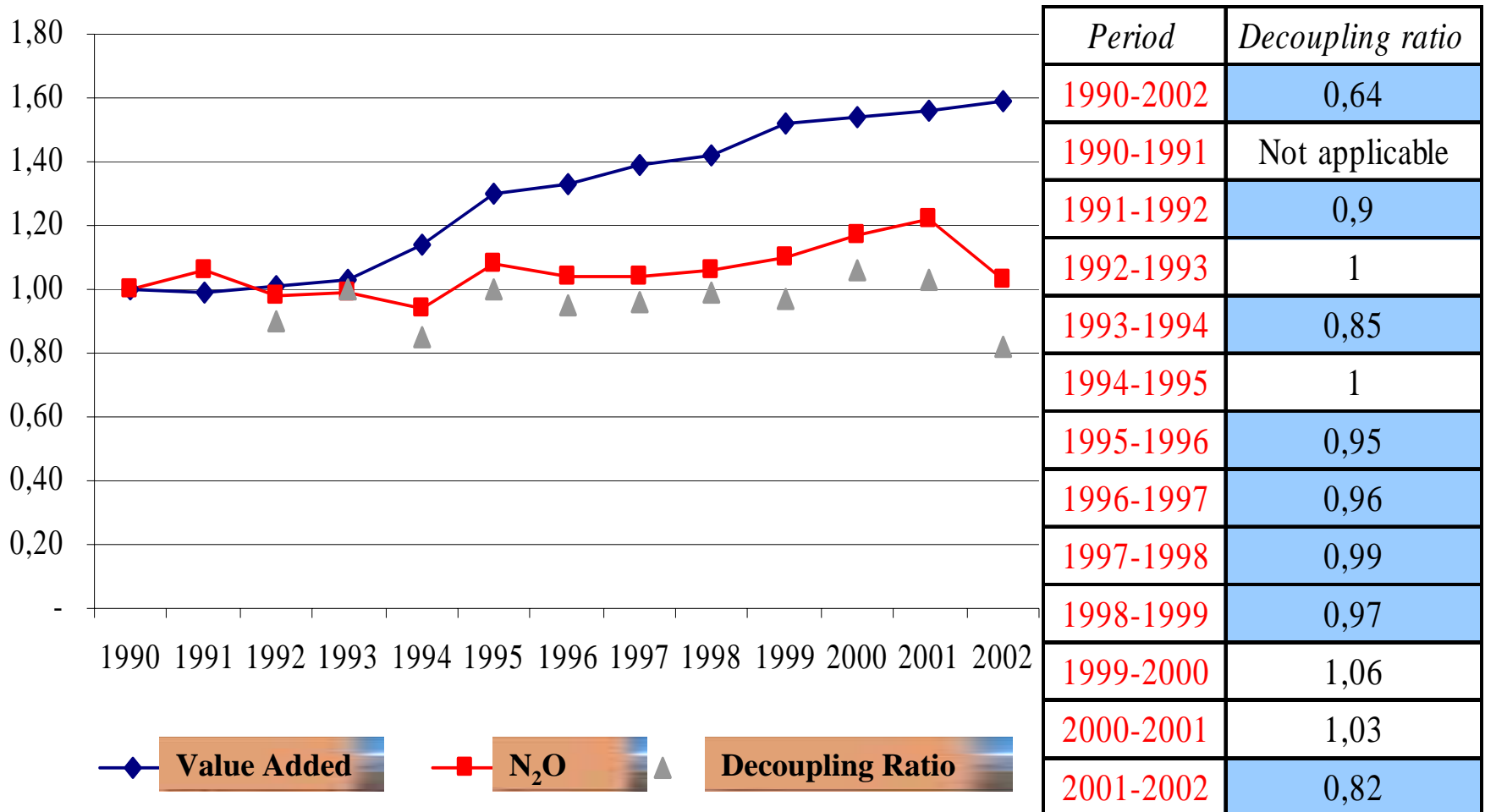
$$\Delta D = \frac{13,5}{115,5} * 100 = 11,6\%$$

$$\Delta P = \frac{8}{52} * 100 = 15,3\%$$

from which it is deduced that the pressure grows more quickly than the determinant and therefore that there are not the conditions for the decoupling in the period 2000-2001.

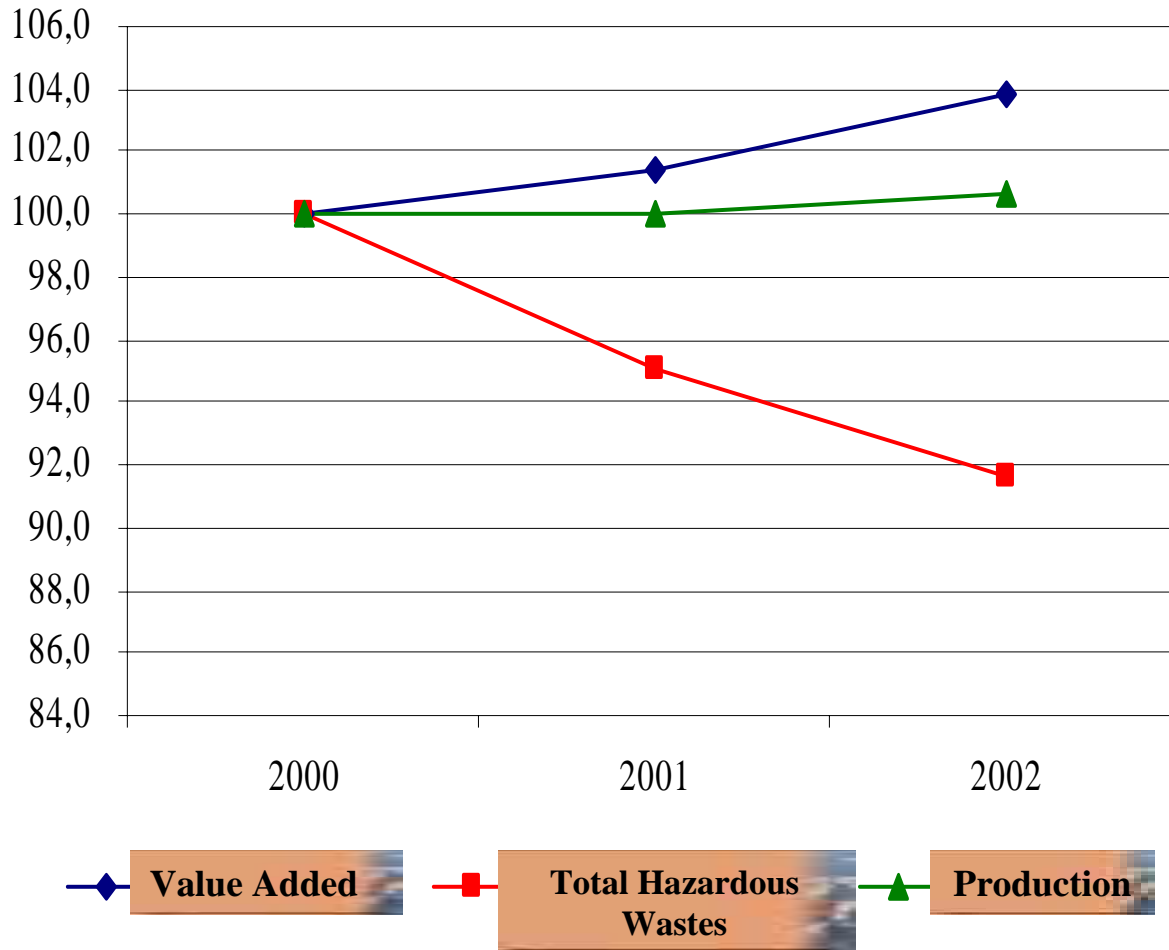
Example

Economic activity ATECO – DG “Manufacture of chemical and synthetic products and artificial fibers”



Example

Economic activity ATECO – DG “Manufacture of chemical and synthetic products and artificial fibers”



Added Value vs. Total Hazardous Wastes	
<i>Period</i>	<i>Decoupling ratio</i>
2000-2002	0,88
2000-2001	0,94
2001-2002	0,94

Production vs. Total Hazardous Wastes	
<i>Period</i>	<i>Decoupling ratio</i>
2000-2002	0,91
2000-2001	0,95
2001-2002	0,96

Conclusion

The indicators of decoupling are characterized for:

conciseness in analytical terms

immediateness in the representations

they represent an essential tool for the Policy Makers to monitor the sustainable development.

Main References

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Example of Exercises

- ✓ For which of the following couples of variables it's correct to evaluate the decoupling.
- ✓ Based on the following graph, in which periods does not have sense to investigate the decoupling presence and why?
- ✓ Establish where the decoupling is present and qualify it by the only graphic help.
- ✓ Verify the decoupling existence for the period "X" by the decoupling factor calculation.
- ✓ Verify the decoupling existence in the period "X" between the indicators "determinant" and the "pressure" synthetically expressed in the following.