RAMEA, a shared environmental accounting tool to control and monitor regional environmental taxes

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INTRODUCTION*

Starting from the World Commission on Environment and Development (Brundtland Commission, 1987), following with the Earth Summit in Rio de Janeiro (UN 1992), the Millennium Declaration (UN, 2000 http://www.un.org/millenniumgoals/) and the Conference "Beyond GDP"[6] (EC, OECD, WWF, Club of Rome 2007) there was a great deal of interest in developing a broader set of statistics to supplement the System of National Accounts and to give values to things left outside the traditional economic system. Around the world a consensus is growing that countries and governments need to develop a more comprehensive view of

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[6] Commissioner Dimas stated that "..we will also need to speed up and improve the development of integrated accounting in the social and environmental spheres". According to Commissioner Almunia, in the long term, integrated environmental and economic accounting is likely to be the "strongest tool" for supporting the promotion of well-being and progress. Please consult http://www.beyond-gdp.eu/ for further information.

progress, rather than focusing mainly on economic indicators such as Gross Domestic Product (GDP) (Halstead, 1998 cited in Hall, 2005[7]).

Non-market variables like environmental externalities (e.g. air pollution) are not counted in the GDP. From international to local scales there is a growing emphasis on "evidence based policy-making" which needs better measures of the current programs and policies, thus requiring statistical and analytical approaches that go beyond national borders and conventional reporting systems. This process has shown some weaknesses: in several countries, data used to calculate indicators do not come from national statistics, but are estimated by international organisations; this need derives also from the widespread lack of data that should be provided by official institutes[8]. The attempt of this study was to develop an environmental accounting matrix[9] at a regional scale integrating it with an environmental taxes scheme in order to define strategic tools in support to policy makers work; it is to remark the research is based on official data and standardized systems; if estimated data will be used it will clearly pointed out in the text. Several

[7] J Hall, 'Measuring Progress – An Australian Travelogue' [2005] Journal of Official Statistics, Vol. 21, No. 4, 2005, pp. 727–746

[8] J Hall, [2005]

[9] See M De Haan, P Kee, in OECD, *Measuring Sustainable Development integrated economic, environmental and social frameworks*, 2004.

international and supranational organizations have established collections of statistical indicators[10] to measure economic, social and environmental phenomena. Some of these measures are used to design sector policies and to monitor their effects. A key indicator system would pull together these various measures to tell how a region or nation is doing.

[10] An indicator is a quantitative or a qualitative measure derived from a series of observed facts that can reveal relative positions (*e.g*. of a country) in a given area. When evaluated at regular intervals, an indicator can point out the direction of change across different units and through time. In the context of policy analysis, indicators are useful in identifying trends and drawing attention to particular issues. They can also be helpful in setting policy priorities and in benchmarking or monitoring performance. A composite indicator should ideally measure multi-dimensional concepts which cannot be captured by a single indicator alone, *e.g*., sustainability [M Nardo, M Saisana, A Saltelli, S Tarantola, A Hoffman, E Giovannini, *Handbook on constructing composite indicators: methodology and user guide. Working Statistical Paper,* STD/DOC(2005)3 pag. 8].

The different kind of approaches generally fall into three broad types: the extension of the basic national accounts schemes to cover social and environmental dimensions (satellite accounts[11]); the use of a wide range of indicators and composite indicators referring to economic, social and environmental dimensions; the use of "subjective" measures of well-being[12]. The selection of key indicators is a political process and needs to be carried out in supporting policy-makers decisions'.

In June 2006, the European Council adopted an ambitious and comprehensive renewed EU Strategy for Sustainable Development[13]. It was stated that: 'For better understanding of interlinkages between the three dimensions of Sustainable Development, the core system of national income accounting could be extended by inter alia integrating stock and flow concepts

[11] Please consult the OECD Glossary of Statistical terms: http://stats.oecd.org/glossary/detail.asp?ID=2385

[12] See E Matthews, MEASURING WELL-BEING AND SOCIETAL PROGRESS: A BRIEF HISTORY AND THE LATEST NEWS , Prepared for the joint OECD-JRC workshop "Measuring Well-being and Societal Progress" (2006)

[13] Council of the European Union 10917/06, Review of the EU Sustainable Development Strategy (EU SDS) − Renewed Strategy, adopted by the European Council on 15/16 June 2006, ANNEX http://ec.europa.eu/environment/eussd/

and non-market work and be further elaborated by satellite accounts e.g. environmental expenditures and hybrid accounts like NAMEA[14], taking into consideration international best practices.'.

The strategy invites all EU institutions and Member States to use specific tools, such as impact assessments, in order to ensure that major policy decisions are based on robust proposals, assessing in a balanced way their social, environmental and economic impacts. Furthermore, the renewed strategy emphasises the cost-effectiveness of market-based instruments to deliver its objectives.

[14] The relationship between the environment and the national economy is provided by the National Accounting Matrix including Environmental Accounts (NAMEA), introduced by the Dutch Statistics in 1993. It has been developing since 1995 by Eurostat (Statistical Office of the European Communities). The NAMEA consists of the framework of National Accounts with the supply and use of goods and services expressed in monetary units linked with integrated environmental accounts where the input of resources and output of emissions and pollutants are expressed in physical units. See Eurostat. 2007. *NAMEA for Air Emissions - Compilation Guide, Eurostat, Preliminary Draft by the ESTAT NAMEA TF*. Eurostat: Luxembourg.

Among the objectives and principles related to good governance the policy guiding principles provide: Make polluters pay: ensure that prices reflect the real costs to society of consumption and production activities and that polluters pay for the damage they cause to human health and the environment.

To reach this goal economic instruments are encouraged: the EU will seek to use the full range of policy instruments in the implementation of its policies. The most appropriate economic instruments should be used to promote market transparency and prices that reflect the real economic, social and environmental costs of products and services (getting prices right). Use of environmental taxes is remarked. In particular Member States should consider further steps to shift taxation from labour to natural resource and energy consumption[15]. Following these thoughts later the study tries to create a new eco-tax.

The existing ESEA-2003 (European Strategy for Environmental Accounts) has been reviewed and renewed. Accelerating the production of data, documenting existing statistical collection approaches, extending environmental accounting methodologies and encouraging the use of accounting data in policy-relevant analyses are some of the driving forces for focusing the European efforts regarding environmental accounts.

[15] Eurostat, *Measuring progress towards a more sustainable Europe. 2007 monitoring report of the EU sustainable development strategy,* 2007, European Communities

The Revised European Strategy for Environmental Accounting[16] (ESEA, 2008) will help to ensure the availability of important environmental accounts data from all European countries and will enable these data to be harmonised, timely and of adequate quality, in order to facilitate their use in developing and informing policy. In addition, the strategy will also encourage the further development of environmental economic accounts as a statistical area.

The Strategy focuses on environmental-economic accounting that helps to bring together statistics in coherent frameworks or accounts that allow disparate datasets to be coordinated in such a way that cross-cutting analyses can be made with confidence.

'The ESEA Task Force recommends that the priority for environmental accounts focuses primarily on physical and monetary flows including hybrid accounts, like NAMEA, economic

[16] 68th meeting of the Statistical Programme Committee, Revised European Strategy for Environmental Accounting Eurostat E-3 CPS 2008/68/7/EN http://epp.eurostat.ec.europa.eu/portal/page/portal/environmental_accounts/introduction. It focus on the statistical developments that are needed. Environmental Accounts in Europe are so prioritized according to the ESEA 2008. In Europe, Eurostat and the European Environment Agency are taking the lead in the data and methodological developments for environmental accounts.

information on the environment and economic activities and products related to the environment and other environmentally related transactions such as taxes and subsidies'[17].

Linking environmental and economic indicators encourages and facilitates the involvement of the decision makers who are going to pay an increasing amount of attention to the effects of economic activities on the environment.

The research is based on a RAMEA matrix (Regional Accounting Matrix including Environmental Accounts) for Emilia-Romagna (a region in the north of Italy, see Ch. 2.2. for more details), a regional version of a NAMEA matrix. NAMEA statistical structure derives from official and standardized systems (SNA 1993[18], SEEA 2003[19], ESA 1995[20]). RAMEA is the result of one of the 16 Projects financed by the INTERREG IIIC Program 2005-2007 under GROW, the Regional Framework Operation (RFO) whose main topic is to help Regions in adopting strategies coherent with the Lisbon & Gothenburg Agendas goals[21].

[17] ESEA 2008, pag. 11

[18] see Ch 1 for more details.

[19] see Ch 1 for more details.

[20] see Ch 1 for more details.

[21] E Bonazzi, M Goralczyk, M Sansoni, P J Stauvermann, RAMEA: how to support regional policies towards Sustainable Development, Journal of Sustainable Development (in press)

Since application to policies is a fundamental requisite for environmental accounting tools that aspire to more than just mere compilation of data, RAMEA has been thought as a decision support system for regional sustainable development.

An environmental accounting system, like RAMEA, could be useful to evaluate the economic and environmental performance of regions and to inform regional policies/strategies about sustainable development (production and value added of economic activities, households' consumption, employment, emissions in air). RAMEA is based on an internationally accepted methodology (UN, Eurostat), reliable data (official statistical accounts) and standardized systems. These conditions ensure its coherency with similar tools at national level (NAMEA).

RAMEA could be moreover scheduled for different kinds of analyses, to explore some of the possibilities that this type of tool offer to the regional planning/reporting, e.g.: monitoring regional air emissions and eco-efficiency, comparing regional eco-efficiency with the national one, understanding the indirect effects/responsibilities of production and consumption chains on the environment[22].

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[22] E Bonazzi, M Sansoni, *Valutazione dell'efficienza emissiva dei gas serra nella regione Emilia-Romagna: un'analisi statistica Shift Share a supporto dei decisori pubblici*, 2008 Valutazione Ambientale, Anno VII - n° 13 gennaio/giugno.

In particular the study is focused on the possibility to integrate RAMEA matrix with a new theme on environmental taxes, following international guidelines[23], using available data provided by Eurostat and *Istat* (Italian Statistics Office) and according to NAMEA scheme. The focus is on the possibility of steering a sustainable economy, investigating the use of environmental taxes coordinated with RAMEA in order to improve the knowledge base to support policy makers.

In the long run Eurostat aims at developing all accounts for environmentally related transactions. In the short run Eurostat's activities will focus on the environmental taxes (ESEA 2008):

a) by compiling tax revenues by categories (transport, energy, pollution/resources) from the voluntary "detailed tables" received from the national accounts data collection.

b) by more detailed information on environmental taxes through breaking down taxes by category according to industries. In 2001 Eurostat published a guideline and standard reporting tables for environmental taxes by final user which were endorsed by the plenary meeting of environment statistics and accounts in 2003. These tables have a clear link to the NAMEA-air standard tables. Following EU directions, environmental taxes[24] have long been: an instrument to boost the

[23] Eurostat, *Environmental taxes in the European economy 1995-2003*, 1/2007 European Communities; Eurostat, *Taxation trends in the European Union*, 2008 European Communities.

[24] Starting from 1998 guidelines the compilation of environmental taxes (eco-taxes) have been developed at international level (European Commission, OECD and International Energy

behaviour change of citizens by giving monetary values to negative externalities on the environment, like polluting, also by increasing the costs of certain products which have a negative impact on the environment; an instrument to adjust revenues in national budgets spending or reduce other taxes. The green tax reform[25] should lead to decreasing labour taxes and more weight being put on environmental taxes.

Environmentally related taxes can often usefully be implemented in the context of instrument mixes, in combination with other policy instruments, such as command and control regulations, voluntary approaches, and environmental accounting tools. Among environmental policy tools, environmental taxes are considered to be environmentally effective, and economically efficient. The OECD has supported the use of these instruments, and has carried out an analysis of their implementation[26].

Agency). Ecotaxes are taxes whose tax base has a proved harmful effect on the environment, e. g. a process or product which pollutes the environment. They are grouped into the following categories: Energy taxes, Transport taxes, Pollution taxes, Resource taxes.

[25] http://www.eea.europa.eu/highlights/green-tax-reform-can-boost-eco-innovation-and employment

[26] OECD, *Oecd environmental strategy for the first decade of the 21st century*, ENV/EPOC(2000)13/REV4. Political Economy book, database, etc.

The Sixth Community Action Programme on the Environment, approved in 2002, recommends the use of economic instruments (energy taxes, taxes on resources, ..) in order to mitigate climate change and promote sustainable use of resources.

CHAPTER I

1.1 Environmental accounting and satellite accounts like NAMEA

In 1994, the European Commission identified the main lines of action for the development of a Green National Accounting framework based on satellites to National Accounts[27]. Since then, Eurostat, in collaboration with Member States' statistical offices and European Commission DG Environment's financial support, has developed and implemented different accounting modules that cover almost all types of accounts, introduced in SEEA 2003[28], and that are drawn in the ESEA 2003.

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[27] UE-COM (94) 670

[28] The Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003, referred to as SEEA 2003, is a satellite system of the System of National Accounts. It brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the

The SEEA 2003 describes four main types of environmental accounts:

1. Physical flow accounts including hybrid (NAMEA) accounts;

2. Economic information on the environment (economic activities and products related to the environment and other environmentally related transactions);

3. Natural resource asset accounts;

4. Valuation of non-market flows and environmentally adjusted aggregates (e.g. adjusted for defensive expenditures).

NAMEA statistical structure derives from official and standardized systems (SNA 1993[29], SEEA 2003, ESA 1995[30]).

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environment. It provides policy-makers with indicators and descriptive statistics to monitor these interactions as well as a database for strategic planning and policy analysis to identify more sustainable paths of development (United Nations, European Commission, International Monetary Fund, OECD, World Bank, *The Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003*, Series F, No.61, Rev.1 (ST/ESA/STAT/SER.F/61/Rev.1).

[29]The System of National Accounts (SNA) consists of a coherent, consistent and integrated set of economic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. Together, these principles provide a

In the context of revising the ESEA in 2008, Eurostat commissioned a study in 2006 to assess the progress made by European countries in the compilation of Environmental Accounts in order to facilitate the strategic planning for the further development of Environmental Accounts in Europe towards 2010 and beyond. It should be noted that Germany, Italy, Austria, Finland, Sweden and United Kingdom are involved in further areas of environmental accounting such as Accounts for Environmental Taxes. In the draft ESEA 2008 it is recommended that the development in the medium term (2-3 years) should include: data collection for the areas of NAMEA energy and

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comprehensive accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision-taking and policy-making. The 1993 SNA was prepared under the joint responsibility of the United Nations, the International Monetary Fund, the Commission of the European Communities, the OECD and the World Bank (UN 1993: *System of National Accounts 1993 - United Nations publications Series F, n° 61, rev. 1, Final draft*. UN, Eurostat, International Monetary Fund, OECD and World Bank).

[30] The European System of National and Regional Accounts (1995 ESA) is an internationally compatible accounting framework for a systematic and detailed description of a total economy (that is a region, country or group of countries), its components and its relations with other total economies.

NAMEA waste accounts, and environmentally related transactions according to standard industry NACE[31] groups (e.g. environmental taxes and subsidies).

The first ESEA edition incorporates estimates of Environmental Taxes by branches of activity as a priority for implementation, and which will continue to be regarded thus in their 2008 review. Eurostat requested, for the first time during 2006, information from member countries, on the basis of a questionnaire designed to be integrated with a NAMEA-type framework.

In this framework, carried out jointly in 1997 by Eurostat, the European Commission, the OECD and the International Energy Agency (IEA), environmental taxes are defined, such as 'those whose taxable base consists of a physical unit (or similar) of material with a negative, checked and specific impact on the environment'.

The successful search for a complete statistical description of the interrelationships between the economic and environmental dimensions of development should be one of the basic features of environmental accounting.

The basic idea of NAMEA is the harmonisation of economic and environmental data to allow for a direct comparison of parameters of both dimensions in a sector structure. Such comparisons shift the focus from economic results to consumed natural resources or, like in our case study, to

[31] French acronym for statistical classification of economic activities in the European Community.

emitted emissions. This strategy can provide useful decision guidance for policy makers. Figure 1 shows the possible use of a NAMEA matrix, in an integrated view with other policy tools or statistics (like National and other environmental accounts, eco-taxes, etc)

Figure 1

A clear vision of these interrelationships has therefore been considered to be essential since the beginning of work developed by *Istat* in this field. To that end, a map of the relevant relationships has been identified in the internationally agreed-upon DPSIR[32] model (OECD, 2004). The DPSIR model can also be looked at as a framework in which the statistical tools developed to measure the ecological sustainability of the development can be contained and organised[33]. Figure 2 shows the placement of *Istat* environmental accounting priority modules in the DPSIR scheme. In particular NAMEA module covers the Pressures side (Costantino *et al.* 2004).

[32] DPSIR model: Driver, Pressures, State, Impact, Response.

[33] C Costantino, F Falcitelli, A Femia, A Tudini, 'Integrated environmental and economic accounting in Italy' in OECD, *Measuring sustainable development. Integrated economic, environmental and social frameworks*, 2004.

Figure 2

1.2 Focus on NAMEA matrix

NAMEA methodology goes back to the analysis of physical economy by Leontief (1970), who combined input-output modelling with environmental accounts. NAMEA[34] is classifiable as a hybrid accounts system. According to SEEA, the term "hybrid flow accounts" is used to denote a single accounting framework combining national accounts in monetary terms and physical flow accounts. By means of a system of satellite accounts the environmental accounting systems like NAMEA, Material Flow Accounts[35] and SERIEE[36] have been implemented at international levels

[34] NAMEA was first released as a pilot in the Netherlands in 1993. M de Haan, SJ Keuning, *Taking the Environment into Account:* The NAMEA Approach. Review of Income and Wealth 1996 **42**(2). M de Haan, SJ Keuning, *The NAMEA as validation instrument for environmental macroeconomics,*. 2001 Integrated Assessment **2**.

[35] A European environmental accounting system elaborated by Eurostat in '90s that provides an aggregate overview of annual material inputs and outputs of an economy in tonnes. It follows the Physical approach to environmental Accounting.

[36] Système Européen de Rassemblement de l'Information Économique sur l'Environment. It is a European environmental accounting system, developed by Eurostat in '90s, consisting mainly of

to measure Sustainable Development[37]. Physical and monetary aggregates stemming from environmental accounting can therefore be used in helping economic analysis in a sustainable perspective, as well as facilitating the building of measures of sustainable development based on an integrated view of the economy and the environment.

Summing up, NAMEA is a national statistical information system that gives the possibility of analysing the pressures placed on the environment by production and consumption activities, extending the economic aggregates with related environmental themes. The matrix scheme allows studying the economy-environment relationship with the robustness offered by statistical data .

Figure 3

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data on environmental protection expenditure and economic data on the management of natural resources. It follows the Monetary approach to environmental accounting.

[37] M De Haan, P Kee, 'Accounting for sustainable development: the namea-based approach' in OECD, *Measuring Sustainable Development integrated economic, environmental and social frameworks*, 2004.

In 1994 the European Union stated that 'further integration of environmental and economic information systems aiming at a 'greening' of National Accounts following the satellite approach should be intensified in accordance with a common framework and using a common reference' (COM(94)670).

Following EU Communication, in 1995 Eurostat started working on NAMEA accounts, regarding them as one of the satellite accounts with top priority at European and international level. In 2007 Eurostat released a revised version of its "Air – emissions compilation guide" and, in 2008, promoted a survey to understand to what extent the NAMEA matrices are developed in Member States.

This research, along with RAMEA project, is focused on air emissions accounts of industry and household, following Eurostat publications on NAMEA for air emissions.

In November 2008 the Revised "European Strategy for Environmental Accounting" stated: '*..The Task Force recommends that the priority for environmental accounts will focus primarily on physical and monetary flows including hybrid (NAMEA) accounts, economic information on the environment (economic activities and products related to the environment and other environmentally related transactions such as taxes and subsidies). ..*'[38].

[38] [ESEA 2008], pag 11.

Following Goralczyk and Stauvermann[39] (2007), "*NAMEA is a multi-purpose information system, which is able to inform the public and policy-makers about the status quo of the environmental assets and environmental pollution*", useful to organize and analyse economic and environmental data in relation to policy objectives.

CHAPTER II

2.1 RAMEA: Regional Accounting Matrix including Environmental Accounts

Two RAMEA[40] matrices referred to year 1995 and 2000 are the outcomes derived from an European project. RAMEA could be regarded as the first example of four EU regions that cooperate in building a regional NAMEA following a shared methodology and improving

[39] M Goralczyk, P J Stauvermann., 'The Usefulness of Hybrid Accounting Systems for Environmental Policy Advice regarding Sustainability, paper for the 16th International Input-output Conference, Istanbul.

[40] RAMEA (Regionalized NAMEA-type matrix) was build for the air-emissions side. See www.ramea.eu for more details and the results. The regions involved in the Project were chosen for their common goal of achieving sustainable economic growth through international cooperation and efficient resource management.

knowledge base for regional sustainable development policies: the regional scale for economic-environmental accounting demonstrated a crucial role in building a pathway for sustainable development.

RAMEA is based on an internationally accepted methodology (UN, Eurostat), reliable data (official statistical accounts) and standardized systems (SEEA 2003, SNA 1993, ESA 1995): these conditions allow benchmarking between regions/nations. A RAMEA could be compiled deriving its numbers from national and regional accounts. The economic activities follow NACE classification and the Household categories COICOP [41] nomenclature. Its main features are shown in Figure 4, also considering the following developments.

Figure 4

Application to policies is a fundamental prerequisite for environmental accounting that aspires to be more than just mere compilation of data; RAMEA has been devised to support policy-makers in tracking regional sustainable development.

[41] Classification of Individual Consumption According to Purpose (UN 1993).

RAMEA applied to regional development policies might have an important role in rationally supporting decision processes. However it is to be remembered that models can not take decisions: only people take decisions and, in particular at policy making scale, technical results of models are sometimes overlooked.

2.2 RAMEA in Emilia-Romagna[42] and eco-taxes

Emilia-Romagna is a region of Northern Italy. About a half of the region is constituted by the Padan Plain, an extremely fertile alluvial plain crossed by the river Po. Today the region consists of nine provinces, the capital is Bologna. It has an area of almost 20,124 km² and about 4.3 million inhabitants. The population density is equal to 195 inhabitants per km^2. Emilia Romagna is considered one of the leading regions in the country. These results were achieved developing a very well-balanced economy based on one of the biggest agricultural sectors in Italy, and on a

[42] The first pilot of RAMEA in Emilia-Romagna (Italy) has been realized by *Arpa Emilia-Romagna* (Regional Environment Agency), in collaboration with *Irpet* (Institute for Economic Planning in Tuscany), *Istat* and ISPRA (National Environment Agency) [RAMEA. 2007. RAMEA - Case Studies Manual.

http://www.arpa.emr.it/cms3/documenti/ramea/RAMEA_Case_Studies_web.pdf .

secular tradition in automotive, motor and mechanic production. The region benefits from a very good system of transport. Nevertheless, in Emilia-Romagna, like many other developed regions, there is a critical growth of GHGs emissions; transports, industries, agriculture and civil energy consumptions are responsible for this growth. A low-carbon economy is part of the new Regional Development Strategy.

Nowadays one official matrix, for each Italian region, is available thanks to recent updates and publication by *Istat*: in March 2009 *Istat* provided regional NAMEA air emissions for all Italian regions, related to 2005[43]. Next analyses are referred to year 2005.

The methodology used to link the two sets of data refers to the so-called 'air emission inventory first approach' [44]. It mainly deals with the activities carried out to shift from the CORINAIR process-oriented source nomenclature (SNAP97 [45]) to the RAMEA socio-economic nomenclature (NACE codes plus COICOP classification). The application of this approach to Emilia-Romagna

[43] http://www.istat.it/dati/dataset/20090401_00/

[44] Eurostat, *NAMEA for Air Emissions - Compilation Guide*, 2007 Preliminary Draft, European Commission; Eurostat, ***Manual for Air Emissions Accounts,*** version as of 23 Feb 2009, European Commission

[45] Selected Nomenclature for Sources of Air Pollution.

benefited from previous pilots of regional NAMEA for two Italian regions, Toscana and Lazio, together with the compilation of national NAMEA for Italy[46].

Table 1 shows a simplified structure of RAMEA (2005), in which three economic aggregates and five environmental themes are presented. As mentioned above the following data have been published by *Istat*.

Table 1

It is to note that in RAMEA 2005 provided by *Istat*, data on output are missing. In the 1995-2000 RAMEA regional data on output were gathered thanks to the multi-regional input-output model developed by *Irpet*[47].

[46] R De Lauretis, A Tudini, G Vetrella, *NAMEA air emission accounts: the Istat methodology*, 2002 Istat, Roma

[47] S Casini Benvenuti, R Paniccià, 'A multi-regional input-output model for Italy', in *Interventi note e rassegne*, Irpet, 2003 vol. 22/03

The structure of RAMEA, shown in Table 1, highlights the different contributions of economic sectors and households to the economy and the environment as a percentage of total.

It becomes immediately obvious how much each sector contributes to the economy and to aggregate emissions relatively. If emissions are related to the value added of each sector it is easy to see what is the relative environmental impact of the sector.

As introduced the study is focused on the integration of RAMEA matrix with an environmental taxes scheme, related to the year 2005, and following Eurostat guidelines.

Regional data about environmental taxes are not available in Italy yet, but Eurostat actually provides environmental taxes split up in economic activities and household consumption (following NACE classification) at national scale [48].

In Italy three kinds of environmental taxes are now available: Energy taxes, Pollution taxes, Transport taxes. In particular the CO2-taxes are included under energy taxes rather than under pollution taxes, and the second one includes taxes on measured or estimated emission to air and water, management of solid waste [49].

[48] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home

[49] See Eurostat and European Commission, *Environmental taxes — A statistical guide*, 2001 European Communities

In order to build a RAMEA matrix integrated with eco-taxes, it is necessary to estimate regional eco-taxes by downscaling the national data. It was useful to get through the investigation of a proxy variable whereby to downscale the environmental taxes. Starting from regional economic indicators provided by *Istat* (year 2005[50]) value added[51] and household consumption have been identified as good proxies to scale down national data on environmental taxes.

A very good statistic correlation is obtained between total regional and national values added (historical series 2000-2006) and an excellent correlation between regional household final consumption and national ones (Graphs 1-2).

Graph 1

Graph 2

[50] http://www.istat.it/dati/dataset/20090401_00/

[51] Following United Nations definitions, value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector. It generally measures the increasing of the production.

Starting from here, the three environmental taxes available at national scale (Energy, Pollution, Transport) are downscaled at regional level, split up in economic activities and household, using the following formulas:

$$ET_{ER,i} = \frac{VA_{ER,i}}{VA_{IT,i}} \cdot ET_{IT,i}$$

for economic activities, where $ET_{ER,I}$ is the regional environmental tax for the ith sector, $VA_{ER,i}$ is the regional value added for the ith sector, $VA_{IT,i}$ is the national value added for the ith sector and $ET_{IT,i}$ is the national environmental tax for the ith sector and

$$ET_{ER,H} = \frac{H_{ER}}{H_{IT}} \cdot ET_{IT,H}$$

for household, where $ET_{ER,H}$ is the regional environmental tax for household, H_{ER} is the regional household consumption, H_{IT} is the national household consumption and $ET_{IT,H}$ is the national environmental tax for household.

It is important to remark that data performed derived from the estimations carried out. It was justified from the high correlation verified between total regional and national economic indicators (value added and household consumptions). We took into consideration these proxies variables (available in RAMEA): value added for economic activities and household consumptions for household. At the same time it has to be noted that there is a high statistic

correlation between the total values added alike there isn't remarkable statistic correlation between every economic sectors (regional and national) It is shown in Table 2.

Table 2

Table 2 shows also in the fifth column the percentage ratio (E-R/Italy) whereby it has been downscaled national eco-taxes. It seems to be obvious, considering the peculiar feature of Emilia-Romagna region in comparison with the majority of Italian regions (as mentioned at the beginning of this paragraph). So it is heartily recommended attention to valuate the quality of data here presented; in this case the attempt is essentially to show the structure of a new environmental economic tool, at a regional scale, useful to monitor, control and address the effects of environmental fiscal policies. It is important to take care of the structure proposed and the relevance in addressing Statistical Offices to provide data at local scale, in order to support sustainable local policies. The strength of this tool, as shown by its features, is the interactions between an official environmental accounting matrix integrated with eco-taxes structured following the same classification, NACE. In addition it is to remark another weakness connected with the quality of data: RAMEA air-emission matrix integrated with overall estimated regional

eco-taxes. Since the lack of official data and information, it wasn't possible to break down the total regional eco-taxes isolating the part related to polluting air emissions.

In the analysed context eco-taxes alone are not an effective economic tool yet, it doesn't seem to be fair and often clear, especially for the generated revenues in the eyes of the taxpayers. So the tool aim of enhancing eco-behaviour change is not reached yet. The integration with RAMEA seems instead to be efficient in covering these weaknesses: to monitor and forecast the effects of an environmental fiscal policy (see Chapter 3). In this way it has been pursued the strengths of the basic RAMEA tool in forecasting and monitoring regional environmental-economic performances.

Analysing the so build structure of this tool (Graph 3 and Tables 3-4), it can be noticed that in some cases two of the eco-taxes features are not respected: equity and efficiency. E.g. the sector Manufactures (D) reports a discrete amount of polluting emissions (above all GHG) despite of a non adequate environmental taxes level.Agriculture and Fishing (A and B) sectors:they show high levels of PM10 emissions and of acidifying pollutants,beside the level of ecotaxes that seems to be too low. A great disparity, in the opposite sense, is also visible for Household considering the spread between their final consumptions and air emissions.

This study, starting from this topic, concerning the Italian application of eco-taxes, has tried to go ahead thinking of a new eco-tax[52] in coordination with a regional environmental accounting tool, like RAMEA, that, looking into the regional economic structure, is able to monitor, forecast and address the efficiency and equity of eco-taxes.

Graph 3

Table 3

Table 4

CHAPTER III

3.1 Environmental taxes, efficiency and equity

Given the set of the environmental taxes currently applied in Italy, the impact of which seems to be quite limited both when their receipts are compared to the total amount of the fiscal yields[53], and when their (economic and environmental) efficacy is considered, the study analyses the

[52] The coming analysis is referred to year 2006

[53] Against a growing consumption of the natural resources, the yearly receipt obtained from the environmental taxes is less than the 7% of the total tax yields collected in Italy (2006).

feasibility of the introduction of a new environmental tax under the conditions posed by the economic crisis, and based on the support offered by the regional green accounting tool RAMEA.

In the current recession phase, the strengthening of the environmental taxation (in this case study through a new eco tax to improve the air quality and to contribute to climate change prevention) needs to respect some rigorous criteria and, in the meantime, to achieve multiple objectives.

First of all, in order to avoid further depressive effects and to give an impulse to the sustainable development, a new environmental tax must be derived from the simultaneous reduction of the income taxes charged on job and on production activities.

The analysed new environmental tax should be therefore defined not as an additional tax, but as a compensative measure (switch of the tax base).

The considered new fiscal regime depicts a context where the current total tax load is unchanged, but where the fiscal burden is in part shifted from the use of (private) available economic resources - e.g. the job - to the consumption of a (public) limited economic resource - the air quality - [54], then where direct tax is partially replaced with an indirect one, and where the reduction of the private production costs is counterbalanced by the input of an equal amount of external costs (from private to social costs).

[54] I Musu, *Introduzione all'economia dell'ambiente* (Bologna: Il Mulino, 2000).

It should be furthermore stated that the proposed fiscal scheme, that to a certain extent decouples tax from income and conversely links tax to the natural resource use, enforces the role of the environmental taxes in the settlement of the more general conflict between efficiency and equity (Okun [55]).

Through the internalisation of the externalities, the eco-taxes charge in fact the use cost of the natural resources to the beneficiary consumers (increasing the equity level in the society) and, in the meanwhile, reduce the markets distortion (improving the efficiency of the economic system).

The creation (the adjustment) of an environmental tax determined by the equivalent reduction of an income tax intensifies the parallel positive repercussion both on the equity (increase of occupation and of work opportunities) and on the efficiency (improvement of the resources allocation) [56].

[55] A Okun, *Equality and Efficiency: The Big Tradeoff* (Washington D.C.: Brookings Institution, 1973).

[56] C Carraro, D Siniscalco, *Environmental fiscal reform and unemployment* (Dordrecht: Kluwer Academic Publishers, 1996).

The capability of the new environmental tax to contribute to the improvement of both the considered conceptual dimensions - the equity and the efficiency [57] - depends on the satisfaction of further conditions that can be identified, with no purpose to exhaust the statement, by the following elements.

Even if a centralised coordination appears to be suitable in particular when global ecological problems are faced, the implementation and the administration of the (new) environmental tax at local level, in compliance with the known principle of subsidiarity (Oates [58]), can ensure the necessary flexibility in modulating and monitoring the policy measure in function of the local economic and environmental conditions and purposes.

Yet, the (equivalent) shift from the income tax to the environmental tax needs to be properly dimensioned in order to ensure the efficacy of the measure in economic, ecological, social, and ethic terms[59].

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[57] It must be underlined that the simultaneous and equivalent shift from income tax to eco tax allows to internalise public costs without modifying the prices and further distorting the market.

[58] W E Oates, *Fiscal Federalism* (New York: Harcourt Brace & Jovanovich, 1972).

[59] S Zamagni, "L'ancoraggio etico della responsabilità sociale d'impresa", in L. Sacconi *Guida critica alla R.S.I.* (Roma: Bancaria Editrice, 2005).

Furthermore it's appropriate to extend the (new) environmental tax at a multi-sector level, and to implement it in function of the existing differences between the sector fiscal loads (income tax burdens) [60].

According to the mentioned principles and aims, the study takes into exam two regional income taxes in order to move part of the current fiscal obligation (the possession of income) towards the consumption of natural capital (the use of income), and to derive a new environmental tax:

I. the local additional tax on individual incomes (IRPEF[61]), a progressive tax administered by the regional government, the tax base of which is identified by the incomes at the disposal of natural persons and, in particular, by the job incomes;
II. the local tax on production activities (IRAP [62]), a proportional tax administered by the central government and, to a defined extent (a range equal to $\pm$ 1% from the standard tax rate: 3,9%), by the regional government, the tax base of which is defined by the income realised by corporation before personnel costs.

[60] D M Hyman, *Public Finance: A Contemporary Application of Theory to Policy* (Chicago: Dryden Press, 1990).

[61] Regional Individual Income surtax.

[62] Regional Income tax derived from Production Activities.

Again with reference to the Emilia-Romagna administrative region, it is assumed that:

I. the regional fiscal yield remains unaffected [63];
II. the distribution of the tax load among citizens and, respectively, corporations remains unchanged as well;
III. a 20% quota of the cited income taxes burden (IRPEF and IRAP) becomes a new environmental tax imposed, since 2010, on the emissions of potential greenhouse gases (CO2 equivalent);
IV. the new ecological tax is based on an incentive (sub-optimal) tax rate (€/t CO2) differentiated by economic activities in order to keep the current distribution of the fiscal burden and to avoid further distortions in the tax system;
V. the environmental tax rate is a progressive one[64] in order to take into account (and / or to incentivize) the achievement of the established CO2 reduction target for 2020 (20% below 1990 level) in all sectors while fixing the current regional fiscal revenue.

[63] Source: *Ministero dell'Economia e delle Finanze - Dipartimento delle Finanze.*

[64] The tax rate increases as the tax base decreases.

The depicted scenario implies an average environmental tax rate for individuals (families) and corporations (economic sectors) equal to 8,74 euro / t CO2 and, respectively, to 14,28 euro / t CO2 in 2010.

Table 5

It is to remark the role that the analysed political framework assigns to the regional green accounting tool RAMEA, a fulcrum in the configuration of the depicted environmental tax and in the assessment of its efficiency and efficacy through the control of the administrative costs, of the economic performances, and of the air quality consumption.

Together with a general increase of the communities' quality of life, the delineated environmental policy is expected to be able to:

I. for the Corporations:

1. be neutral in terms of influence on the competition between sectors,
2. reduce the markets distortions (efficiency),
3. redistribute the firms' production costs with no additional burden,
4. orient firms towards more labour intensive management schemes,

5. pull the technological innovation in order to improve the eco-compatibility of the production activities, and to prevent the climate change,
6. allow private benefits (when discrete adjustments of the progressive tax rate are scheduled),
7. increase the corporate social responsibility (corporate governance) [65],
8. reduce the consumption of the air quality and the intensive use of the natural resources (environmental cross-achievement);

II. for the Citizens and the Public Administrations:

1. admit flexibility at regional (or municipal) level, in terms both of scheduled adjustments of the progressive tax rates up to 2020, and of concerted modulation of the tax rates in order to take into account the different sector abatement costs,
2. keep the local (regional / municipal) tax yields at the current level,
3. give a fiscal incentive to support occupation, wages and demand (anti-depressive measure),

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[65] A Matacena, *Responsabilità sociale delle imprese ed accountability: alcune glosse* (Rimini: Diapason, 2008).

S Zamagni, *Responsabilità Sociale delle Imprese e "Democratic Stakeholding"* (Bologna: Working Paper n. 28, AICOON, 2006).

4. push the scientific research to create and to transfer knowledge in order to contribute to prevent the climate change,
5. reduce the consumption of a public good (air quality) and contribute to the climate protection,
6. reduce the external costs (equity and social benefit),
7. stimulate ethic private behaviours and the diffusion of good practices,
8. determine a double dividend.

CONCLUSION

Internalising external environmental costs is the main reason for using environmental taxes. They incorporate the costs of environmental services and damages directly into the prices of the goods or services. At a regional scale this feature can improve sustainable development policies, can stimulate the eco-compatibility of the production processes, and can offer a (limited) contribution to address environmental problems.

As mentioned before, some aspects related to the down-scale process need to be deepened:

I. the quality of estimated data could be improved, if more official regional economic indicators following NACE classification were available (e.g. output, that could be more related to eco-taxes, allowing better downscales); of course the availability of data on environmental taxes at local scale could sort out this issue;

II. the three eco-taxes analysed for Emilia-Romagna do not regard only atmospheric pollution, despite this is the sole environmental theme now available in RAMEA: the development of new environmental themes (like energy consumption and waste production) could bring to a better interpretation of eco taxes and their dynamics.

Summing up, the integration of environmental taxes accounts in the RAMEA framework, as European guidelines suggest, could lead to:

I. a monitoring system to analyse the pressures placed on the environment by the economic sectors and households, helps in identifying the "hot spots" in terms of environmental pressures and potential decoupling patterns, allows the elaboration of eco-efficiency indexes, uses the knowledge base on the economic and environmental performances of regional sectors enforcing the role of environmental taxes in promoting sustainable behaviour ('to make the polluter pay')[66];

[66] Eurostat, *Measuring progress towards a more sustainable Europe. 2007 monitoring report*

II. a forecasting tool that allows scenario analysis both to evaluate the economic-environmental effects of the policies and to plan combined uses of environmental taxes in order to gather an efficient redistribution of tax revenues (see chapter 3);

III. a benchmarking tool that gives the possibility of comparison between European regions and countries;

IV. an evaluation tool that helps the assessment of fiscal policy effects on the economic system, the identification of what are the most efficient (eco-efficient) sectors in the Region and that, together with an input-output matrix, could be helpful in verifying the environmental-economic interrelations among the sectors.

V. an enforcing tool that should strengthen the feature of environmental taxes of creating incentives for producers and consumers to shift away from environmentally damaging behaviour; thanks to RAMEA environmental taxes could be applied, in the long term, in a more efficiently way, acting in proper economic sectors.

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of the EU sustainable development strategy, 2007 European Communities

Figure 1 Integrated accounts scheme and environmentally related transactions (Environment - Facts and Figures 2006, Statistics Austria http://www.statistik.at/web_en/statistics/index.html)

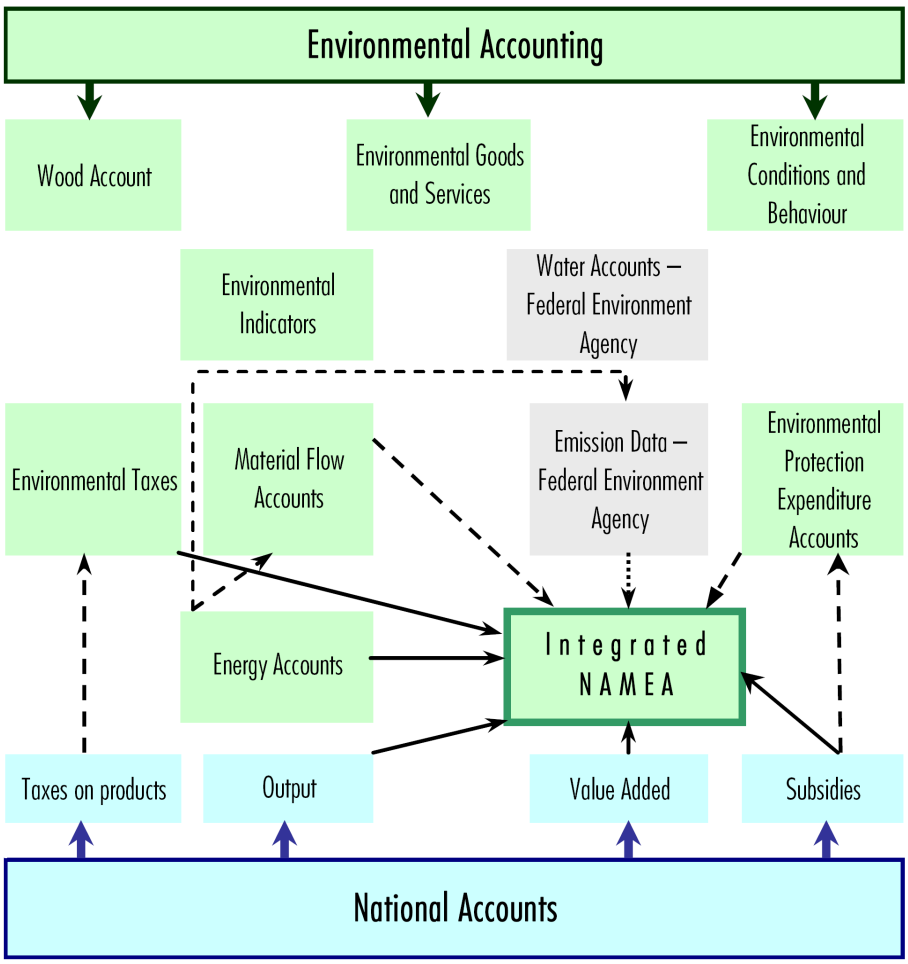


Figure 2. Placement of Istat environmental accounting priority modules in the DPSIR map (OECD 2004, p. 219)

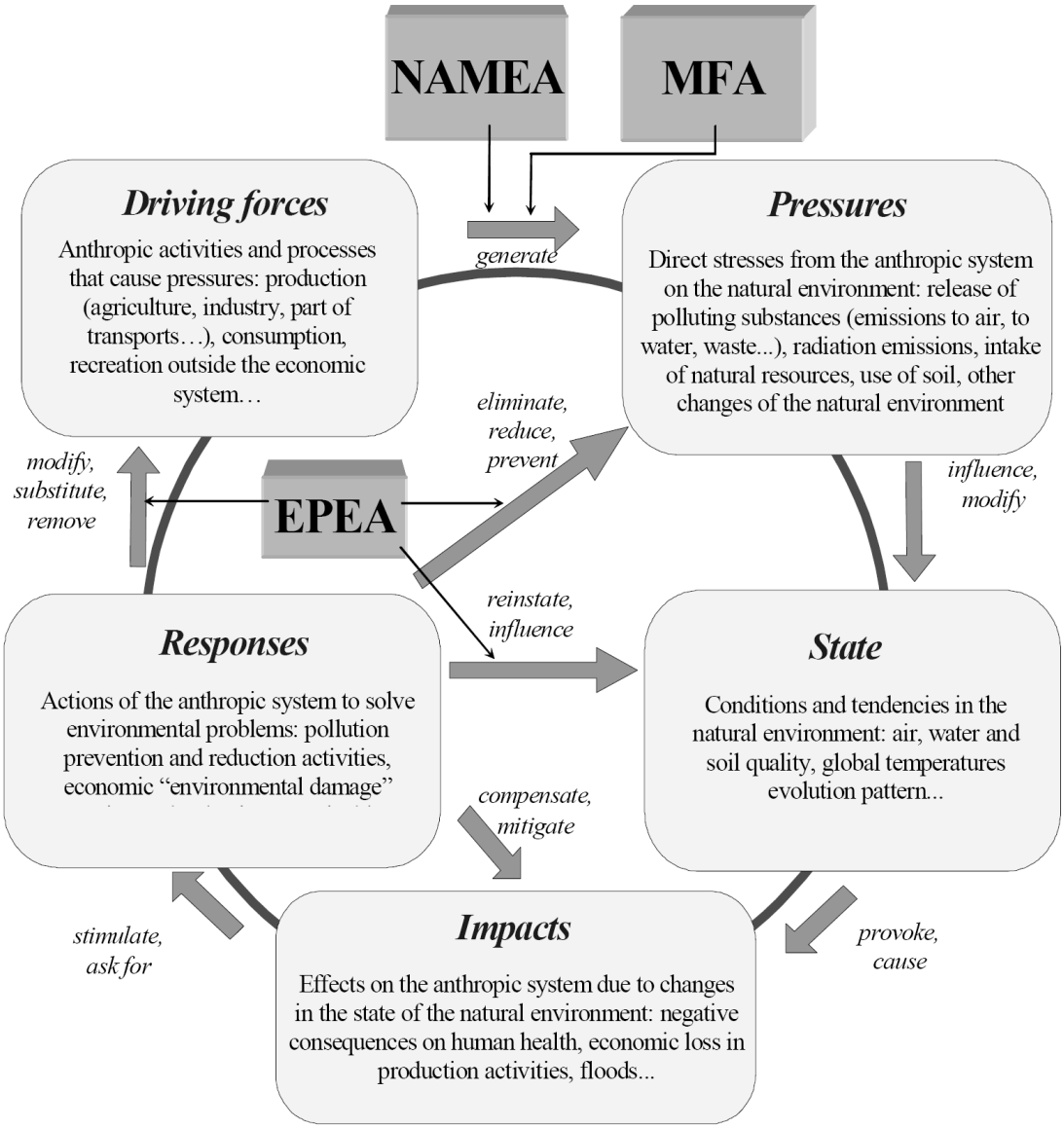
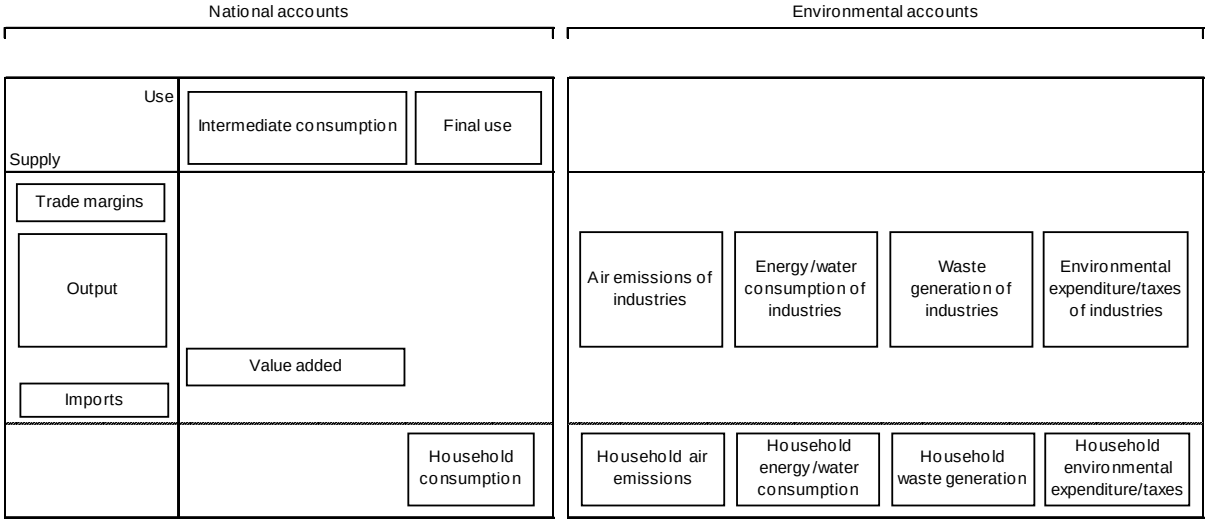


Figure 3 - Schematic description of a simplified NAMEA (Eurostat. *NAMEA for Air Emissions - Compilation Guide*, Eurostat, Preliminary Draft, Luxembourg 2007)



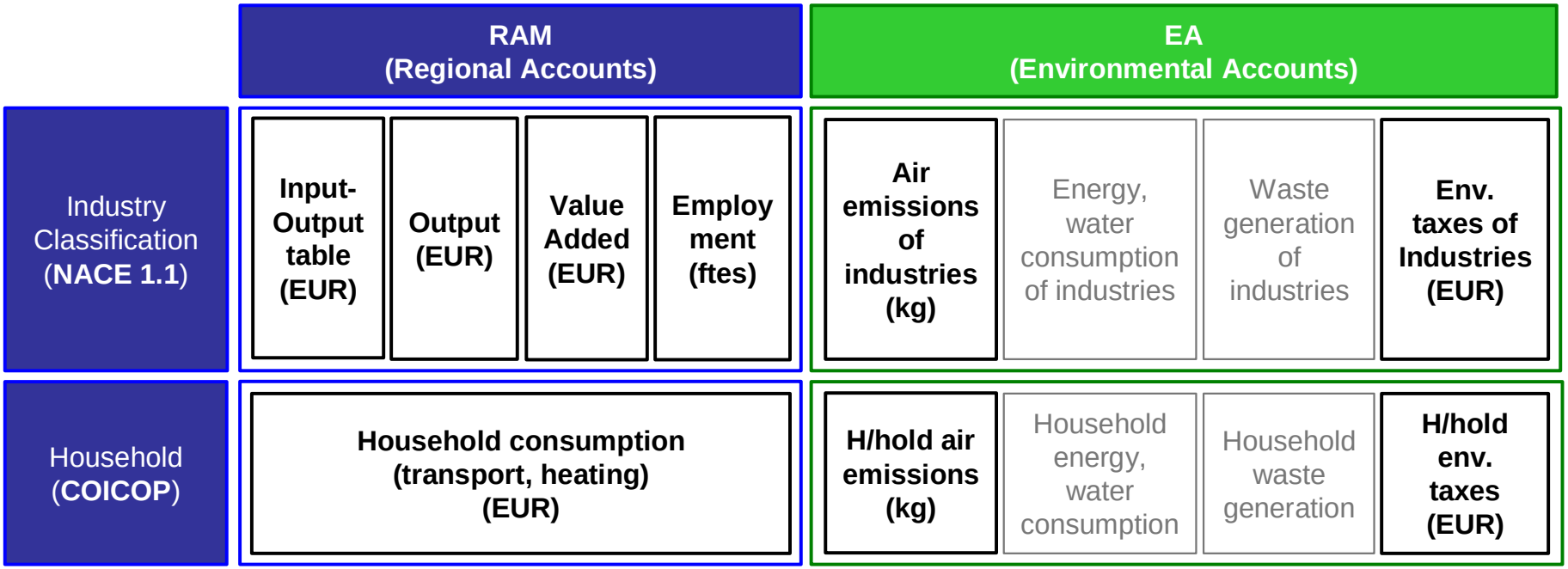


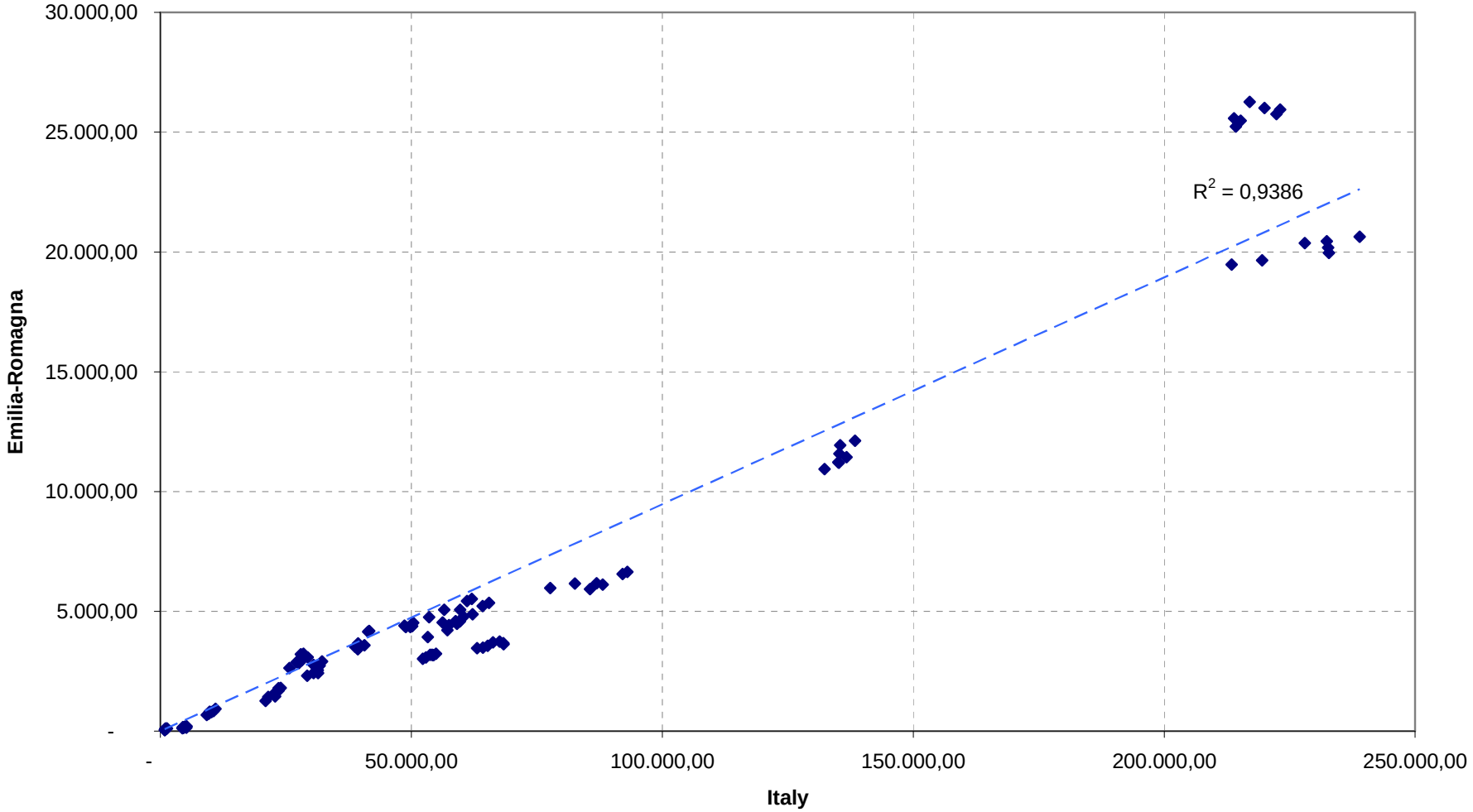
Figure 4 – RAMEA simplified framework

(in gray indicators under study. Data availability depends on indicator: Input-Output table 1995-2000, Output 1995-2000, Value Added 1995-2000-2005, Employment 2000-2005, Household consumption 1995-2000-2005, Air emissions 1995-2000-2005, Environmental taxes 2005)

Table 1- RAMEA for Emilia-Romagna: 2005 (%) This environmental accounting matrix preserve a rigorous separation between environmental and economic indicators: the first (right side) are measured in physical unit, the second (left side) in monetary ones.

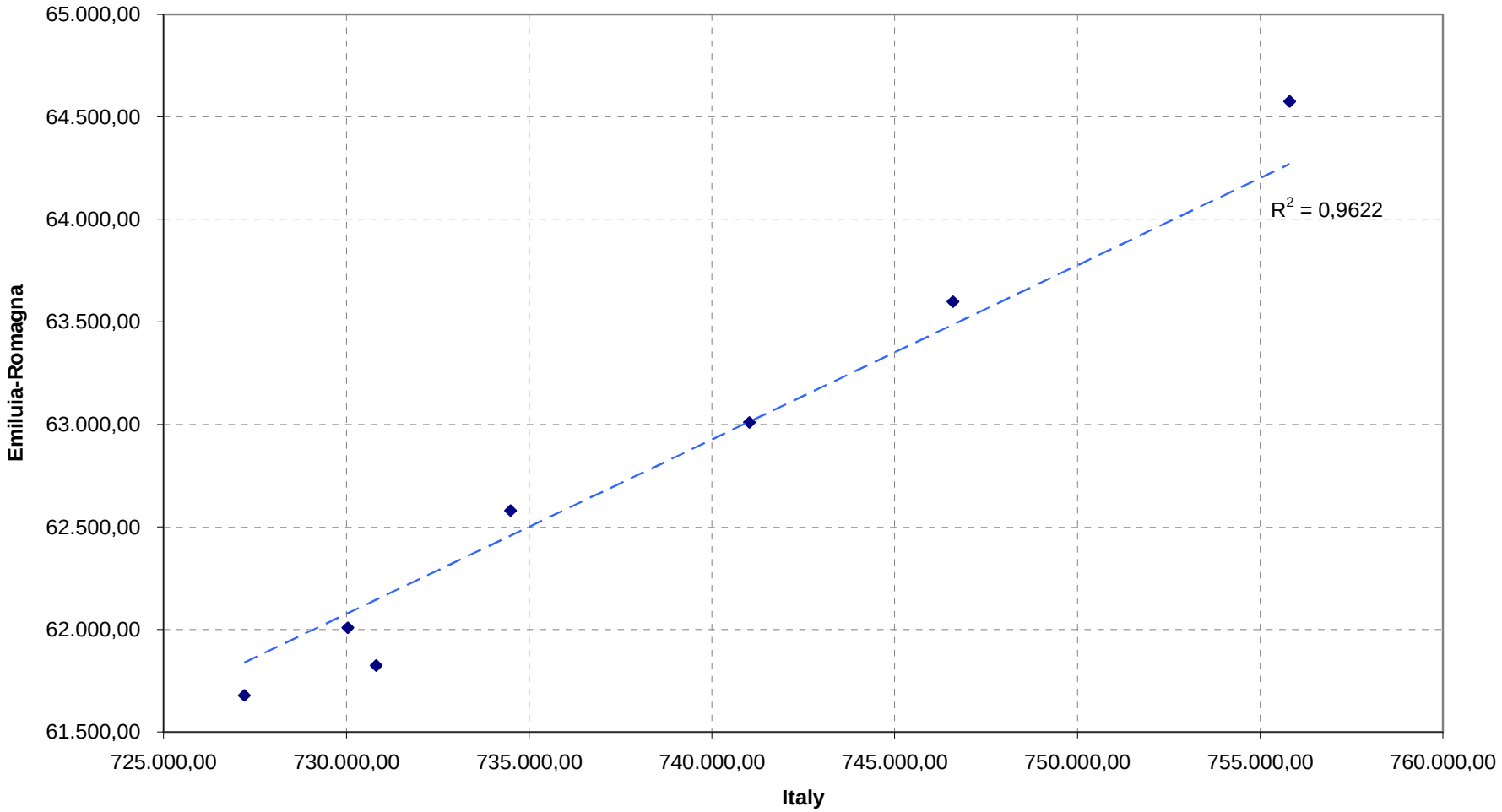
EMILIA-ROMAGNA 2005		Value Added - basic prices	Final Consumpt.	Employment	Global Warming	Acidification	PM10	NMVOC	CO
NACE/ COICOP	Economic activities/Household consumption (%)								
A	Agriculture, hunting and forestry	3,0		5,2	10,4	55,0	35,1	3,2	10,2
B	Fishing	0,1		0,2	0,1	0,3	0,5	0,1	0,1
C	Mining and quarrying	0,1		0,1	0,7	0,3	0,5	0,4	0,1
D	Manifactures activities	26,0		25,5	35,1	20,2	27,8	31,6	5,6
E	Electricity, gas and water supply	1,9		0,5	14,0	1,6	0,7	4,7	0,8
F	Construction	5,6		7,1	0,7	0,6	2,6	7,2	0,4
G	Wholesale and retail trade	11,6		14,0	3,3	2,7	4,9	3,2	1,5
H	Hotels and restaurants	3,5		6,3	0,6	0,4	0,6	0,1	0,2
I	Transport, storage and communication	6,8		6,1	4,9	6,4	9,0	2,2	3,7
J	Financial intermediation	4,9		2,4	0,2	0,2	0,2	0,1	0,1
K	Business activities, R&D and IT	20,8		11,1	1,2	1,1	1,9	0,4	0,6
L	Public administration	3,8		3,7	0,5	0,6	0,9	0,3	2,0
M	Education	3,3		4,5	0,1	0,1	0,1	0,0	0,0
N	Health and social work	5,4		6,1	0,7	0,2	0,2	0,1	0,1
O	Other community, social and personal service activities	2,5		4,3	3,8	1,7	1,0	3,0	0,2
P	Domestic services	0,9		2,8	-	-	-	-	-
	Economic activities - Total	**100,0**		**100,0**	**76,2**	**91,2**	**85,9**	**56,5**	**25,7**
CP07	Household - Transport		13,8		8,4	5,6	7,8	27,6	64,5
CP04	Household - Heating		18,6		15,3	3,2	6,3	2,3	9,8
other	Household - Other		67,6		0,1	-	-	13,5	-
	Household consumption - Total		**100,0**		**23,8**	**8,8**	**14,1**	**43,5**	**74,3**
	Total (Economic activities + Household)	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Graph 1 - scatter plot Industries (GVA IT, GVA ER; 2000-2006)



As explained in the paper, this chart is useful to verify the statistic correlation between the overall Value Added in Emilia-Romagna and in Italy

Graph 2 - scatter plot Household (Consumption IT, Consumption ER; 2000-2006)



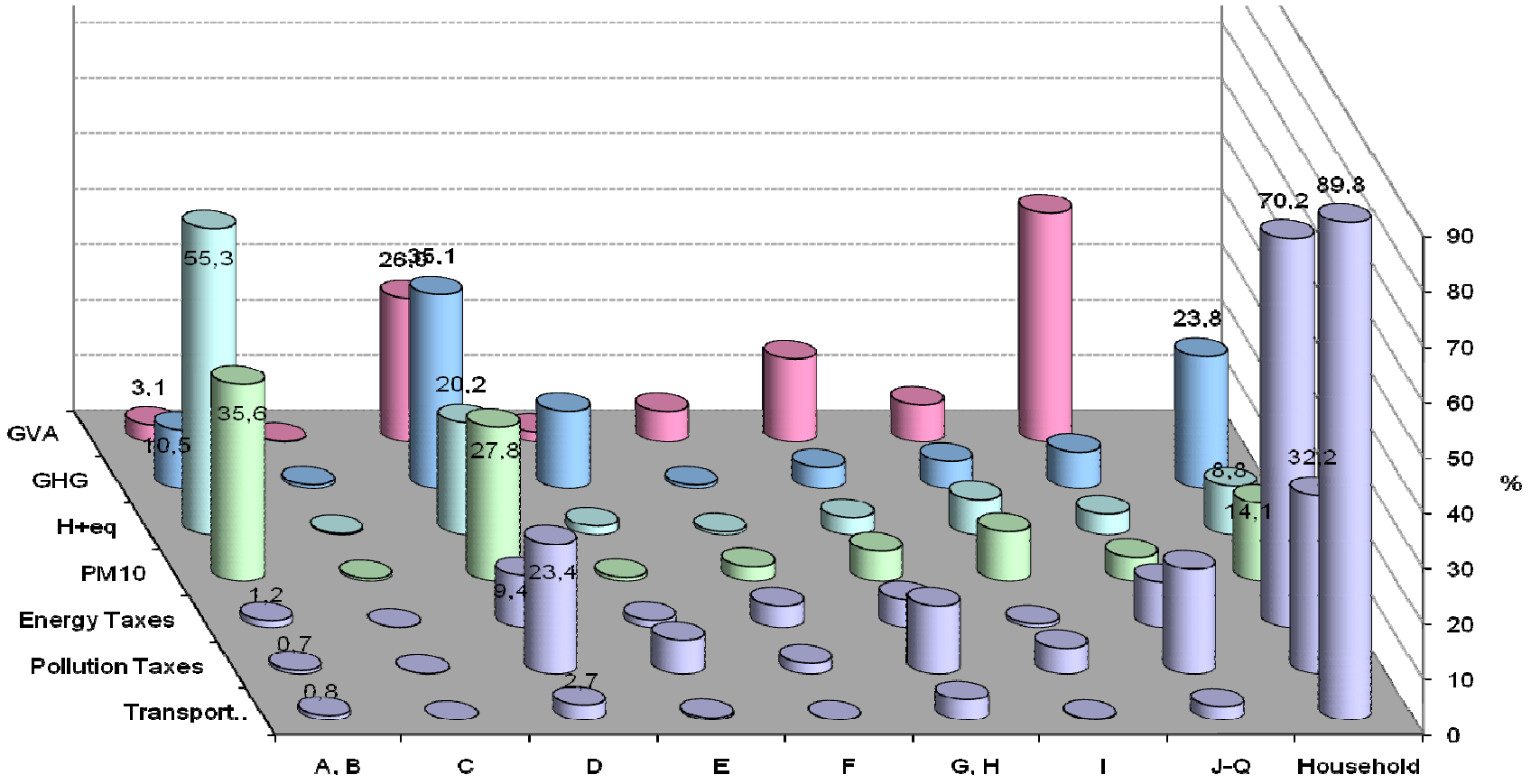
As explained in the paper, this chart is useful to verify the statistic correlation between the Household consumptions in Emilia-Romagna and in Italy

Table 2 - Statistic correlation and percentage ratio between regional and national economic indicators

NACE / COICOP	year	E-R Value Added/Household consumption (M EUR)	ITALY Value Added//Household consumption (M EUR)	E-R/Italy %	*r*
A	2000	3.227,08	28.476,00	11,33%	
A	2001	3.209,34	27.964,00	11,48%	
A	2002	2.884,10	27.128,00	10,63%	
A	2003	2.634,66	25.736,00	10,24%	**0,7969**
A	2004	3.081,22	29.357,00	10,50%	
A	2005	2.954,17	28.131,00	10,50%	
A	2006	2.842,21	27.599,00	10,30%	
B	2000	115,76	1.281,00	9,04%	
B	2001	120,90	1.061,00	11,40%	
B	2002	91,05	1.007,00	9,04%	
B	2003	88,19	1.006,00	8,77%	**0,8325**
B	2004	80,70	948,00	8,51%	
B	2005	51,92	857,00	6,06%	
B	2006	55,90	920,00	6,08%	
C	2000	198,75	5.224,00	3,80%	
C	2001	188,41	4.884,00	3,86%	
C	2002	152,25	5.167,00	2,95%	
C	2003	135,62	4.585,00	2,96%	**0,6416**
C	2004	168,11	4.449,00	3,78%	
C	2005	145,58	4.514,00	3,23%	
C	2006	128,76	4.378,00	2,94%	
D	2000	25.946,24	223.062,00	11,63%	
D	2001	25.760,52	222.353,00	11,59%	
D	2002	26.007,35	219.963,00	11,82%	
D	2003	25.583,16	213.938,00	11,96%	**0,5477**
D	2004	25.483,92	215.261,00	11,84%	
D	2005	25.245,31	214.289,00	11,78%	
D	2006	26.259,38	217.031,00	12,10%	
E	2000	1.259,34	20.956,00	6,01%	
E	2001	1.434,40	21.496,00	6,67%	
E	2002	1.454,24	22.861,00	6,36%	
E	2003	1.569,88	22.674,00	6,92%	**0,9313**
E	2004	1.694,61	23.546,00	7,20%	
E	2005	1.799,45	23.557,00	7,64%	
E	2006	1.809,28	23.938,00	7,56%	
F	2000	3.923,13	53.224,00	7,37%	
F	2001	4.533,30	56.225,00	8,06%	
F	2002	4.431,69	57.492,00	7,71%	
F	2003	4.593,40	58.828,00	7,81%	**0,9573**
F	2004	5.075,62	59.722,00	8,50%	
F	2005	5.434,36	61.098,00	8,89%	
F	2006	5.529,16	62.011,00	8,92%	
G	2000	11.938,43	135.419,00	8,82%	
G	2001	12.127,57	138.362,00	8,77%	
G	2002	11.574,84	135.274,00	8,56%	
G	2003	10.939,86	132.304,00	8,27%	**0,7902**
G	2004	11.194,76	135.149,00	8,28%	
G	2005	11.226,76	135.067,00	8,31%	
G	2006	11.441,32	136.708,00	8,37%	
H	2000	4.181,62	41.586,00	10,06%	
H	2001	4.152,59	41.370,00	10,04%	
H	2002	3.667,98	39.358,00	9,32%	
H	2003	3.512,37	38.770,00	9,06%	**0,8753**
H	2004	3.535,97	39.151,00	9,03%	
H	2005	3.424,79	39.325,00	8,71%	
H	2006	3.588,13	40.653,00	8,83%	
I	2000	5.977,11	77.665,00	7,70%	**0,8034**
I	2001	6.173,32	82.555,00	7,48%	
I	2002	5.927,49	85.590,00	6,93%	
I	2003	6.179,36	86.888,00	7,11%	
I	2004	6.117,69	88.124,00	6,94%	

NACE / COICOP	year	E-R Value Added/Household consumption (M EUR)	ITALY Value Added//Household consumption (M EUR)	E-R/Italy %	*r*
I	2005	6.561,64	92.066,00	7,13%	
I	2006	6.654,45	93.048,00	7,15%	
J	2000	4.344,78	49.802,00	8,72%	
J	2001	4.375,74	50.141,00	8,73%	
J	2002	4.344,17	48.898,00	8,88%	
J	2003	4.409,08	48.614,00	9,07%	**0,9721**
J	2004	4.526,48	50.378,00	8,99%	
J	2005	4.755,94	53.537,00	8,88%	
J	2006	5.068,73	56.576,00	8,96%	
K	2000	19.468,84	213.407,00	9,12%	
K	2001	19.649,61	219.522,00	8,95%	
K	2002	20.370,14	227.985,00	8,93%	
K	2003	20.456,83	232.434,00	8,80%	**0,8807**
K	2004	19.955,74	232.825,00	8,57%	
K	2005	20.177,02	232.662,00	8,67%	
K	2006	20.643,28	238.963,00	8,64%	
L	2000	3.465,43	63.068,00	5,49%	
L	2001	3.486,71	64.226,00	5,43%	
L	2002	3.573,41	65.207,00	5,48%	
L	2003	3.704,16	66.233,00	5,59%	**0,8304**
L	2004	3.742,85	67.546,00	5,54%	
L	2005	3.676,74	68.299,00	5,38%	
L	2006	3.631,51	68.364,00	5,31%	
M	2000	3.024,91	52.274,00	5,79%	
M	2001	3.076,17	52.910,00	5,81%	
M	2002	3.178,69	54.236,00	5,86%	
M	2003	3.233,34	54.905,00	5,89%	**0,9602**
M	2004	3.175,33	54.468,00	5,83%	
M	2005	3.185,17	53.744,00	5,93%	
M	2006	3.186,16	54.109,00	5,89%	
N	2000	4.221,84	57.169,00	7,38%	
N	2001	4.479,01	59.064,00	7,58%	
N	2002	4.575,79	59.684,00	7,67%	
N	2003	4.776,11	60.385,00	7,91%	**0,9936**
N	2004	4.887,17	62.185,00	7,86%	
N	2005	5.221,89	64.185,00	8,14%	
N	2006	5.353,51	65.451,00	8,18%	
O	2000	2.916,84	32.205,00	9,06%	
O	2001	2.732,58	31.733,00	8,61%	
O	2002	2.767,71	30.486,00	9,08%	
O	2003	2.313,90	29.223,00	7,92%	**0,6864**
O	2004	2.545,30	31.362,00	8,12%	
O	2005	2.420,54	30.483,00	7,94%	
O	2006	2.434,08	31.417,00	7,75%	
P	2000	684,60	9.219,00	7,43%	
P	2001	737,60	9.633,00	7,66%	
P	2002	806,13	9.811,00	8,22%	
P	2003	786,84	9.789,00	8,04%	**0,9573**
P	2004	804,93	10.210,00	7,88%	
P	2005	844,16	10.593,00	7,97%	
P	2006	937,03	10.958,00	8,55%	
Household	2000	61.677,70	727.205,00	8,48%	
Household	2001	61.824,70	730.819,00	8,46%	
Household	2002	62.008,51	730.039,00	8,49%	
Household	2003	62.579,26	734.494,00	8,52%	**0,9939**
Household	2004	63.009,56	741.027,00	8,50%	
Household	2005	63.598,80	746.596,00	8,52%	
Household	2006	64574,56	755.806,00	8,54%	
r industries	**0,9734**				
r household	**0,9939**				

Graph 3 - Contribution of different sectors to the economy and the environment with the related allocation of ecotaxes 2005 (%)



How much does cost the importance of a sector in the regional economy in terms of emissions and how is the level of ecotaxes?
In this chart we can see the contribution of regional sectors and households to both the economy and the environment (%), the regional hot spots and the correspondent levels of regional ecotaxes: priority economic sectors generating significant environmental pressures and related levels of ecotaxes.

Table 3 – RAMEA and ecotaxes for Emilia-Romagna 2005 (MLN Euro)

EMILIA-ROMAGNA 2005		Value Added - basic prices	Final Consumpt.	Employment	Global Warming	Acidification	PM10	NMVOC	CO	Energy taxes	Pollution taxes	Transport taxes
NACE/ COICOP	Economic activities/Household consumption	MEUR	MEUR	fte	M tonn CO2eq	tonn H+eq	tonn	tonn	tonn	MEUR	MEUR	MEUR
A	Agriculture, hunting and forestry	2.954,2		109,4	5.259,6	3.204,0	4.873,5	2.911,7	22.932,0	57,6	0,3	8,6
B	Fishing	51,9		3,9	51,1	15,0	72,6	107,7	238,3	3,2	0,0	0,2
C	Mining and quarrying	145,6		1,6	335,6	16,2	66,5	356,7	117,2	2,9	0,0	0,2
D	Manifactures activities	25.245,3		531,9	17.652,2	1.178,4	3.868,0	29.126,4	12.601,4	461,1	12,0	28,8
E	Electricity, gas and water supply	1.799,5		9,9	7.039,4	91,8	96,1	4.299,9	1.875,0	64,0	3,1	4,3
F	Construction	5.434,4		147,1	330,5	32,3	366,7	6.649,5	852,0	191,5	1,0	0,8
G	Wholesale and retail trade	11.226,8		291,7	1.637,3	158,5	678,0	2.920,1	3.363,5	62,6	4,9	13,7
H	Hotels and restaurants	3.424,8		131,5	280,9	23,7	77,7	126,1	516,3	184,8	1,4	25,9
I	Transport, storage and communication	6.561,6		128,0	2.452,7	369,9	1.244,9	2.044,7	8.309,6	32,5	2,3	2,3
J	Financial intermediation	4.755,9		51,0	100,4	8,8	34,3	52,8	189,9	239,9	1,5	8,0
K	Business activities, R&D and IT	20.177,0		231,6	626,9	63,0	258,8	384,9	1.381,4	12,0	1,9	1,6
L	Public administration	3.676,7		77,5	248,2	32,9	131,7	268,8	4.514,5	76,6	1,5	9,1
M	Education	3.185,2		93,5	75,1	4,3	8,6	16,4	76,2	20,0	0,0	1,4
N	Health and social work	5.221,9		128,1	333,1	14,3	30,9	63,9	285,7	7,9	0,9	0,6
O	Other community, social and personal service activities	2.420,5		90,2	1.935,2	96,4	135,6	2.724,0	549,5	23,6	4,0	2,6
P	Domestic services	844,2		57,7	-	-	-	-	-	23,3	-	2,1
	Economic activities - Total	**97.174,3**		**2.084,6**	**38.358,2**	**5.309,4**	**11.943,9**	**52.053,6**	**57.802,4**	**1.463,6**	**34,7**	**110,1**
CP07	Household - Transport		8.806,9		4.248,7	324,8	1.079,3	25.424,5	145.243,0	-	-	-
CP04	Household - Heating		11.822,0		7.706,5	188,3	877,9	2.130,6	22.129,0	-	-	-
other	Household - Other		42.967,4		45,7	-	-	12.457,7	-	-	-	-
	Household consumption - Total		**63.598,8**		**12.000,9**	**513,0**	**1.957,1**	**40.012,8**	**167.372,0**	**3.453,8**	**16,5**	**973,9**
	Total (Economic activities + Household)	**97.174,3**	**63.598,8**	**2.084,6**	**50.359,1**	**5.822,4**	**13.901,0**	**92.066,4**	**225.174,4**	**4.917,4**	**51,1**	**1.084,0**

Table 4 – RAMEA and ecotaxes for Emilia-Romagna: aggregated version 2005 (%)

Emilia-Romagna 2005		Basic Prices		Employment	Global Warming	Acidification	Local air quality (Mg)			Environmental Taxes		
NACE (COICOP)	Economic activities	Gross Value Added	Final Consumption	full time equivalents	CO2 eq	H+ eq	PM	NMVOC	CO	Energy taxes	Pollution taxes	Transport taxes
A, B	Agriculture, hunting and forestry, fishing	3,1	-	5,4	10,5	55,3	35,6	3,3	10,3	1,2	0,7	0,8
C	Mining and quarrying	0,1	-	0,1	0,7	0,3	0,5	0,4	0,1	0,1	0,1	0,0
D	Manufacturing activities	26,0	-	25,5	35,1	20,2	27,8	31,6	5,6	9,4	23,4	2,7
E	Electricity, gas and water supply	1,9	-	0,5	14,0	1,6	0,7	4,7	0,8	1,3	6,0	0,4
F	Construction	5,6	-	7,1	0,7	0,6	2,6	7,2	0,4	3,9	1,9	0,1
G, H	Wholesale and retail trade, hotels and restaurants	15,1	-	20,3	3,8	3,1	5,4	3,3	1,7	5,0	12,3	3,6
I	Transport, storage and communication	6,8	-	6,1	4,9	6,4	9,0	2,2	3,7	0,7	4,6	0,2
J-Q	Other services	41,5	-	35,0	6,6	3,8	4,3	3,8	3,1	8,2	18,9	2,3
Household	**Households**											
07	Transport	-	13,8									
04	Heating	-	18,6									
-	Other	-	67,6									
	Total - Economic activites	**99,9**	**-**	**100,0**	**76,2**	**91,2**	**85,9**	**56,5**	**25,7**	**29,8**	**67,8**	**10,2**
	Total - Households	**-**	**100,0**	**-**	**23,8**	**8,8**	**14,1**	**43,5**	**74,3**	**70,2**	**32,2**	**89,8**
	Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Table 5 – RAMEA and new ecotaxes by shifting taxation form labour to polluting activities

EMILIA-ROMAGNA		Global Warming	Local additional IRPEF (*) and IRAP	New local additional IRPEF (*) and IRAP	New environmental tax on GHG	New environmental tax on GHG	Environmental tax rate 2010	Environmental tax rate 2020
NACE/ COICOP	Economic activities/Household consumption	M tonn CO2eq	MEUR	MEUR	MEUR	%	(€/t)	(€/t) (**)
A	Agriculture, hunting and forestry	5.259,6	37.447,0	29.957,6	7.489,4	1,1	1,4	1,8
B	Fishing	51,1	2.076,0	1.660,8	415,2	0,1	8,1	10,1
C	Mining and quarrying	335,6	4.808,0	3.846,4	961,6	0,1	2,9	3,6
DA	Manufacture of food products; beverages and tobacco	2.972,2	104.165,0	83.332,0	20.833,0	3,2	7,0	8,8
DB	Manufacture of textiles and textile products	486,7	58.747,0	46.997,6	11.749,4	1,8	24,1	30,2
DC	Manufacture of leather and leather products	97,2	11.450,0	9.160,0	2.290,0	0,4	23,6	29,5
DD-DH-DN	Manufacture of wood, rubber, plastic and manufacturing n.e.c	533,2	19.478,0	15.582,4	3.895,6	0,6	7,3	9,1
DE	Manufacture of pulp, paper and paper products; publishing and printing	433,4	41.111,0	32.888,8	8.222,2	1,3	19,0	23,7
DF-DG	Manufacture of coke, refined petroleum products, chemicals and chemical products	5.465,4	73.856,0	59.084,8	14.771,2	2,3	2,7	3,4
DI	Manufacture of other non-metallic mineral products	6.077,9	103.357,0	82.685,6	20.671,4	3,2	3,4	4,3
DJ	Manufacture of basic metals and fabricated metal products	258,4	161.080,0	128.864,0	32.216,0	4,9	124,7	155,9
DK-DL-DM	Manufacture of machinery and equipment, electrical and optical; transport equipment	1.327,9	415.325,0	332.260,0	83.065,0	12,7	62,6	78,2
E	Electricity, gas and water supply	7.039,4	28.554,0	22.843,2	5.710,8	0,9	0,8	1,0
F	Construction	330,5	211.694,0	169.355,2	42.338,8	6,5	128,1	160,1
G	Wholesale and retail trade	1.637,3	396.262,0	317.009,6	79.252,4	12,1	48,4	60,5
H	Hotels and restaurants	280,9	67.940,0	54.352,0	13.588,0	2,1	48,4	60,5
I	Transport, storage and communication	2.452,7	100.846,0	80.676,8	20.169,2	3,1	8,2	10,3
J	Financial intermediation	100,4	347.973,0	347.973,0 (***)	-	-	-	-
K	Business activities, R&D and IT	626,9	334.289,0	267.431,2	66.857,8	10,2	106,6	133,3
L	Public administration	248,2	351.266,0	281.012,8	70.253,2	10,8	283,1	353,9
M	Education	75,1	31.287,0	25.029,6	6.257,4	1,0	83,3	104,2
N	Health and social work	333,1	84.521,0	67.616,8	16.904,2	2,6	50,8	63,4
O	Other community, social and personal service activities	1.935,2	65.329,0	52.263,2	13.065,8	2,0	6,8	8,4
P	Domestic services	-	4,0	3,2	0,8	0,0	-	-
	Not classified	-	34.410,0	27.528,0	6.882,0	1,1	-	-
	Economic activities - Total	**38.358,2**	**3.087.274,0**	**2.539.414,6**	**547.859,4**	**83,9**	**14,3**	**17,9**
CP07	Household - Transport	4.248,7						
CP04	Household - Heating	7.706,5						
other	Household - Other	45,7						
	Household consumption - Total	**12.000,9**	**524.476,0** (*)	**419.580,8** (*)	**104.895,2**	**16,1**	**8,7**	**10,9**

Green house gases emissione: 2005. Income taxes revenues: 2006.

(**) 20% greenhouse gases reduction here defined with base 2005.

(***) Unchanged income tax load.