Italian lifestyle and Socio-ecological changes:

issues in sustainability and environmental load displacement

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Abstract

The Sustainable Development (or eco-efficiency) paradigm and the Ecological Economics (or Bioeconomics) paradigm are two of the most important approaches that try to integrate the social, economical and environmental dimensions. Using a systemic approach and considering the complexity of reality, they introduce the ecological constraints of societies and suggest to adopt a inter- transdisciplinary approach.

In this paper a comparative analysis between a production-based approach and a consumption based approach has been performed to analyse the differences between Sustainable Development (or eco-efficiency) and Ecological Economics (or Bioeconomics) paradigms. An Italian case study has been considered in order to highlight that a productive dematerialization don't means a lifestyle dematerialization and that a local de-pollution does not necessarily mean a sustainability improvement. The international trade, the socio-ecological conflicts and the patterns of consumptions has been studied in a global dimension to show that a local sustainability improvement may be accompanied by global un-sustainability displacement,

Using different dimensions and languages of valuation, this paper highlight the necessity to use a methodological pluralism when analysing a complex reality. Moreover, considering consumption (rather than local production) as the main cause of environmental damage, this work points to the need to identify and analyse the links between demand, trade, and socio-environmental conflicts.

In order to analyse the interaction of human life and socio-ecological dimensions, governance research and long-term policies have to adopt a global sustainability perspective. This would allow us to better understand the short and long terms effects of our lifestyle and integrate private sector and civil society in strategies to address socio-ecological challenges. The question then arises of what explanations we have for the patterns of consumption of the rich part of the world.

Key Words: Sustainable Development, Bioeconomics, Consumption, Material flow analysis, Europe, Italy.

Introduction

The Sustainable Development (or eco-efficiency) approach and the Bioeconomics (or Ecological Economics) approach try to integrate the social, economical and ecological issues, considering the reflexive relations between human and environment.

The Sustainable Development paradigm acknowledges that economy depends on environmental functions, which provides materials, energies, services and sinks for waste. In order to integrate social, environmental and economic dimensions, physical indicators and alternative national accounts have been proposed (Lawn, 2003; El Serafy, 1989; Max-Neef, 1995). However the main theoretical framework, still focused on neoclassical theory, believes that economic growth will "de-link" itself from its environmental base and biophysical constraints through "dematerialization" and "de-pollution" because of the improvement in eco-efficiency, that is, increased resource productivity and decreased pollution.

Based on the approach known as "environmental economics", Sustainable Development idea assumes that technological progress and market liberalization are the best ways to reach economic growth and environmental quality (Mikesell, 1994; Lanza, 1997; Panayotou, 1993). Moreover, according to Neoclassical theory, most of the benefit will be located in developing countries and a convergence of income at global level is expected (Park and Brat, 1995). In the absence of barriers, capital will migrate from rich to poor regions in search of higher rate of return, closing the income gap between the developing and industrialized world (UNCTAD 1999).

The Sustainable Development approach preaches the view that economic growth is the best cure for the social and environmental consequences and, in the longer run, the surest way to improve sustainability is to become rich. Environmental issues, which tree decades ago constituted the main point of criticism of the idea of limitless growth are nowadays viewed as fully compatible with marked-based economic expansion

This optimistic vision of the relationship between global economy and environment, which has been labelled the "Bretton Woods Paradigm" (Therien, 1999), is shared by many politicians, mainstreams economists and international institutions and determined the tone of globally influential documents on the economy-environmental relationship, such as the Bruntland Report (Doyle, 1998).

Nonetheless, this optimistic vision is challenged by several remarkable facts. The environmental problems haven't seems to be reduced and the gap in per capita income between the world's poorest and wealthiest populations is increased (UNPD, 1997; Atkinson, 1999). According to Singer (1950) and Prebish (1950), price deterioration is probably one of the main reasons for the slower economic growth rate that developing countries specializing in natural resources export experience relative to developing countries specialized in manufactures. In developing countries labour unions don't have great power, a fact that don't enable them to appropriate the gains derived from productivity improvement. These features induce to have a decline in the prices of primary commodities as well as a long-run deterioration in the terms of trade of developing countries. These processes force down the value of non-scarce factors, especially natural resource and labour, producing deteriorating terms of trade for both primary export and labour-intensive manufactured export from developing countries. Moreover, empirical evidence demonstrates also that increased income doesn't necessary represent increased welfare. The "trickle down" effects of economic growth can raise income but, maintaining the same hierarchical position, don't always allow to reduce inequality (Martinez Alier, 2002).

The disappointed expectations related to the Sustainable Development approach and the criticisms about its theoretical framework (Latouche, 1991; Sachs, 1992) reinforce the Bioeconomics approach to sustainability. Based on thermodynamic lows, it was elaborated by Gerogescu-Roegen in 1971, even if Frederick Soddy, prize Nobel of chemistry, was the first, in 1920s, to highlight some thermodynamic foundations of economics (Daly, 1996, Martinez-Alier and Schluepmann, 1987). In "The Entropy Law and the Economic Process" (1971) Georgescu-Roegen highlights that economy is an open system that begins with the dissipation of material/energy to low entropy and finishes with the restitution to the atmosphere of an equal amount of polluting material/energy to high entropy. In contrast with the reversibility of the mechanical phenomena, economy is an entropic process characterized by irreversibility. The Bioeconomics approach introduce the biophysical constraints of societies and considers that not only energy, matter matters too (Georgescu-Roegen, 1977). Moreover, criticizing to neoclassical paradigm, it introduce the necessity to pass from a linear to a systemic approach. Rejecting any physical or monetary reductionism, it suggest to use a plurality of criteria. Realities have to be analysed from different points of view (Martinez-Alier, 2001). Complexity, uncertainty (Funtowicz and Ravetz, 1994; O'Neill, 1996) and incommensurability of values have been added as main elements of this approach.

Based on this theoretical framework, the Bioeconomic paradigm enforce limits to infinite growth and lead to considers the material and energetic requirement of economy as a measurement of the size of societies in relation to the environmental one (Daly, 1991; Daly 1995; Hinterberger et al., 1997). Using biophysical variables as indicator of sustainability it lead to an evolutionistic idea of sustainability based on the reduction in the scale of societal metabolism (Hinterberger et al., 1997). This concept, extending the biological concept of metabolism to human system, defines the economic system as an analogous to a living system that produces waste and needs a continuous throughput of material and energy from natural system (Wolman, 1965; Ayres, 1989; Martinez-Alier, 2004). This approach, based on the Principle of Mass Conservation, investigate the whole of the materials and energy flows going through economies and allow to distinguish between culture and societies.

Considering the economy as a subsystem of the environmental system, limited and thermodynamically closed, Bioeconomics propose specific alternatives to infinite growth and give birth to a radical criticism of neoclassical theory (Daly, 1997a; Daly 1997b; Solow; 1997; Stiglitz, 1997). These alternatives are mainly based on the stationary state (already proposed in the "Limits to Growth" by Meadows et al., (1972), or in "Stationary State Economy" by Herman Daly (1991) or on "de-growth" approach (Bonaiuti, 2004; Latouche, 2004).

According to steady state theory of Daly, the increase of population and production should not drive as beyond the environmental capacity to regenerate resources and to absorb the waste. Once these limits are met, production and reproduction would be reduced to substitution: the physical increase would have to stop while qualitative improvements would continue (Daly, 1996). Sustainability requires the replacement of quantitative growth (increase in throughput and increasing allocation of natural capital) by qualitative development (dematerialisation and biophysical steady state).

On the contrary, "De-growth" ideologists refuse the Stationary State as a solution, as well as the concept of Sustainable Development. They propose a new foundation of the economy based on the acknowledgement of the ineluctability of the entropy law. "Entropic economy" is an economy of necessity not of luxury (Rifkin, 1989) and it aims to reduce the flows of energy and materials of society (Bonaiuti, 2003). For the "de-growth" theory, we don't need only to make some fundamental change in our attitude but we need to think differently, change the culture, the system of values and above all reduce our consumptions, that are considered as the key force leading the socio-environmental transformations (Rothman, 1998).

In this paper, the Sustainable Development and the Bioeconomics approaches are compared with regard to an Italian case study. After an introduction about the theoretical framework, the dematerialisation and the Environmental Kuznets Curve hypotheses have been tested using production and consumption-based perspectives. In order to analyse the strengths and weakness of the two approaches, Italian data have been used.

2. Production-based approach versus consumption-based approach

2.1. Production-based approach

According to the Sustainable Development (or eco-efficiency) paradigm, economic growth improves environmental quality (Anderberg, 1998). It allows to reach "de-materialisation" and "de-pollution" thanks to the de-link between economy and its environmental bases. (Beckerman, 1992).

There are two theories supporting this path: one is the "Dematerialisation Theory" and the other is the "Environmental Kuznets Curve". They are focused on production and consider the environmental consequences of supply.

The Dematerialization Theory, introduced by Malenbaum in 1978, affirms that the environmental impact of the economic process depends on the material throughput of the economy and at the same time the throughput per unit of production may decrease over time. Innovation, investment and technical progress will reduce biophysical constraints of economic growth, achieving a long-run sustainability. Nevertheless, developed economies generally consume ever increasing quantities of materials in absolute terms (Adriaanse et al., 1997).

The Environmental Kuznets Curve (EKC) hypothesis postulates an inverted-U-shaped relationship between different pollutants and per capita income. Environmental pressure increases faster than income at early stages of development and slows down relative to GDP growth at higher income levels. The income elasticity of environmental quality demand, the "composition effect" and the "technological effect" are the tree main factors responsible of this path. (Grossman and Krueger, 1992; Grossman and Krueger, 1994; Radetzki, 1992; Panayotou, 1993; Grossman, 1995, Shafik and Bandyopadhyay, 1992). According to this theory, economic growth is good for the environment because it seems existing an empirical relation between per capita income and some measures of environmental quality (Arrow et al., 1995; Suri and Chapman 1998; Ekins, 2000).

On the bases of this theoretical framework a large number of studies were published in the last few years. Nevertheless most of them, adopting a production-based perspective, evaluate sustainability taking into account the environmental performance of domestic production and neglecting the international trade issue.

2.2 Consumption-based approach

The Bioeconomics (or Ecological Economics) perspective, based on the strong sustainability and on the thermodynamic foundations of the economy (Georgescu-Roegen, 1971; Daly, 1997a; Daly, 1997b) enforces biophysical constraint to economic growth and use together physical and economic indicators (Stern et al., 1994; Suri and Chapman, 1998; Muradian and Martinez-Alier, 2001; Martinez-Alier, 2001; Martinez-Alier, 2002). It consider consumption as a key force of environmental transformation and recognizes the role played by international trade on displacement of socio-environmental loads (Stern et al., 1994; Suri and Chapman, 1998; Muradian and Martinez-Alier, 2001; Martinez-Alier, 2001; Martinez-Alier, 2002). Since sustainability can't be evaluated only at domestical level (Stern et al., 1994; Suri and Chapman, 1998; Ekins, 1997), links between local consumption and foreign environmental degradation have to be analysed. Adopting a consumption-based perspective, Bioeconomics approach recognized the role played by international trade on displacement of socio-environmental loads. In this framework, physical accounting are particularly suitable to elucidate environmental consequences of economic specialization process in different world regions (Giljum and Eisenmenger, 2004).

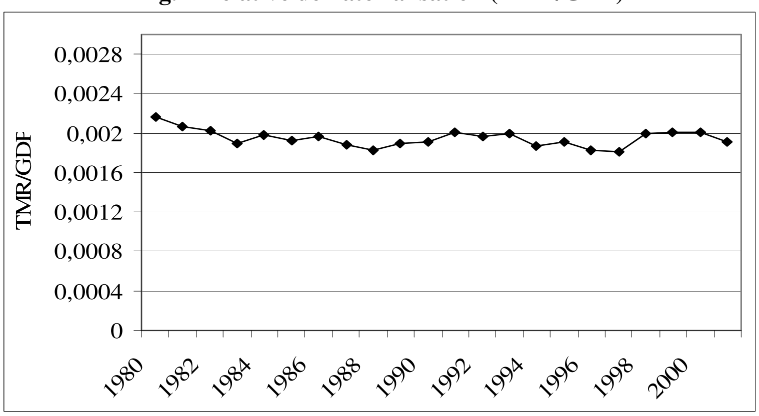
3. The Italian case study

3.1 Production-based perspective

According to a production-based perspective, a dematerialisation analysis and an EKC have been elaborated for the Italian case, using National Institute of Statistics data.

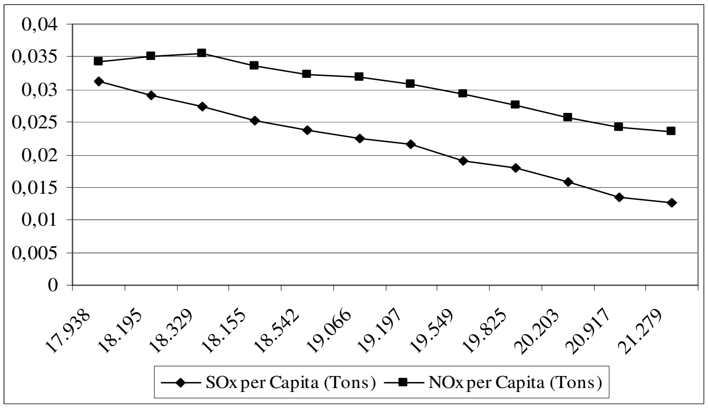
In order to analyse the dematerialisation hypothesis, the Total Material Requirement, that measures the quantities of materials used by economic process (EUROSTAT, 2001), has been related to GDP (chained level series with reference year 2000). The resulting ratio represents the quantities of materials necessary to obtain one unit of income and it can be considered an approximation of the material efficiency use or the resource productivity (EUROSTAT, 2001). This analysis shows that Italian productive system achieved a relative dematerialization during the last 20 years because the quantities of materials used to produce a given income have been reduced (Fig.1).

Fig. 1 Relative dematerialisation (TMR/GDP)



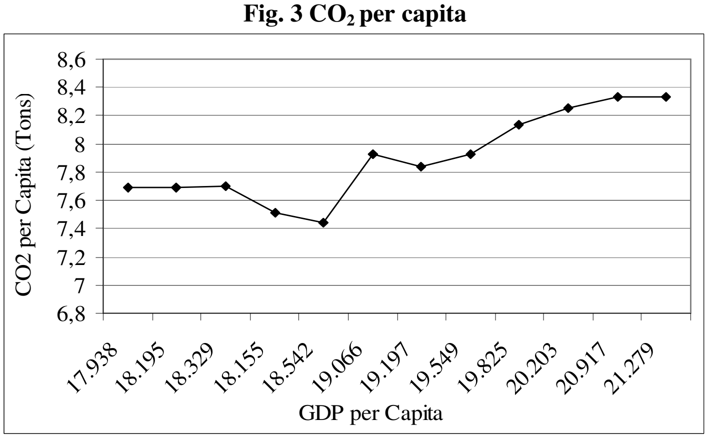
Considering the Environmental Kuznets Curve hypothesis, Italian system reduced some environmental impacts from 1990 to 2002 in absolute terms, and not only relative to income (Fig.2). EKC has been elaborated using the NAMEA (National Account Matrix including Environmental Accounts) data about emissions. Fig.2 show that "de-pollution" hypothesis of economic growth is respected for SOx and NOx emissions.

Fig. 2 SOx and NOx per Capita



However, for the Italian case too, EKC cannot be generalized for all types of pollutants. CO_2 emissions for example, have been increased during the period considered (Fig.3). According to different studies, the inverted-U shaped is confirmed only for pollutants involving local short term cost (for example, SPM, SO_2, CO, etc.), but not for accumulated stocks of waste or for pollutants involving long-term and more dispersed costs (such as CO_2), which are often increasing functions of income (Arrow et al., 1995; Cole et al., 1997).

Fig. 3 CO_2 per capita



Using a Sustainable Development or eco-efficiency approach, it seems that Italy has augmented to some extent its sustainability. The materials used to produce income have decreased in relative terms and, according to the EKC hypothesis, some pollutants have been reduced in absolute terms as the GDP increased.

3.2. Consumption-based perspective

In order to quantify consumption, data of Italian Statistic Institute about expenditures for commodity categories and waste has been used. They can be considered as indirect indicators of environmental pressures generated by income variations.

Regarding the EKC hypothesis, I applied the Kuznets curve to model the quantities of per capita consumption for nine categories of consumer goods at different levels of GDP per capita (from 1982 to 2005). In order to remove the inflation effect, GDP and consumer expenditures have been considered in chained level series with reference year 2000.

The relationships between income and per capita consumption for nine categories of consumer goods are reported in Fig.4, Fig.5 and Fig.6. Table 1 summarizes these relationships. The purpose of the analysis was to provide an initial indication whether these relationships show an inverted-U type of behaviour that might support the EKC hypothesis. The high R^2 values highlight that second order polynomials represent good models for these relationships. Turning points has been found for 4 categories of goods but only "Clothing and Footwear" have yet displayed an inverted-U shape curve. The other 5 categories seems to be always increasing.

Fig. 4 Consumption by commodity category

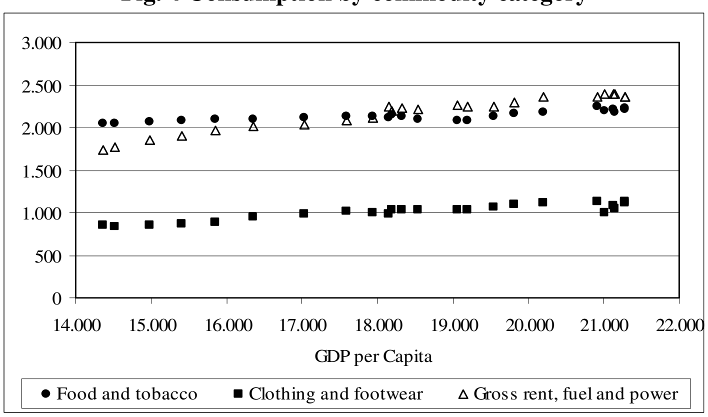


Fig. 5 Consumption by commodity category

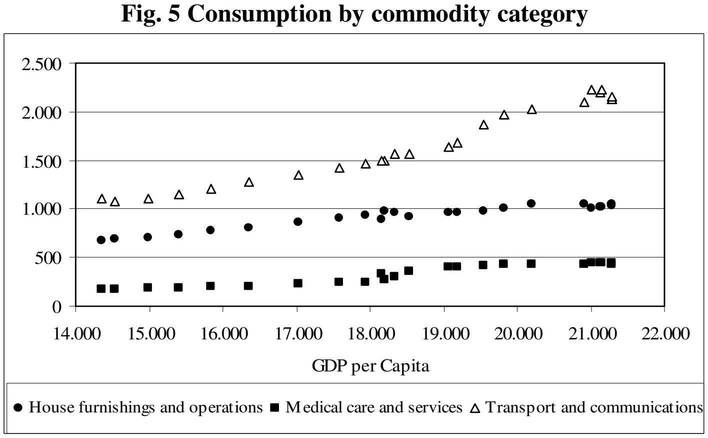
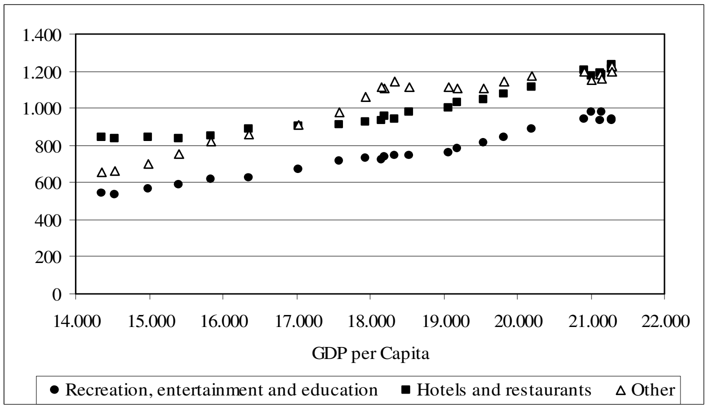


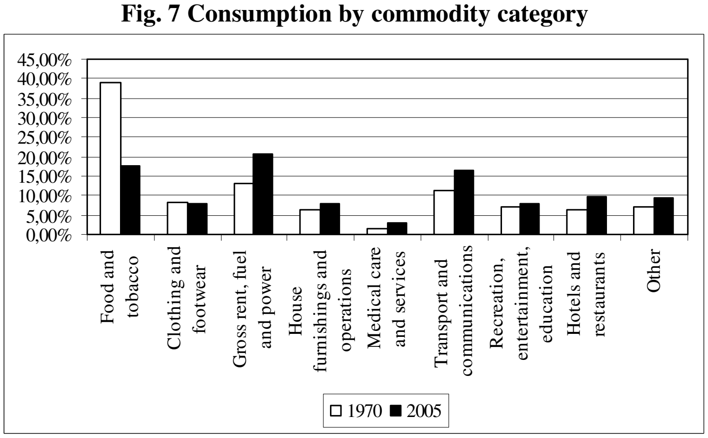
Fig. 6 Consumption by commodity category



Tab. 1 Quadratic fits to consumption data

Commodity	Fitted equation	Adjusted R^2	Turning point (Euro)
Food and tobacco	y = 3E-06x2 - 0,0764x + 2609,2	0,7905	/
Clothing and footwear	y = -4E-06x2 + 0,1668x - 828,46	0,8842	20.850
Cross rent, fuel and power	y = -7E-06x2 + 0,3468x - 1746,4	0,9813	24.771
House furnishings and operations	y = -5E-06x2 + 0,2449x - 1757,8	0,9744	24.490
Medical care and services	y = 8E-07x2 + 0,0169x - 254,78	0,915	/
Transport and communications	y = 2E-05x2 - 0,3949x + 3502,5	0,9842	/
Recreation, entertainment, education	y = 3E-06x2 - 0,0638x + 739,24	0,9854	/
Hotels, restaurants	y = 8E-06x2 - 0,2407x + 2581,6	0,9922	/
Other	y = -1E-05x2 + 0,4755x - 3932	0,9701	23.775

Fig. 7 Consumption by commodity category



Moreover, the analysis shows that income distribution between commodity categories changed with the increase of GDP (Fig.7). The percentage of every commodity category on the annual expenses changed between 1970 and 2005. The basic commodities (food and clothing) reduced their percentage whereas expenditures for house, transport, communication and entertainment augmented. In other words, the increase of GDP during the study period have balanced the expenditures between the different commodities categories.

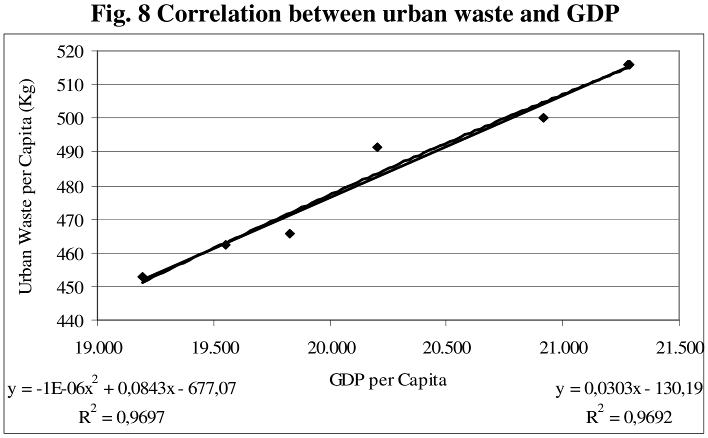
The consumption-based approach shows that EKC is not respected and that Italy is still augmenting its environmental impacts.

With the purpose to evaluate the degree of lifestyle dematerialisation, the data about waste has been used as an indirect approximation of consumptions. Since all the materials used return to environment, according to Thermodynamic Lows, an analysis of waste can be a good approximation of the dematerialisation degree of society. Moreover, according to Tamanoy, waste can be considered the entropy produced by consumption society (Tamanoy et al., 1984). Since a distinction between waste derived from production and consumption is not made in the balance usually compiled in MFA (EUROSTAT, 2001), I considered the data about waste collected by ISTAT. In particular, I observed per capita and absolute variations (1996 – 2002) and I looked for correlations with GDP and consumptions expenditures.

From 1996 to 2002, waste augmented from 451 kg/year per capita to 516 kg/year per capita. According to the other European countries the objective of V Environmental Action Plan (EAP) (http://europa.eu) (300 kg/years per capita by 2000) has not been achieved.

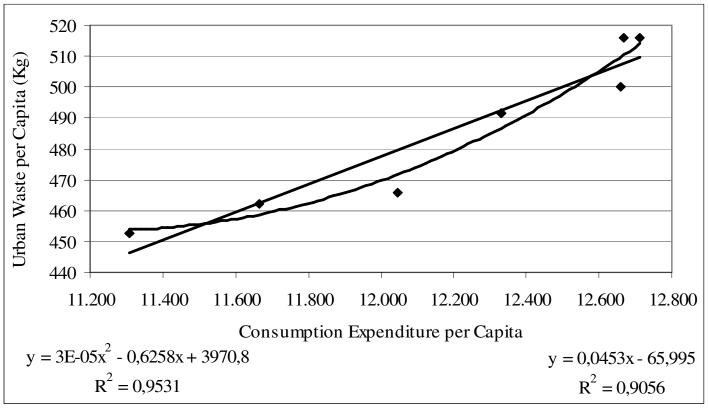
The relationship between per capita urban waste (kg) and per capita GDP (chained level series with reference year 2000) is reported in Fig.8. Both the polynomial model and the linear model present a R^2 very high (96%). Considering the EKC theory, the inverted-U shape is confirmed and the turning point is 41.150 euro per Capita. Notice that increase of urban waste cannot be easily explained by the fact that the impacts fall far away in time and space (as to some extent it is the case of carbon dioxide) – although perhaps urban waste manages to become invisible to the inhabitant of well-to-do urban zones.

Fig. 8 Correlation between urban waste and GDP



Moreover, Fig.9 shows that per capita urban waste (kg) is strictly related to per capita consumption expenditures (chained level series with reference year 2000) because they depend on family patterns of consumption. Consumptions are strictly related to GDP too, as reported in Fig.4, Fig.5 and Fig.6.

Fig. 9 Correlation between urban waste and consumption expenditures



The relationship between per capita urban waste (kg) and per capita expenditures for consumptions (Fig.9) is a second order polynomial model. It presents a R^2 very high (95%) and the relation doesn't confirm the inverted-U shape. The second order polynomial equation seems to be always growing. This means that an increasing per capita expenditures for consumptions will determine increasing production of urban waste. The second order polynomial equation seems to be always growing and the EKC is not respected.

These analyses show that an increase of GDP determined an increase of consumption and waste in the Italian society. Contrary to a production-based perspective where we have seen some cases where pollution decreased with income, here there is no EKC of consumption.

4. Discussion

The analysis of Italian case shows that:

- according to the Sustainable Development (eco-efficiency) paradigm, economic growth improves environmental quality and reduces the biophysical constraints of societies.
- according Bioeconomics (or Ecological Economics) paradigm de-pollution and dematerialisation do not seem to occur. Economic growth increases environmental pressures.

The different conclusions obtained from the Italian data, using a production-based or a consumption-based approach, underline the importance of the focus considered. Complexity, uncertainty and incommensurability of values cannot be studied in a single analysis perspective. "Methodological Pluralism" has to be adopted (Norgaard, 1989). Nature has to been “taken into account” not only in monetary terms but also in physical terms (Martinez-Alier, 2002). However, to say this is not enough. The results obtained will depend on whether e focus on production or on consumption.

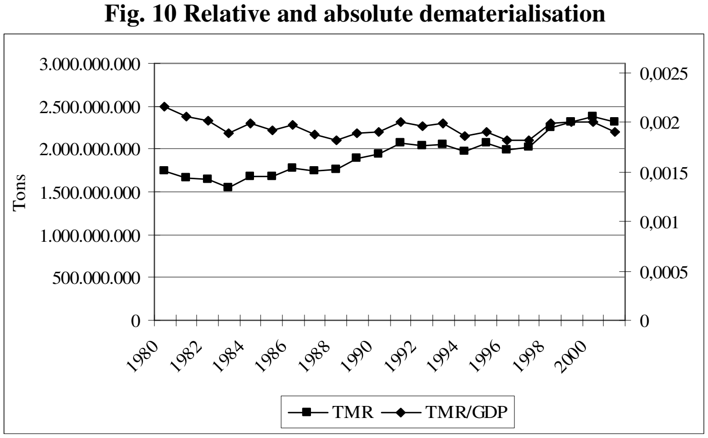
4.1 Production-based approach

The Environmental Kuznets Curve and Dematerialization Theory have been criticized by several authors (Suri and Chapman, 1998; Rothman, 1998; Ekins, 1997; Dinda, 2004; Arrow et al., 1995; Ayres, 1995). For the Italian case I have analysed two main issues.

First, the relationship between economic growth and environment fails to consider the notion of carrying capacity, the ecological thresholds with respect to the accumulation of pollutants (Arrow et al., 1995) and the rebound effect (Greening et al., 2000). The turning points of the EKC should be investigated and the variables analysed should be considered in absolute terms.

Contrary to relative valuation (TMR/GDP), dematerialisation hypothesis is not confirmed in absolute terms (TMR in tons) (Fig.10). During the lasts 25 years, the material intensity of Italian system has been reduced but the total material requirement increased (+ 33,6%, Tab.2). A de-linking between economic growth and resources consumption is not occurring, and Italy has not augmented its sustainability in absolute terms. According to Jevons Paradox, an efficiency increase can generate increasing consumption.

Fig. 10 Relative and absolute dematerialisation



Second, the EKC omits the “environmental load displacement”. Considering a productive-based approach, the EKC reflects impacts that are local in nature and for which abatement is relatively inexpensive in terms of lifestyle changes (Rothman, 1998). Environmental improvements can be obtained thanks to changes in productive structure without determine a change in consumption lifestyle, which is the first cause of environmental pressures.

In this context, international trade becomes an important explanatory factor for EKC relationship because it provides the means by which national patterns of production and consumption can become disassociated within a nation. Contrary to Neoclassical theory (based on Ricardo and Hecksher – Ohlin theory) that considers trade good for economic growth and consequently good for the environment (Dollar, 1992; Frankel and Romer, 1999), some ecological economists (Daly 1993; Ayres 1996) argue that trade can have a "discrimination and a peripheralisation effect". Poor countries may attract "dirty" and material-intensive productions while richer country specialize in clean and material-extensive production, without altering their consumption patterns (Stern et al., 1994). According to Pearce and Warford (1993): ''It is perfectly possible for a single nation to secure sustainable development—in the sense of not depleting its own stock of capital assets—at the cost of procuring unsustainable development in another country''. In this case the environmental costs are displaced from one country to another, rather than reduced (Ekins, 1997), and the high-income countries consumption of environmentally intensive goods is increasingly met by imports.

Considering that, the quantity of imported resources can be considered a proxy of the degree an economy is responsible for pollution outside its political frontiers, natural resource flows can be seen as "ecological flows" in the sense that some countries may appropriate the carrying capacity of other country (Hornborg, 1998; Naredo, 1998; Proops et al., 1999).

In our case, it is important to highlight that after the second world war, the Italian economy grew six times (in monetary terms, excluding inflationary effects) and it realized a "structural change" (Leontief, 1968) or a socio-economic-ecological transition that allowed to reduce the weight of agricultural sector. The growing industrial activity has been accompanied by growing imports and exports (in monetary and physical terms) (Ciocca and Toniolo, 2002).

According to Material Flow Accounting data (ISTAT, 2002), table 2 shows that, the Total Material Requirement (TMR) and the Total Material Consumption (TMC) are strongly augmented in the last 15 years. TMR is an input indicator, which takes into account all primary material required by a national economy in order to perform its production. The TMC considers all primary materials which are associated to the (intermediate and final) consumption of a national economy (EUROSTAT, 2001). The TMR include, in addition to DMI (Domestic used extractions plus imports), the indirect material flows associated to imports (defined as the up-stream material input flows that are associated to imports but are not physically imported) and the unused domestic extraction (materials that are moved by economic activities but that do not serve as input for production or consumption activities). The TMC equals TMR minus exports and associated indirect flows of exports (defined as the upstream material input flows associated to exports but are not physically exported).

Indirect Flows and unused domestic extraction are important variables to consider when production and consumption patterns are evaluated from the perspective of global sustainable development. They report that each product, besides its actual weight, carry a so-called "ecological rucksack" of all the material flows that were activated along its life cycle. They are important variable to consider in order to estimate the impacts (e.g. habitat destruction, soil erosion) of material requirement of the economy (Giljum and Eisenmenger, 2004). In order to understand the Italian strategic position in terms of international specialization it is important to note that the indirect flows associated to imports are strongly augmented (+ 84%) while the unused domestic extractions has been reduced (- 30,5%). The increased physical imports of Italy have compensated for the increasing material requirement and the reduction of national extraction. In order to analyse the potential displacing effect of the Italian system, these results are very important, especially considering that in the same period, the protection of national territory has been tripled.

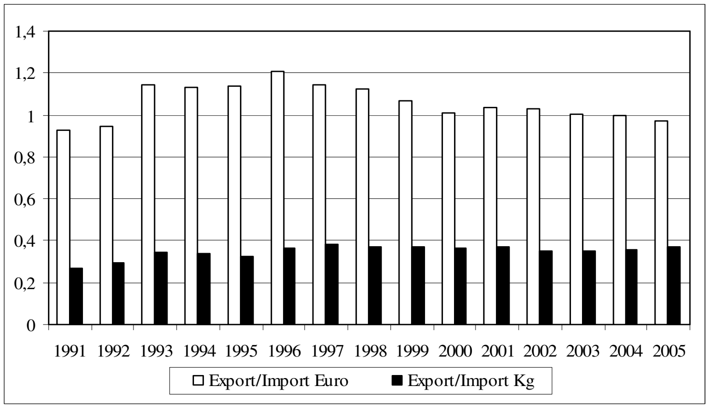
Table 2 highlight also the great importance of trade in the Italian economy. Imports and exports are strongly augmented in the period considered and, in absolute terms, the difference between the two value confirms that Italian economy can be defined as a "transformation economy". It imports materials that during the economic process loss weigh in physical terms and augment its value in monetary terms.

Tab. 2 Material Flow Accounting Italia (Tons)

	1980	2001	Δ	Δ%
Used Domestic Extraction	**754.783.954**	**747.810.442**	**- 6.973.512**	**- 0,92%**
Biomass	249.423.715	179.685.275	- 69.738.440	- 28%
Fossil fuels	12.607.926	15.057.170	+ 2.449.244	+ 19,4%
Minerals	492.752.313	553.067.997	+ 60.315.684	+ 12%
Unused Domestic Extraction	**124.301.961**	**86.445.648**	**- 37.856.313**	**- 30,5%**
Biomass	11.897.087	19.271.971	+ 7.374.884	+ 62%
Minerals	34.903.612	19.682.377	- 15.221.235	- 43,5%
Other	77.501.262	47.491.300	- 30.009.962	- 38,7%
Imports	**229.959.493**	**330.035.125**	**+ 100.075.632**	**+ 43,5%**
Indirect flows imports	**628.246.908**	**1.156.049.017**	**+ 527.802.109**	**+ 84%**
Total Material Requirement	**1.737.292.316**	**2.320.340.232**	**+ 583.047.916**	**+ 33,6%**
Export	**57.945.200**	**123.117.502**	**+ 65.172.302**	**+ 112%**
Indirect flows export	**137.044.321**	**420.917.109**	**283.872.788**	**+ 207%**
Total Material Consumption	**1.542.302.795**	**1.776.305.621**	**234.002.826**	**+ 15%**

Also for the Italian case, according to the main developed economies, in spite of the increasing physical trade, economic variations resulted higher than physical variations. Import in monetary terms (+ 155%) augmented more that in material terms (+ 43,5%) The high variability of international price highlights that a monetary analysis is not enough to study the trade exchanges. For example the quantitative imports from Africa didn't really change (+ 4%) while augmented of 180% in monetary terms as consequence of energetic resources price increment. Some conclusions can be reached by analysing the physical trade balance of Italian system. It clearly presents a physical trade deficit and an economic balance, as reported in Fig.11.

Fig. 11 Italian export-import ratio



In physical terms, Italy as so many other European countries, depends upon material and energy imports while final products and consumer goods and services are the main exports, with an unitary value higher than the unitary value of imports (ISTAT, 2002).

In other words, Italy imports raw materials, farm produce and energy resources that lose weight in physical terms but gain economic value during the national transformation process.

The Italian data prove that a dematerialisation of production cannot be considered as a lifestyle dematerialisation. A production-based analysis may lead to a false appearance of sustainability. According to Ekins (1997): "If the shift in production patterns has not been accompanied by a shift in consumption patterns, two conclusions follow: 1) environmental effects due to the composition effect are being displaced from one country to another, rather than reduced, and 2) this means of reducing environmental impacts will not be available to the latest-developing countries, because there will be no countries coming up behind them to which environmentally-intensive activities can be located". For this reason the EKC cannot be extended to global level. The externalization of environmental costs achieved by Italy (and Europe) in the last decades cannot be imitated by latecomers. However, it might be that in some large countries (China and India), the prosperity of some regions is being achieved not at the cost (only) of environmental load displacement to raw material and energy exporting countries (in Africa, Latin America) but also at the cost of the sacrifice of some internal regions that specialize in mining and heavy industry.

Since consumption is the key force of environmental transformation, it is more appropriate to consider the impacts stemming from consumption activities than from production activities (Rothman, 1998). Moreover, as trade is a spatial component of the environmental consequences of local consumption patterns, an inter-country or inter-regional perspective should be adopted, and environmental impacts should be explained as a consequence of the biophysical metabolism of societies (Giljum and Eisenmenger, 2004).

4.2 Consumption-based approach

Considering the international trade issue and adopting a consumption-based approach, the Bioeconomics approach tries to analyse the effects of social metabolism. Nevertheless some methodological limits can be found also in this approach. First of all, biophysical analyses are often performed in a one-dimensional way considering only the weight of consumptions but not their qualitative differences. Since the environmental impacts of material consumption are not only a matter of "scale" but also of "quality", it is recommendable to consider not only the aggregate consumptions or imports, but to differentiate the throughput in its components (Muradian et al., 2002, Perez Rincon, 2007). Sustainability should be reached reducing total consumption but also diminishing the requirement of the most polluting materials.

Second, methodological problems exist to allocate consumption responsibilities. According to Muradian et al., (2002) "The analysis of the terms of ecological exchange between different regions or countries can be very complex because international production – commercialization – consumption chains are usually extremely intricate".

Third, the physical quantification of consumptions is very difficult. In MFA, for example, they are extracted indirectly as difference between imports plus domestic extraction minus exports. Nevertheless tourist consumptions are not considered in this kind of analysis. Water flows are neglected though they are increasingly analysed through the "virtual water" accounting methodologies (Perez Rincon, 2007).

Fourth, the socio-environmental impacts by unit of import value probably increase substantially if "Environmental and Social Memory" of physical flows is considered (Muradian et al. 2002). For sustainability policies, it is relevant to examine the effect of cross-country movement of goods and services that embody pollution (Suri and Chapman, 1998).

5. Conclusions

The previous analysis shows that the Italian system has improved his environmental quality during the last 20 years: some polluting emissions have decreased, domestic extractions (especially the unused extractions) have been reduced and the efficiency in material use has been augmented (that is, resource productivity has increased). However, in spite of these encouraging results, the production of waste, the level of consumptions and the international trade increased both in monetary and in physical terms. Imports are a substantial part of the supply of raw materials and energy.

Sustainability improvements are uncertain if we consider consumption as the main cause of ecological pressures and regard trade as a cause of "environmental load displacement" (Muradian et al., 2002)

The Italian data on the Environmental Kuznets Curves for some pollutants, and on the physical aspects of international trade that have been used, show that sustainability improvement cannot be evaluated only at national scale. In the Italian economy, there has been an increase in resource productivity, moreover some pollutants have decreased in absolute terms, but consumption keeps increasing as also production of waste. It has been shown that imports into Italy vastly exceed exports from Italy in physical terms, and even more so when the "hidden flows" are taken into account. In the exporting countries, the environmental impacts are felt by the local peoples. The environmental local displacement effect allows developed countries to alienate themselves from the socio-environmental consequences of their own patterns of consumption but, in the long run, the consequences of unsustainable lifestyles cannot be ignored. A relative dematerialisation of domestic production, does not mean a consumption dematerialisation, while local de-pollution does not necessarily mean a sustainability improvement.

For these reasons, international trade has to be considered and sustainability has to been evaluated in a global dimension. As highlighted by the Bioeconomics approach, consumptions have to be recognized as the main cause of environmental pressures, and biophysical constraints have to been respected.

Comparing the Sustainable Development (eco-efficiency) approach and the Bioeconomic (or Ecological Economics) approach, this work has highlighted the necessity to use different dimensions and languages of valuation when analysing a complex reality. Moreover, considering consumption (rather than local production) as the main cause of environmental damage, this work points to the need to identify and analyse the links between demand, trade, and consumptions. This would allow us to better understand the socio-ecological effects of our lifestyle. The question then arises of what explanations we have for the patterns of consumption of the rich part of the world.

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