Advances in Green Economy and Sustainability: Introduction

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Abstract
The environment is changing in a dynamic way. Sustainable development consists of both natural environmental changes as well as changes caused by humans. Nowadays environmental changes occur more often and much quicker and these changes challenge ecosystems and human societies. The aim of this special issue is to address the achievement of sustainable development by addressing the current issues of concern. Specifically, the green economy concept is an important term in international agendas. Together with the current economic crisis and the view that policies to attain sustainability cannot be put into operation efficiently, policy makers anticipate a solution from the greening of the economy. Green growth, more energy efficiency, cleaner energy technologies and sustainable development are regularly considered as harmonizing goals by international policy makers.

Keywords: Energy consumption; trade; energy security risk; decoupling; green industrialization; greening workplace; digitalization; green communication.

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1. Economic activities and energy consumption

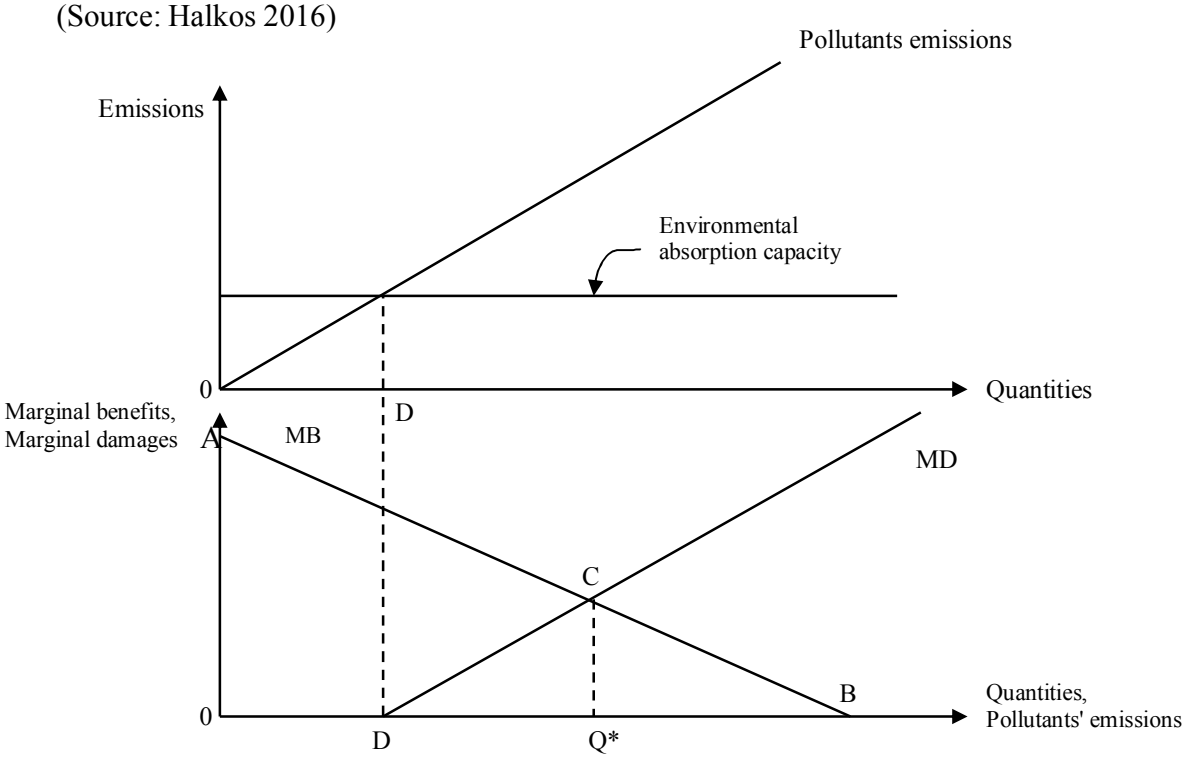
1.1 Decoupling, energy consumption and security

Due to higher levels of wind power system uses, technological improvements of wind power are increasingly necessary to decisions makers and societies. Advanced wind turbines can vary in both size and functionality with smaller types to be installed in order to satisfy residential demand in rural areas isolated from the electricity grid with larger types to be able to provide electricity directly into the greater grid. In these lines, wind energy may become more considerable in improving energy security risk and coping with the higher energy consumption levels with additional installation cost reductions and efficiency developments.

The first paper by Clarence Tolliver, Moinul Islam, Kong Joo Shin and Shunsuke Managi assesses the effect of energy security risks on energy consumption and observes the disparities in the size of effects relying on the energy source. For this task a panel data set of 64 countries for the time period 1980 to 2014 is analyzed. The empirical findings reveal that growing energy security risk expands oil, natural gas, nuclear power and wind power consumption and reduces hydroelectric power consumption. At the same it is shown that countries with higher energy security risks have expanded the comparative segment of wind energy in their total energy consumption. These empirical findings imply that energy security risk leads to an expanded energy consumption by means of implementing renewable energy methods with economic and population growth also affecting the general increases in energy consumption levels.

Every individual action has an environmental consequence with the environment being able to absorb some of these effects through its assimilative capacity as shown in Figure 1. This figure shows the determination of the optimal pollution level having taken into consideration the assimilative capacity of the environment (Halkos, 2016). This absorption capacity has to be considered in advanced before any environmental policy is planned with the main task to prevent any irreversible situations where the environment and the ecosystems are severely damaged.

Figure 1: Determining optimal pollution level with environmental assimilative capacity (Source: Halkos 2016)



The second paper by Vassilios Profillidis, George Botzoris and Athanasios Galanis discusses the decoupling of economic activities related to transport energy consumption. Obviously the rapid development of the transport sector causes severe environmental effects. At the same time the extreme use of energy resources and the associated excessive pollution and noise levels indicate the importance of transport development in the standards of living.

Decoupling between GDP and energy consumption in transportation is the only approach to reduce carbon dioxide emissions ensuring higher rates of economic development. In this study the coupling-decoupling circumstances for European countries for the time period 1990 to 2014 is considered. As transport depends heavily on energy it cannot continue operating without energy feeding. The authors show that satisfactorily developed dissimilar transport infrastructure networks and transport systems require efficient cooperation to tackle any rising demand. Evidently they have to be administered in an environmental-friendly manner, limiting environmental damage with lower energy consumption and less congestion and accidents.

2.2 Trade and the environment

Economic theory proposes that development is increased through income growth driven through enhanced trade. The next paper by Paramita Sengupta and Kakali Mukhopadhyay discusses the pollution haven hypothesis and India's Intra-industry Trade. There is a growing dispute across the literature about the effects of international trade on the environment. According to Arrow et al. (1995) there exist two opposite views regarding this issue. Copeland and Taylor (1995) present the environmentalist view

where the openness of trade accelerates growth which in turn generates more pollution. In contrast, the economist view proposes that growth and increased income from trade liberalization lead to cleaner environment through the growing demand for environmental quality, environmentally friendly investments and more stringent regulations (Copeland and Taylor, 1995).

Along with the two aforementioned points of view, there are several established hypotheses about the relationship of trade and environment. Perhaps the most well-known is the "pollution haven" hypothesis (PHH). Developed countries which impose more stringent environmental regulation than developing countries, will fail to maintain their competitive advantage in high-polluting sectors under liberalization of trade. As a result, developing countries will suffer environmental degradation while developed countries will benefit form trade openness with an increase in environmental quality (He, 2010). PHH is favored by the fact that developing countries has not signed environmental agreements like the Kyoto protocol (Mongelli et al., 2006).

In addition, PHH leads to another common term in trade-environment relationship, the "carbon leakage". "Carbon leakage" refers to the rise of a country's CO_2 emissions as a result of the reduction in another country's CO_2 emissions (Guo et al., 2010). From PHH, a developed country tends to impose more stringent environmental policies which will result in more expensive pollution-intense products. A developing country may produces this product cheaper (strategic advantage) and export it to the developed country. The developed country purchase this product in lower cost than if it was to produce it and avoid the emissions while the developing country will enjoy a rise in exports and suffer an environmental degradation. The most indicative example of "carbon

leakage" is China, world's largest CO_2 emitter (Weber et al., 2008, Yunfeng and Laike, 2010). In contrast with the PHH, there is the "simple factor endowment hypothesis" which promotes that trade will favor the redistribution of expensive pollution-intense industries to relatively wealthy countries (Antweiler et al., 2001).

The probable loss of the competitive advantage through stringent environmental policies may lead trade-free countries to relax their stringent regulation in order to maintain their advantage (Frankel and Rose, 2005). This is "race-to-bottom" hypothesis which is in consensus with PHH about developing countries which are open to trade and tend to become pollution havens. The opposite hypothesis is "gains-from-trade" hypothesis which is in consensus with the economist view. According to "gains-from-trade" hypothesis, trade openness promotes environmental quality through innovations, imitation of the state-of-art technology and public demand for cleaner environment (Frankel and Rose, 2005).

According to Grossman and Kruger (1991), the liberalization of trade has a three-side effect on the environment, scale effect, technique effect and composition effect. Scale effect refers to the expansion of the overall economic activity which will result in increased pollution and environmental degradation. Composition effect refers to the competitive advantage of a developing country at its competitive sectors, both in pollution-intense sectors through PHH and non-pollution intense sectors through cheap labor force (He, 2010). Technique effect is related with "gains-from-trade" hypothesis and refers to the betterment of the technology through innovation, investment and imitation. He (2010) studies the three-side effects for the case SO_2 emissions in China and finds that scale and technique effects are significant and in opposite direction. As

scale and technique effect are neutralized, the final outcome is determined by the composition effect.

Antweiler et al. (2001) recognize three different groups of research about the connection between trade and environment. The first group examines trade through Environmental Kuznets Curve (EKC), the second group investigates the connection between abatement costs and trade flows and the last group focuses on pollution intensity of exports and production. EKC is a widely used context in environmental economics.

EKC has many supporters and many critics among the researchers (Halkos, 1996, 2003, 2006, 2012, 2013, 2015). Economists who support EKC believe that economic growth and environmental quality are connected by an inverted U-shaped relationship. Specifically, when moving on the downward side of the EKC where a country has low income per capita, a rise in economic growth may result in increased pollution while moving on the upward side of EKC where a country has a high income per capita country, a rise in economic growth may result in a positive effect for the environmental quality (Lopez and Mitra, 2000). Lopez (1994) examines the inverted U-shaped relationship between income and environmental degradation, while Lopez and Mitra (2000) find a positive linkage between exhaustion of natural resources and income per capita. Liu et al. (2007), states that the EKC relationship is verified only for a number of pollutants. Dasgupta et al. (2002) presents a number of critic views about the EKC such as the claim that it is only a snapshot of a dynamic procedure, and although several pollutants may be reduced beyond a certain point, new pollutants are generated which may be more toxic than the previous ones. Despite of the above, the author argues that there is evidence which validate the existence and the use of EKC.

Several empirical analyses investigate the relationship of trade and environment through the EKC framework by confirming PHH (Cole, 2004) and by adding additional regressors in EKC as measures for trade openness. The "trade intensity" (Grossman and Krueger, 1991, Shafik and Bandyopadhyay, 1992), measured as the ratio of imports and exports to GDP, and the Dollar's index of openness (Shafik and Bandyopadhyay, 1992) are the two most significant variables used across the literature. Grossman and Krueger (1991) apply the EKC at SO_2 case and find that SO_2 emissions are less in trade opened countries, a result which is not verified for other pollutants. Shafik and Bandyopadhyay (1992) also find mixed results which can not lead to a safe assumption about the nature of the relationship between trade and pollution. Suri and Chapman (1998) argue that these approaches do not consider the direct impact of trade on pollution through the distribution of goods between countries and they note that the pollution of the producer country is related with the consumption of the buyer country.

In accordance with the theoretical approaches, the empirical results vary significantly across the literature. Copeland and Taylor (1994) isolate the three-side effect (scale, composition and technical) of trade liberalization on environment and find that openness of trade results in increased world pollution. In addition, the authors explain that a country in autarky can negate the reverse effect of growth on pollution, while an open to trade country can not, a result which is verified by Liddle (2001). Copeland and Taylor (1995) argue that these results are valid only in the case of income inequalities among countries. Additionally, the authors find that the trade of pollution permits is an effective environmental policy while stricter regulation is not. Liddle (2001) reach to a similar conclusion that the effects of trade depend on the country's characteristics. Kukla-

Gryz (2009) studies the case of China and finds that in developing countries, trade has a significant and negative effect on the environment, especially when the country has achieved openness of trade. Li and Hewitt (2008) investigate the China-UK trade and demonstrate that the global pollution has increased, validating the negative effect of trade on the environment. Shui and Harriss (2006) and Guo et al. (2010) verify the results for the China-US trade.

Other studies propose alternative policies and solutions in order to deal with the pollution-trade problem. Chichilnisky (1994) examines the North-South US trade where the North overconsumes and South overproduces which leads to environmental degradation and proposes that the establishment of property rights in developing countries might be the solution for the problem. Muradian and Martinez-Alier (2001) provide a number of alternative solutions for the North-South trade problem, like the "eco-cartels" and the enforcement of the international monetary environmental policies. Machado et al. (2001) suggest that countries like Brazil, a large contributor in global pollution, must revise its trade targets and adopt more environmental-friendly policies. McAusland (2008) presents an interesting alternative perspective where the study focus on the pollution generated from the consumer country, not the producer. Similarly, Peters and Hertwich (2006) address that global environmental policies may be more effective if they focus on consumption instead of production.

On the other hand, there are several studies where the openness of trade appears to have a positive effect on environmental quality. Antweiler et al. (2001) and Frankel and Rose (2005) support the "gains-from-trade" hypothesis where the trade benefits the environment. Kander and Lindmark (2006) investigate Swedish economy and find that

although the environmental pollution has been declined, international trade has no effect on this betterment of the environmental quality.

In these lines, economic globalization denotes the increasing interdependence of world economies due to the growing scale of cross-border trade of goods, international capital movements and broad and fast extend of new innovative technologies. With the acceptance of trade liberalization measures India's merchandised trade increased noteworthy after 1991. Paramita Sengupta and Kakali Mukhopadhyay show that for the post-1991 period, the trade in differentiated products (the intra-industry trade, IIT) has an increased function in India's international trade.

That is, a significant feature of such creditable growth is the considerable extension in India's Intra-industry Trade. Under these conditions it is worth exploring if such fast growth in IIT has any harmful influence on the environment. This study calculates the pollution portions of India's 'inter-industry trade' and 'IIT', and its environmental effect by using Input-Output framework for the time period 2001-02 to 2011-12. For this task the Grubel-Lloyd index is applied and the shares of IIT are estimated together with Vertical and Horizontal in India's total trade with the USA and the EU-27. It detects that the Vertical IIT is prevailing over those of the Horizontal IIT and export in IIT is extremely pollution intensive. Most of all, the results of Pollution terms of trade offer stronger confirmation on the pollution haven effect.

2. Green industrialization and greening the workplace

Structural change drives economic growth and takes place by shifting from lower to higher productivity sectors; traditionally such shifts occurred mainly from agriculture,

to industry and services. Halkos (2011) shows that as economies expand the economic structure shifts from agricultural activities to pollution-intensive industrial economy and eventually to less damaging the environment service economy. Figure 2 depicts graphically these effects (Halkos, 2012).

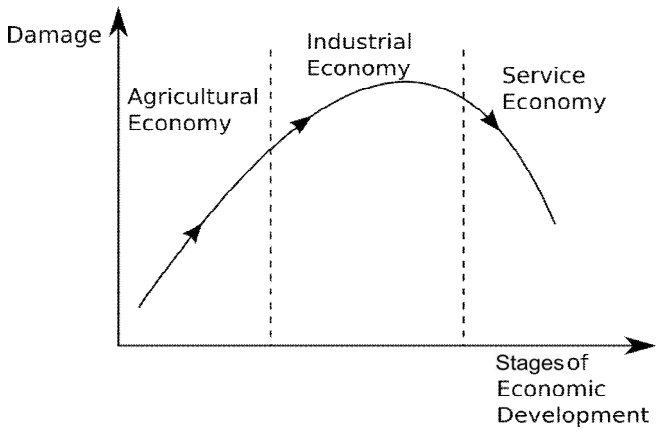


Figure 2: Environmental damage and economic development

Manufacturing keeps offering prospects for developing countries although recently most benefits from industrialization seem to have been gathered by a few countries. Obviously sustainable development is significant with the "greening" of our world being a priority, with emphasis given to the whole economy, the manufacturing sector and to the environmental investments.

The paper by Jaime Moll de Alba and Valentin Todorov reviews the concept of green industry referring to the status and prospects of national green industrialization in the case of Morocco. Specifically it reviews the concept of green industry introducing an innovative methodology to examine green industrial development at a country level. For this purpose an original database is constructed paying attention at green industrial production and employment data derived from UNIDO's industrial statistics database (INDSTAT) and for a selected set of countries. They conclude that countries have not

seized yet the chances offered by green industry. Moreover, a closer analysis is performed for Morocco, a country that, even though has established an impressive green industrial policy, failed to enhance industrial development. Their findings imply that green industrialization offers an unexploited ability that developing countries may use in the future as an alternative way to activate their structural conversion within the context of the existing international industrial development setting.

The study by Elisabeth Süßbauer and Martina Schäfer refers to the greening of the workplace conceptualizing workplaces as settings for achieving sustainable consumption. Obviously factors influencing stress and job satisfaction such as number of work hours, good relations between management and employees, good function of the group and work related to employees' area of education are basic determinants for a healthy operation of a company (Halkos and Bousinakis, 2010). In these lines, this theoretical paper plays a part to management studies on workplace-related pro-environmental behavior (PEB) by mixing approaches from social practices theory (SPT), the settings-based method to health endorsement as well as the literature on organizational knowledge. They argue that companies – instead of paying attention on individual attitudes and knowledge of employees – have to enable them to try out sustainable consumption practices, make available helpful organizational and informational structures, and incorporate their experiences and needs in a nonstop process of co-designing such an inspiring setting. An analytical framework is presented to recognize weaknesses of existing entrepreneurial strategies in promoting PEB among employees and to conceptualize complete strategies for “greening” the workplace.

3. Digitalization and green communications

The enormous increase in the use of mobile phones, laptops and other related devices indicate that carbon dioxide emissions from these devices are rapidly increasing reaching almost 3% of total emissions with energy consumption equally on the higher side. Nowadays, main attention is given to energy-efficient design of wireless sensor networks etc. since such networks demand high degree of energy-responsiveness. The recent research trend concerns green communications with a number of studies concentrating on learning and improving energy efficiency of wireless communication systems.

The paper by Yamuna Moorthy and Sakuntala Pillai discusses the optimal sensing duration for interweave cognitive radios relying on energy efficiency. Cognitive Radios (CR) have come forward as a capable physical layer contestant for 5G and future wireless systems. CR networks employ the licensed spectrum when not used by the licensed users. In their paper an energy efficiency non-convex optimization problem in interweave or spectrum sensing cognitive systems is explored aiming to maximize energy efficiency by simultaneously choosing sensing duration and detection threshold.

The last paper by Silke Niehoff and Grischa Beier presents a short study on the perception and expectations of experts in Germany concerning Industrie 4.0 and the aim of sustainability. The proposed strategy in "INDUSTRY 4.0" is where the physical world merges with the virtual. Information technology, telecommunications and manufacturing are united when the ways of production become more independent. It is still difficult if not impossible to predict how smart factories will appear in the future with scientists from all scientific fields seeking to answer the many challenges of "INDUSTRY 4.0".

These trends predict an additional ‘industrial revolution’ derived from digitalisation. Industry as discussed already always seriously affects sustainable development and this indicates the importance of fully understanding and monitoring industrial transformations from a sustainability science point of view. This last study provides a first set of ideas and insights as a starting point for research addressing the environmental dimensions of the triple bottom line. Relying on a primary survey among 100 participants from companies and research institutions it provides their findings recommending that digitalisation has the prospective to positively influence the environmental dimension of a sustainable development. But this demands more attention from researchers and companies on the digitalised industry to better understand and quantify this potential avoiding a plain problem shifting as well as rebound effects.

More specifically, one consequence of this decentralisation of production could be a higher transport volume and an increase of the related greenhouse gas emissions. This is one example of a possible rebound effect that has to be closely monitored. Attention is required as experts in this survey do not expect a significant reduction in energy consumption. The necessity of in-depth research with life-cycle assessments to determine the real possible rebound effects concern material and energy efficiency with an important environmental feature being the possible synergies between energy transition and a digitalised production. More than the one third of all participants in their survey expects that their companies will generate their own renewable energy strengthening the initiative of linking the idea of energy transition with a neat industrial production. They find that integrating smart production into smart grids to synchronise energy availability and energy intensive industrial production is not an unrealistic

scenario, although adaptability of industrial production will face its own limitations. In industries like the cement, a synchronisation is unreasonable as the blast furnace functions at very high temperatures, demanding a long and very energy-intensive heating-up process. This implies the necessity for Improvements in energy efficiency, integration of renewable energy and optimised logistics in order to achieve greenhouse gas emissions reductions.

4. Empirical findings and policy implications

A number of policy implications are associated with the empirical findings of the studies of this special issue. Namely:

- Increasing energy security risk leads to higher oil, natural gas, nuclear power and wind power consumption reducing hydroelectric power consumption.
- Countries with higher energy security risks open out their comparative segment of wind energy in total energy consumption.
- Decoupling between GDP and energy consumption in transportation is unique in achieving higher rates of economic development by decreasing CO_2 emissions.
- On the use of different transport infrastructure networks and transport systems, efficient cooperation to cope with increased demand is required to limit environmental damage with lower energy consumption and less traffic hours and accidents.

- Economic globalization indicates among others the rising association and dependence of world economies because of increasing scale of cross-border trade of commodities, services and capital movements.
- Green industrialization may offer developing countries the ability to activate their structural change within the context of existing international industrial development settings.
- Greening of workplaces may lead to sustainable consumption.
- Maximization of energy efficiency may be achieved by jointly choosing sensing duration and detection threshold.
- Information technology, telecommunications and manufacturing are united when production methods become more autonomous.
- Industry affects sustainable development and this implies the significance of fully understanding and monitoring industrial transformations from a sustainability viewpoint.
- Additional 'industrial revolution' is derived from digitalisation and this requires attention on the digitalised industries to fully understand and quantify this potential to adjust any rebound effects.

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