



Going Green

*-A Relationship between Environmental Goals and
Firms' Competitiveness*

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ABSTRACT

There is a possibility to mitigate the externalities from production by expenditures on abatement. However, it is believed that these costs have a negative influence over the firm's competitiveness. Despite the fact that a tradeoff between social benefits (increase of welfare by reduction of environmental problems) and private costs (of the firm) is observed, there is an increasing number of firms that reduce their environmental impact even more than is required (so-called 'over-compliance'). Therefore, the aim of this paper is to find how the firm's competitiveness is influenced under the mandatory environmental regulation by government and under a voluntary initiative of abatement by the firm.

From the literature review it was found that there are three different approaches towards this 'relationship': inevitable loss in competitiveness; no loss or even gain in competitiveness; and finally gain in competitiveness by imposing environmental standards voluntary by the firm itself. Thus two models provided by Palmer et al. (1995) and Porter & Linde (1995), and the concept of Corporate Social Responsibility are discussed.

Compliance costs, productivity measures and changes in trade patterns were used as indicators of the relationship between environmental regulation and firm's competitiveness in empirical studies. It was concluded that no loss or little loss was identified from compliance with environmental regulation for the environmental sensitive industries. On the other hand, gain in firm's competitiveness was observed, when additional environmental standards were set within the firm, under the voluntary approach.

Key words: environmental regulation, international competitiveness, innovation, voluntary approaches, Corporate Social Responsibility

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1 INTRODUCTION

The following chapter consists of the background, problem discussion and brief description of the task. Furthermore, the research methodology of the work is presented.

1.1 Background

An early definition of the sustainability problem was formulated in the World Commission on Environment and Development report in 1987 – ‘Our Common Future’, also known as ‘the Brundtland report’. In this work it was stated that current consumption of environmental resources and the impact of economic activity over the environment will become serious constraints on economic growth in the future. Thus, the concept of *sustainable development* was defined as a development that ‘seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future’ (Perman et al., 1999, 49).

Following this report a United Nations Conference on Environment and Development was held in 1992 in Rio de Janeiro where an agreement for an adoption of Agenda 21 took place. This document provides many different programs which could help with transformation towards a more sustainable path (Perman et al., 1999; Rege, 2000, 294):

Governments and private-sector organizations should promote more positive attitudes towards sustainable consumption through education, public awareness programs and other means, such as positive advertising of products and services that utilize environmentally sound technologies or encourage sustainable production and consumption patterns.

Therefore, there is an important role of the government in the matter of environmental protection and sustainable consumption.

Environmental pollution is an example of a negative externality from a production process of other goods. A market failure occurs as the externalities exist due to undefined property rights and the firms frequently emit effluents harmful for the human health and the environment without paying or not bearing the full cost of their actions. Thus, a governmental intervention is needed which based on pollution policy tries to find ‘feasible ways of achieving the socially

optimal level of pollution, or of at least reducing the social costs associated with externalities' (Helfand et al., 2003, 254).

1.2 Problem Formulation

There is a possibility to mitigate the externalities from the production by expenditures on abatement. However, it is believed that these costs have a negative influence over the firm's competitiveness. Moreover, the relation between the abatement costs and level of pollution is directly proportional: the lower is the level of pollution, the higher are the marginal abatement costs (Helfand et al., 2003). Additionally to the compliance costs, environmental regulations have been criticized for high administrative and transaction costs as well as for inflexibility. Therefore, there has been an increasing interest in market-based environmental policy tools that incorporate 'the external cost of production or consumption activities through taxes or charges on processes or products, or by creating property rights and facilitating the establishment of a proxy market for the use of environmental services' (Segerson & Li, 1999, 273; www, Entwined, 2008).

Despite the fact that a tradeoff between social benefits (increase of welfare by reduction of environmental problems) and private costs (of the firm) is observed, there is an increasing number of firms that reduce their environmental impact even more than is required. This phenomenon of "over-compliance" or "corporate environmentalism" helps firms to reduce the sources of possible conflicts between them and society (i.e. pollution of the environment). What is more, there are examples of firms that have increased their (international) competitiveness by over-compliance (Heal, 2007).

Therefore, it is interesting to discuss how the firm's competitiveness is influenced under the mandatory environmental regulation by government and under a voluntary initiative of abatement by the firm.

1.3 Aim

First of all, this paper aims to address the fundamental question – *Does the compliance with environmental policies [the costs] influence the competitiveness of the firms and if yes – how is it directed (positive or negative influence)?* Moreover, *what is the influence on the firm's competitiveness of the implementation of a higher environmental standard?*

Secondly, a closer insight is made towards the concept of Corporate Social Responsibilities with a focus on environmental issues. *What are the incentives for a firm to voluntarily initiate an improvement of environmental standards?*

Finally, taking into consideration all the above it is interesting to discuss – *What should be the ideal policy strategy – the mandatory regulation by government or the voluntary initiated by the firm or maybe a mix of both?*

1.4 Research Methodology

There are two different types of research methods to choose from when conducting a scientific study. One can either choose to utilize a qualitative or quantitative method (Wallen, 1996). A decision of what methods to use for the study should focus on the method that is best suiting the intended study. The decision should be based on what problem formulation, resources and previous research experience is used (Holme & Solvang, 1997).

Due to the purpose of this work, both a qualitative and quantitative research methods were used to gather information. It was collected by literature research where scientific articles, related books and international web sites were utilized in order to get a better understanding of the topic.

1.5 Outline

The paper is organized as follows. Section 2 discusses the concept of firm's competitiveness, providing the definition of international competitiveness, how it can be measured, and what factors affect it the most. In Section 3, the influence of environmental regulation on the firm's profits is illustrated using basic economic theory. Furthermore, the direction (positive or

negative) of this influence is discussed using two approaches – one of them is characterized as the conventional one and the other is the new, dynamic approach. Following that, an overview of empirical studies on the relationship between environmental regulations and firms' international competitiveness is given in Section 4. The incentives for firms to undertake voluntary actions and the concept of Corporate Social Responsibility are presented in Section 5. Taking into the consideration all the information gathered, a discussion in Section 6 examines the relationship between environmental regulations and firms' international competitiveness. Major findings and conclusions are summarized in the final section.

2 FIRM'S COMPETITIVENESS

This chapter presents the definition of competitiveness of a firm and how that can be measured, as well as the concept of international competitiveness. Environmental issues are postponed to later sections.

2.1 Definition

According to Depperu & Cerrato (2005)¹, competitiveness is closely related to competitive advantage since it directly affects the firm's performance. Thus, the firm's competitiveness 'indicates a firm's ability to design, produce and market products superior to those offered by competitors, where superiority can be evaluated from several factors, like price, quality, technological advancement, etc' (Depperu & Cerrato, 2005, 4). The firm's competitiveness is often associated with firm's profits. Therefore, the higher the profit, the more competitive is the firm.

Apart from the firm level, competitiveness can be considered also at the industry level, in other words in an 'industrial cluster' (Aiginger, 1998). The competitiveness at the industry level is of a great importance since it better reflects the condition of the nation's economy than the competitiveness at the firm level. That is due to the fact that the success of one firm in the nation can be a result of company-specific factors whereas the success of several firms from the same industry is more probable to reflect the nation-specific factors and therefore indicates the nation's potential (www, TCI, 2006). Under open trade conditions, the competitiveness of industries can be compared between regions and nations (Depperu & Cerrato, 2005).

Moreover, there is also a discussion over the concept of a nation's competitiveness. Aiginger (1998) argues that there are many definitions which do not fully describe the problem and proposes a new definition of a nation's competitiveness 'as the ability of a nation to sell enough products and services in the world [measured in the balance of the current account or in the world market shares], at factor incomes in line with the country's aspiration level and at macro conditions seen as satisfactory by the electorate' (Aiginger, 1998, 164). However, Porter (cited

¹ This chapter builds largely on Depperu & Cerrato (2005).

by Aiginger (1998)) rejects the concept of a nation's competitiveness and focuses on the industrial cluster level, since 'no country can be competitive in all industries'. In this work, the concept of competitiveness will be used in terms of firm and industry level.

2.2 What Factors Influence Firm's Competitiveness?

Depperu & Cerrato (2005) state that the most important factors that influence the firm's competitiveness are: 'resource endowments, cost of labour and production inputs, financial and technological infrastructure, access to markets, institutional and regulatory frameworks' (Depperu & Cerrato, 2005, 4).

On the other hand, Depperu & Cerrato (2005) cite Porter (1980), who defines the competition at the industry level using the following indicators: 'current competition within the industry, bargaining power of suppliers, bargaining power of buyers, threat of new entrants, threat of substitute products or services'.

The authors consider profitability, costs, productivity and market share as commonly used measurements of the firm's competitiveness, with the profitability being the most important one. It is measured using the financial performance indicators such as ROA, ROS, ROI and Value added per employee (Depperu & Cerrato, 2005). There are also other nonfinancial performance indicators (e.g. market share, percentage of loyal suppliers, etc.) and other variables (e.g. innovativeness, quality, working conditions of employees, etc.) that are useful when assessing the firm's competitiveness. Therefore, there are many factors that constitute for the competitiveness of the firm and thus more than one indicator should be considered under the specific time and spatial conditions when the competitiveness of a firm or an industry is assessed (Depperu & Cerrato, 2005).

2.3 International Competitiveness

The international competitiveness of the firm is described as the 'firm's capability to achieve higher performance than its competitors in foreign markets and preserve the conditions that sustain its higher performance also in the future' (Depperu & Cerrato, 2005).

Depperu & Cerrato (2005) suggest that the international competitiveness should be considered in terms of the firm's performance (measured by the export market share), competitive potential and the management practices (which are important in improving the performance and developing and using the potential).

The following indicators (preferably all of them) can be used in order to measure the international performance (also called 'ex post' competitiveness) (Depperu & Cerrato, 2005):

- International market share (it is suggested to use a 'profitable market share' so that the industry norm of profitability is sustained);
- Rate of growth of the foreign sales and total sales ratio (assuming that the trend of the total sales in non-decreasing);
- Return on foreign investments (measured with e.g. ROI and ROA).

Moreover, the 'ex ante' competitiveness could be determined using the following variables (Depperu & Cerrato, 2005):

- Quality of international customers;
- Brand recognition in international markets;
- Listing in foreign stock exchange;
- Number of international patents and trademarks.

Summing up, there are many variables that determine the firm's competitiveness, however, the profitability of the firm is considered as the most important one. Thus, if any factor leads to a decrease in firm's profits, it is inevitably connected to a loss of the firm's competitiveness. Environmental regulations are thought to be one of the threats to firm's competitiveness since the associated costs lower the firm's profit. In the next section, the influence of environmental regulation on the firm's profits is explained using basic economic theory.

3 ENVIRONMENTAL REGULATION & COMPETITIVENESS

The following chapter provides a short description of environmental regulation, its impact on the firm's competitiveness, using the 'old' and 'new' (dynamic) approach to the problem.

3.1 Environmental regulation

The role of environmental regulation is first to determine a socially optimal level of pollution and then use appropriate instruments to achieve this level. The marginal damage function (i.e. damage caused by the negative externality, e.g. pollution) and the marginal benefit function (i.e. the benefit from the good or service produced, which is related to the externality) are used to find the socially optimal level of pollution. In Figure 1 below the marginal benefit function is at E^* equal to the marginal cost. Note also that the marginal benefit function coincides with the marginal abatement cost function. This means that the marginal cost of reducing the pollution is equal to loss in the marginal benefits from pollution at that point. By maximization of net benefits (benefits from pollution minus damages from pollution) it is found that the marginal benefit (marginal abatement cost) should be equal to marginal damage.

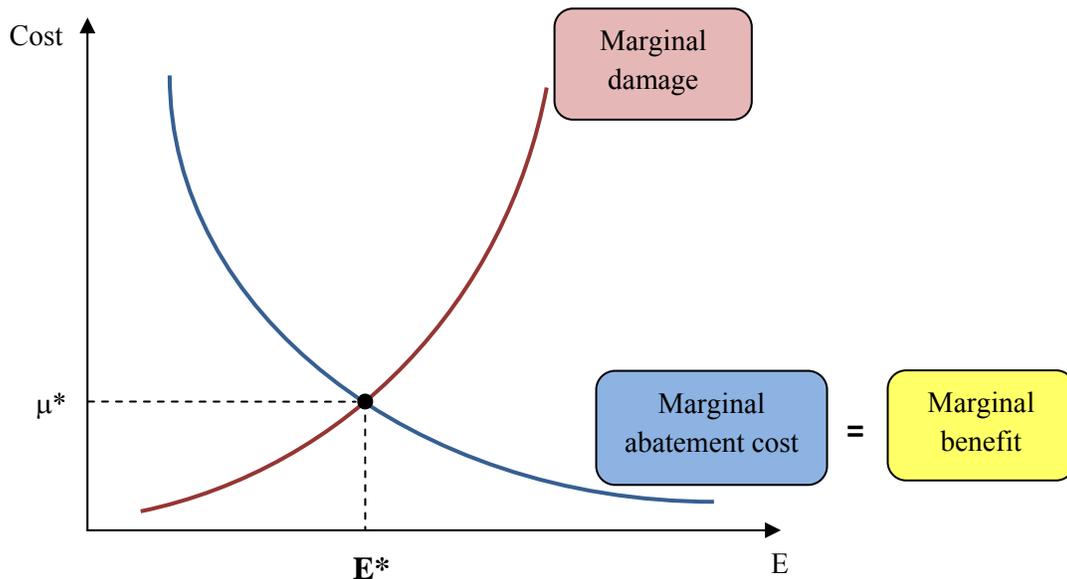


Figure 1. Determination of the economically efficient level of pollution (Source: Perman et al., 1999).

Therefore a socially optimal (economically efficient) level of pollution, E^* , is determined by the intersection of the two curves. Moreover, the shadow price, μ^* , of the pollution is also found.

The economically efficient level of production can be obtained by using different instruments, from which ‘command and control’ and ‘market-based’ are the most successful (see Table 1.).

Table 1. Classification of pollution control instruments (Source: Perman et al., 1999).

Institutional approaches to facilitate internalisation of externalities

Enabling bargaining
 Legal redress
 Education/awareness/social responsibility
 Creation of property rights

Command and control instruments

Inputs/technique	Minimum technology requirements, BAT, BATNEEC
Outputs	
Intended output	Quotas
Pollutant	Emission, permits, licenses, quotas
Location	
Of source	Zoning, planning controls, relocation
Of individual	Relocation away from toxic areas
Timing	Noise regulations
Prohibition of activity	

Economic incentive (market-based) instruments

‘Pollution’ taxes	On inputs On emissions
Pollution abatement subsidies	
Marketable (transferable) emissions permits	

Through the ‘command and control’ instruments, the government sets uniform environmental standards, based on what could be achieved by using the ‘best available technology’ (BAT). Moreover, it also decides on the abatement technology that should be used to meet the standards. Thus, the firms that comply with the regulations are issued a licence and those who not – are subject to penalties. Despite the simplicity of this type of the regulation, ‘command and control’

instruments have some disadvantages. Perhaps most importantly, it is not a cost-effective regulation, since the uniform standards and technologies do not take into account different abatement costs facing individual firms. Therefore, the regulated level of pollution would be reached at too high costs, implying welfare losses. Moreover, there are no incentives for the firms to reduce their pollution emissions more than what is required; and with the technology set up by the government, no incentives for innovation exist. Further, the penalties imposed for non-compliance are said to be too low. Finally, conditions (e.g. technology, awareness, etc.) are changing all the time and standards need to be revised but there is always a long time until the implementation of a new standard takes place (Golub, 1998; www, ESCAP, 1).

On the other hand, 'market-based' instruments (MBIs) use price signals or other economic variables in order to give incentives for firms to reduce the pollution emissions. When a tax on emissions is used, it internalizes the externalities (i.e. pollution costs) into the private costs of firms. If properly imposed, the tax is equal to the value of marginal damage at the efficient level of pollution (E^*). Tax readjustments are possible to achieve the desired efficient level of pollution (Perman et al., 1999). This instrument is a flexible and cost-effective solution as it allows the firms to reduce the pollution with the lowest cost possible. Furthermore, the tax gives strong incentives for the firm to invest in R&D and adopt new technology in order to lower the costs imposed. Nevertheless, if the costs of compliance are high, the firm may decide to 'include' a proportion of the tax in the price of their product, and as a result the consumers will partially pay for the pollution caused by the production of this product. What is more, the tax based on the pollution emission levels requires firms to monitor the pollution which in case of some specific chemical compounds might involve high costs (e.g. installation of monitoring equipment, training of the employees, etc.) (www, ESCAP, 2).

Summing up, both 'command and control' and 'market-based' instruments will influence (with a different extent) the firm's profit. Following that, there is a possible loss of the firm's competitiveness. Different approaches used to characterize the influence of environmental regulations on firm's competitiveness are discussed in next subsection.

3.2 Impact of environmental regulations on firm's competitiveness

Xu (1999) identifies three approaches used to describe the relationship between the environmental regulations and firm's competitiveness:

- Race to the bottom effect

Knill et al. (2008) explains that low-regulatory countries² experience much pressure from the international regulatory competitiveness and due to this fact they tend to keep their environmental regulations at low levels and in this way preserve their (industry's) competitive position.

- Pollution haven hypothesis

It is assumed that under the free trade conditions between countries with different environmental regulations, the environmentally sensitive industries (high pollution emitters) will tend to move from countries with high environmental regulation to other with less restrictive environmental standards. Bommer (1999) points out the potential problems that arise from this situation. Firstly, the countries with low environmental standards can use that to gain competitive advantage over other countries leading to an 'eco-dumping' phenomenon. Secondly, the relocation of the firm to the country with low environmental standards might be a result of strategic decisions of an entrepreneur. In this way the firm can signal a low adaptability to higher environmental standards and may convince the government not to further increase the regulations (Brommer, 1999).

- Reduction in international competitiveness of environmentally sensitive industries under the increase in stringency of environmental regulations.

In this study the last approach will be used to discuss the relationship between environmental regulation and firm's competitiveness. The environmentally sensitive (goods) industries, in United States, can be defined as those with high levels of abatement and control expenditures per unit of output as well as those with high levels of emissions per unit of output. High abatement

² High-regulating countries are defined to have an advanced level of economic development, and give high priority for the quality of the environment and are willing to pay the costs for stringer environmental policy. On the other hand, low-regulating countries are poor or less developed and do not have a high priority over the quality of environment and prefer to have less stringer environmental policy (Knill et al., 2008).

costs are defined as approximately 1% or more of the value of the total sales, and in United States in specific the number should be equal or greater than 1.85% (Ratnayake, 1998). Following these criteria five industries have been identified as environmentally sensitive: iron and steel, nonferrous metals, industrial chemicals, pulp and paper, and non-metallic products (Xu, 1999).

3.2.1 The 'old' approach

According to Palmer et al. (1995) the relationship between environmental regulation and competitiveness always implies a trade-off between social benefits and private costs. In this 'static model' all the variables (i.e. technology, processes, customer's preferences, etc.) are assumed to be fixed (stable). Therefore, the introduction of any environmental regulation will impose additional cost for the firm and thus reduce the firm's net profits and competitiveness (Palmer et al., 1995; Porter & Linde, 1995).

This approach might be explained by using the following profit function (π):

$$\pi = F(K, AL, E) - rK - wL - (P_E + \tau)E \quad , \quad (1)$$

where: $F(K, AL, E)$ is a production function, which defines the maximum quantity of output that is possible to produce given the values of K , L , A and E ; K is capital; A is a productivity factor; L is labour; E is a polluting input (energy); r is cost of capital; w is cost of labour; P_E is price of energy; and τ is a tax on polluting input (energy).

Maximization of the profit function with respect to K , L and E gives the optimal level of capital – $K^*(A, \tau)$; the optimal level of labour – $L^*(A, \tau)$; and optimal level of energy – $E^*(A, \tau)$. All the variables depend on the productivity factor and the tax on energy (and the factor prices).

Since the discussion in this paper considers the problem of the introduction of tax or increase in the tax value as well as the possibilities for innovation (increase in the productivity factor), it is therefore interesting to discuss the influence of these factors on each of the variables:

- $K^*(A, \tau)$: increase in productivity factor (A) would lead to an increase in capital; and increase in tax on energy would not have a direct influence over the capital since it does not depend on energy. On the other hand, an increase in tax on energy might cause a

secondary effect of a decrease in investments and following that a decrease in capital value.

- $L^*(A, \tau)$: increase in productivity factor has a positive impact on labour; and increase in tax on energy would not have a direct influence over the labour since it does not depend on energy. However, a significant increase in tax on energy might have a negative impact on the labour since it could lead to a profit-maximizing decision to decrease the number of employees.
- $E^*(A, \tau)$: increase in productivity factor (e.g. using more energy-efficient technology) would have a negative impact on energy input (increase in productivity factor means that less energy is needed to obtain the same output); and increase in tax has a negative impact on the energy input (the higher the tax on energy, the less energy is used).
- Overall the optimal profit of a firm [$\pi^*(A, \tau)$] increases when the productivity factor increases, however, all the possible influence on the variables K , L and E discussed above has an insignificant impact on the profit function. Thus, when the tax increases, the profit of the firm decreases.

3.2.2 The 'dynamic' approach

Porter & Linde (1995) suggest a new *dynamic* approach to the relationship between environmental standards and competitiveness. This model is based on a new definition of a competitive firm, for which innovation³ and ability to improve continually is a source of comparative advantage.

For this approach, the same profit function (π) is used as in the previous section:

$$\pi = F(K, AL, E) - rK - wL - (P_E + \tau)E$$

However, in this new model the productivity factor (A) is defined as a function of tax (τ):

$$A = A(\tau).$$

³ The term 'innovation' is used in many meanings: 'to include a product's or service design, the segments it serves, how it is produced, how it is marketed and how it is supported' (Porter & Linde, 1995).

Considering an increase in stringency of regulations (higher tax), it would lead to an increase in the productivity factor and thus give an incentive for innovation. Then the change in the optimal profit [$\pi^*(A(\tau), \tau)$] of the firm depends on the two factors: the increase in tax would lead to a decrease in the firm's profits (from the direct relation between the firm's profits and tax) and on the other hand, the increase in the tax would also lead to increase more intense innovation activities, leading to higher productivity. This therefore raises in the firm's profits (from the indirect relation between the firm's profits and tax, as a function of productivity factor). The final influence over the firm's profits depends on which of these two forces is stronger.

3.2.3 Differences between the two approaches

Palmer et al. (1995) argue that the influence of the tax on the productivity factor is insignificant and therefore can be neglected in this model, whereas 'increasing the stringency of incentive-based environmental regulations (e.g. tax) must result in reduced profits for the firm' (as it was explained using profit function in section 3.2.1). To support their hypothesis, the authors of the article provide a model that presents their argument on the example of effluent charge⁴. It is explained that expenditures on research and development (R&D) and investment in new technology are considered in terms of a cost-benefit analysis and any of these actions will not be taken unless the cost-savings from the new technology will exceed the R&D costs. Thus, if a firm did not decide to invest in new technology before or under the environmental regulation, it is unlikely that it will do that when the environmental regulation is introduced or more stringent. Moreover, with the proposed model, Palmer et al. (1995) show that despite the new technology possibilities, the introduction of higher environmental standards will reduce profits of the firm. The proposed analysis is admitted to be simplified and a discussion of two factors, namely the strategic behavior and innovation possibilities, follows in order to find a positive influence of stringent environmental regulations on firm's profits. The factor of strategic behavior extends the conditions of the proposed model allowing for strategic interaction between different parties involved. Although there are cases where a stringent environmental regulation has improved the firm's international competitiveness, it is possible only under special conditions.

⁴ For a detailed discussion over the model see Palmer et al. (1995).

On the other hand, Porter & Linde (1995) believe that it is the effect on the productivity factor that plays a dominant role in the firm's profit function. Therefore the role of environmental policy should be to stimulate innovative solutions and thus improve the firm's competitiveness. Moreover, they argue that innovation can offset the costs of compliance with environmental regulations (so-called 'innovation offsets'). In this model, if a higher environmental standard is imposed and following that there are high costs of compliance for the firm, it may trigger more possibilities for 'innovation offsets'. Thus, the more stringent the regulation, the lower *net* cost of compliance can be, leading eventually to net *benefits*. There are two types of changes due to innovation: the first one is the improvement in pollution control technology (only the costs of compliance are reduced) and the second leads to the improvement of the process or product (e.g. improved product performance or quality, reduced product costs, increased in product yields, reduced downtime, substitution of less costly materials, converting waste into recyclable input, etc.) that is affected directly under the environmental regulation (that could offset the costs of compliance)⁵.

However, the concept of 'innovation offsets' is absolutely rejected by Palmer et al. (1995). The authors claim that, even if uncertainties in estimating the costs and benefits are taken into account, the only possible offsets are very low, i.e. the data suggests that for each \$50 spent on abatement, the firm have \$1 in return, which is a result of low rate on investments in the field of environmental protection.

What is more, Palmer et al. (1995) state that low environmental standards should be used to improve the international competitiveness of domestic firms. Porter & Linde (1995) suggest an opposite argument, saying that more stringent environmental regulation is the response to the growing world demand towards environmentally-friendly goods (i.e. produced with low-polluting and energy-efficient technologies). Thus, early imposed environmental standards on the national level can lead to innovative solutions and increase the firm's competitiveness (a so-called 'early-mover advantage'). However, the authors stress that it is important to properly

⁵ Authors of the paper support each 'innovation offset' with examples from United States' industry. For more details see Porter & Linde (1995).

design environmental regulation in order to stimulate innovation. First of all, there should be a focus on the outcome of the policy, not on the technology used to comply with it. The market based instruments are preferred to the command and control instruments providing more flexibility for the firms. What is more, regulators have to consider the whole chain of production and possible technology and resource efficiency improvements, in order to apply the regulation where it is most likely for innovation. Secondly, there is an important role of Environmental Protection Agency (EPA) and other organizations to provide credible information regarding innovative successful technology solutions as well as other relevant 'innovation offsets'. Finally, the regulatory coordination needs continuous improvement, i.e. any environmental regulations should be discussed by the regulatory body and the industries involved before the policy is implemented; there should be a good cooperation between different regulatory bodies in government, which in turn would be coordinated by a centralized body; there is a need for cooperation between nations' regulators in order to set the right environmental regulations, preferably on a slightly higher level than other nations to gain a comparative advantage (Porter & Linde, 1995).

Both authors, Palmer et al. (1995) and Porter & Linde (1995) agree that the benefit-cost approach should be the basis for analysis of any environmental regulations to be implemented. Furthermore, Porter & Linde (1995) suggest that once the environmental regulation is implemented, the firm needs to change its attitude towards the policy as a source of additional unnecessary costs, and choose a strategy to gain benefits. Therefore, the assessments methods for costs and benefits need to be changed in a way that 'indirect or hidden costs (like compliance costs, insurance, on-site waste management, operation of pollution control and future liability) and less tangible benefits (like revenue from enhanced company image)' will be taken into account (Porter & Linde, 1995).

Finally, despite the high cost of environmental protection, Palmer et al. (1995) agree that there is no evidence for environmental regulation to have a negative impact over the firm's international competitiveness. Moreover, Porter & Linde (1995) believe that the relationship between

environmentalism and industrial competitiveness can be complementary assuming that innovation-based solutions are used.

4 EMPIRICAL STUDIES

Many empirical studies have been conducted in order to examine the influence of environmental regulation in high-regulating countries' on firms in terms of abatement expenditures, changes in productivity or trade patterns.

4.1 Compliance costs and competitiveness

Dean (1992) has done a literature review on this subject, concluding that the environmental control costs (ECC)⁶ on average remain a small percent of the total costs of production (e.g. for United States in 1968-1970 the value of ECC was 1.75% and 1.52% of the value of exports and imports, respectively). There were however, some high values of ECC recorded, which could imply loss in competitiveness, for the following industries: construction, mining and plastics (Dean, 1992).

The study by Jaffe *et al.* (1995) supports the results obtained by Dean (1992). Again, the United States were examined and there was no significant impact of environmental regulation (the value of ECC was estimated to be around 2%) on the firm's competitiveness. However, high values of ECC were recorded for the following industries: electrical utilities, chemical, petroleum refining and basic metal manufactures. The authors point out that these conclusions have to be taken with certain precautions due to the fact that the data available for the studies is often unreliable.

Stewart (1993) cites the work of Tobey (1990), who analyzed the pollution control costs faced by high-polluting industries in 1970's in the United States. He found that these costs accounted for 1.92-2.89% of the total production costs for these industries.

⁶ Environmental control costs (ECC) are defined to 'include capital costs of environmental control equipment, depreciation on existing such equipment, operational costs associated with environmental management and research and development expenditure for compliance for environmental standards' (Ratnayake, 1998).

4.2 Productivity measures

The productivity of a firm is measured by how much of input is used in order to obtain one unit of output (www, Economics Web Institute, 2001). Thus, the more output is obtained using one unit of input, the higher the productivity. Therefore, the firm with high productivity (low costs of production) will have a competitive advantage. Imposing environmental regulations would lead to additional costs of prevention and control measures, which might result in decline of productivity (Stewart, 1993).

Stewart (1993) cites the study of Barbera and McConnell (1990), which reports a significant decline in productivity growth (by 10-30%) in the environmentally sensitive goods industries in the United States during the 1970's (when environmental regulations were tightened). However, other studies show that the general decline in productivity growth of United States' industries during 1970's and 1980's was not so significant and accounted for 1.5-1.1% only⁷. Stewart (1993) states that there might be different reasons behind the productivity's decline, such as: 'the energy price shocks, insufficient R&D expenditures, diminishing R&D returns, the changing composition of the work force, insufficient investment (or savings) resulting in less than optimal new capital, and poor managerial performance'. From these findings, it can be concluded that the environmental regulations imposed on firms in the United States, accounted for an annual decline in productivity by 0.2% on average (Stewart, 1993).

4.3 Changes in trade patterns

The compliance costs associated with environmental regulations can also influence the trade patterns. It is assumed that if in one country the compliance costs are higher (i.e. stringent environmental regulations) than in other countries, then it is expected that this country will export more goods that have low compliance costs and import more goods with high compliance costs within their country. Therefore, if the assumption of high compliance costs having a significant influence over the production costs is true, then the exports [of goods under the regulation] in high-regulating countries should decline and imports should increase compared to the low-regulating countries (Stewart, 1993; Ratnayake, 1998).

⁷ For more detailed information regarding different studies, see Stewart (1993).

Stewart (1993) refers to a study by Low and Yeats (1992) who examined the trade patterns of high-polluting industries between different countries in the period of 1965-1988⁸. They found evidence that there was a significant decline in exports in developed countries due to higher environmental regulations and, on the other hand, that a significant increase in exports of the same industries in developing countries was observed. However, the compliance costs were found to be a small percentage of total costs of production. Furthermore, the authors suggest other possible reasons behind the observed trade patterns' changes, namely: 'the pull of lower-cost labor or natural resources in the developing countries, or a compositional effect reflecting the relatively greater importance of pollution-intensive processes in national output during a nation's stage of heavy industrialization'. Another study, by Tobey (1990), analyzed the trade patterns of high-polluting industries in the 1970's in different countries using statistical methods and he found no correlation between the environmental regulations and change in exports or imports⁹ (Stewart, 1993).

A very comprehensive research was done by Xu (1999) who examined a large group of countries to find any type of change in the exports pattern for environmentally sensitive goods between the period of time 1965-1995. A set of 34 countries which accounted for 80% of the world's export for environmentally sensitive goods was selected for the study. The most important outcome of this work is that there were no changes observed in exports performance during the time period given, despite the fact that in many developed countries stringent environmental regulations were introduced in the 1970s and 1980s. Therefore, there is no justification for loss in international competitiveness based on the data used. However, Xu (1999) states that there is need for a more detailed study to fully assess the relationship between environmental standards and international competitiveness.

Sorsa (1994) analyzed data for trade patterns of environmentally sensitive goods and ECC with a focus on a group of high-regulating countries: Germany, Japan, Austria, Finland, Norway, Sweden and the United States. This study concludes that there is no significant correlation

⁸ For more detailed information regarding different studies, see Stewart (1993).

⁹ *Ibid.*

between environmental regulation and competitiveness. What is more, these countries had no loss in competitiveness within the period of 1970-1990 taken into the consideration for the study. Another similar study by Dean (1992) (based on U.S. data) confirmed Sorsa's results and found the influence of environmental regulations on the trade patterns to be minor.

There has been research focused not only on large industrial countries (most commonly on the United States). Ratnayake (1998) has written an interesting paper on the relationship between the environmental regulation and international competitiveness for New Zealand. As in the previously mentioned studies it was based on the observation of trade patterns for environmentally sensitive goods and, no significant influence over the country's competitiveness was found. Moreover, the author states: 'in terms of econometric results, there is no substantial evidence to suggest that environmental stringency leads to loss of international competitiveness'. Instead, there was evidence showing *gain* in comparative advantage for New Zealand, however, lack of data on pollution control expenditures from the industry sector could not explain the reason behind that (for example the gain in comparative advantage could be caused by productivity or environmental control techniques improvements) (Ratnayake, 1998).

3.4 Tightening environmental standards

It is also interesting to take a point of view of the demand side for environmental quality. Rege (2000) claims that tightening environmental standards is not the only solution, or might not be the first attempt, to obtain better environmental quality. Rege (2000) states that assuring the compliance with environmental standards is a way to help the domestic industry to provide more credible information about the environmental quality of its production and therefore increase its international competitiveness. Firms should be required to produce at the environmental standards that they claim to meet and or else pay a penalty if found cheating. It is argued that the 'credible information will differentiate domestic products from other products on the world market, and in this way increase consumers' willingness to pay for domestic products'. Therefore there is a need not only to promote environmentally friendly technology and products

but also take action to reduce the problem of asymmetric information in order to minimize the incentives for cheating (Rege, 2000).

Summing up, different measures were used in order to assess the influence of the environmental regulations on the firms' competitiveness. It was found that there is no or little loss in competitiveness after implementation of environmental policies. Furthermore, it was observed that introduction of more stringent environmental standards again did not have a significant influence on the firms' competitiveness. What is more, the compliance with environmental standards can lead to a gain in firms' competitiveness. In the next section, it is presented that firms have incentives to voluntarily improve their environmental performance in order to increase their domestic and international competitiveness.

5 VOLUNTARY APPROACHES

In this section an introduction to voluntary approaches and a concept of Corporate Social Responsibility is provided.

5.1 Definition

Sullivan (2008)¹⁰ defines voluntary approaches as ‘schemes where organisations agree to improve their environmental performance beyond legal requirements’. However, these ‘voluntary’ actions are often undertaken due to different pressures on the firm, as for example pressure from consumers or community, pressure from the other firms in the industry, competitive pressure or the probability that a new environmental regulation will be introduced by the government.

Voluntary approaches can result in many financial benefits for the firm, e.g. better compliance (the firm can individually set the target abatement level and design their compliance strategy based on their own information, thus uncertainty and the risk of asymmetric information is reduced), improved litigation risk management, better relations with shareholders and society, improved brand or reputation, better morale within the participating parties. Moreover, there are other benefits, such as gaining knowledge on possible abatement technologies that can be used, sharing of information and experience, etc. On the other hand, one has to realize the disadvantages of voluntary approaches, like: sometimes low environmental effectiveness (when low abatement level has been achieved), lack of reliability (some of the agreements do not imply any penalties for non-compliance), questionable efficiency benefits (it has been found that firms use a uniform standard instead of differentiating their strategy to obtain the lowest abatement costs), very often it is used to avoid stringent environmental regulation that might be implemented (Sullivan, 2008).

Nevertheless, the voluntary approaches can play two significant roles in environmental policy area. First of all, it can be used as a transitional policy instrument for the firm to prepare for the introduction of a new or more stringent regulation, as well as to encourage leadership and

¹⁰ This section is largely based on Sullivan (2008).

innovation. Secondly, voluntary approach might be used as a mechanism to address some of the limitations of the corporate cost-benefit assessments (for example to turn the focus of investments on long-term business sustainability instead of short-run returns) (Sullivan, 2008).

One of the examples of voluntary approaches is a concept of Corporate Social Responsibility, which is discussed in the next section.

5.2 Corporate Environmentalism

The ‘Corporate Social Responsibility’ (CSR) concept is defined as the sacrifice of the firm’s profits in the social interest (Reinhardt et al., 2008). This goal of the CSR programme is to internalize the externalities produces in order to minimize or avoid the possible sources of conflicts between firms and the society that could occur in the long-run (Heal, 2007). An example of such a source of conflict is pollution – an externality which shows the private-social cost differences – the costs for society are much higher than the private costs for the firm (Heal, 2005).

The CSR programme is a multidimensional concept, which is commonly divided into four main areas (www, EC, 2008):

- Workforce CSR, which is related to the relationship between the employer and the employees (e.g. payment and working conditions, recruitment, diversity of the work force, health and safety, as well as human rights issues, etc.)
- Marketplace CSR, which relates to the relationship of the firm with its suppliers, consumers and competitors (e.g. imposing social and environmental standards on suppliers, management of consumer complaints, etc.)
- Environment-related CSR, which is connected to any kind of actions which, if taken by the firm, would decrease its negative impact on the environment (e.g. waste reduction, energy-efficient technologies, etc.)

- Community-related CSR, that is associated with the relationships between the firm and the community which is affected by the firm's operations (e.g. 'active contribution to community wellbeing [using] employee volunteering schemes', etc.).

Heal (2005) defines six mechanisms linked to CSR programmes that lead to higher profits and enhanced competitiveness of the firm in the long-run, including: reduction of risk (i.e. minimizing the possible conflicts with the society which in some cases could lead to a significant loss in competitiveness), reduction of waste (due to better management of inputs and processes in the production), improvement of relations with regulators (which is of a significant importance for future negotiations where an environmentally friendly profile of the firm is going to be a big advantage), generation of brand equity (the same goods which are present on the market very often do not differ significantly in their features or in the costs of their production, thus the firm needs to seek an additional way to attract the consumer, e.g. by an environmentally friendly profile), improvement of human relations and employee productivity (employees are willing to work for firms associated with a positive social image, which helps firms to a successful recruiting process and maintains motivation of the employees), decrease in cost of capital (with the connection to the Socially Responsible Investment programme) (Heal, 2005).

However, the authors of the European Competitiveness report (2008) state that the strength of the positive impact of each of these mechanisms, and the extent to which it is relevant to all firms, varies. Each case of CSR is unique for different sectors, sizes and conditions related to the current situation of the firms. The strongest evidence of a positive impact of CSR programmes on competitiveness was found to be in the cases of human resources, risk management, brand equity generation and innovation (www, EC, 2008).

6 DISCUSSION

In this section problems formulated in the introduction chapter will be analyzed and discussed.

6.1 Environmental regulation and competitiveness

In the first question of this paper – *Does the compliance with environmental policies [the costs] influences the competitiveness of the firms and if yes – how is it directed (positive or negative influence)?* – the influence of environmental regulation on firm's competitiveness and its consequences are to be found. From the literature review it is interesting to find three different approaches towards this 'relationship': inevitable loss in competitiveness; no loss or even gain in competitiveness; and finally gain in competitiveness by imposing environmental standards voluntary by the firm itself. The first two theories are discussed here, while the voluntary approach and corporate environmentalism will be discussed in the next section.

Conventional theory on firm's competitiveness suggests that the cost of production inputs, financial and technological infrastructure as well as institutional and regulatory frameworks are among the main factors that influence competitiveness (Depperu & Cerrato, 2005). Therefore imposing pollution control measures, by changing the technologies which were used, implementing new standards to production processes, or any other changes due to environmental regulation would be followed by costs and thus decrease the firm's profitability and its competitiveness. Palmer et al. (1995) follows this 'old' approach and explains the loss in profits for the firm based on a simple economic model. This model is assumed to be a static one where all the variables (i.e. technology, processes, customer's preferences, etc.) are constant. Then, under these conditions any additional costs (from environmental regulation) would result in a decrease in profits. Thus, the government should choose to impose low environmental standards in order to preserve the international competitiveness of the domestic firms. However, such a model does not properly reflect the reality, where the variables being considered are constantly changing – for example new, more efficient, energy-saving technologies are being used, new, simpler processes for production are being invented, the customers' preferences are changing toward more environmentally friendly goods and services, etc. Therefore, this model could rather be used for a short-run analysis of the influence of environmental regulation on the firm's

competitiveness. Then using a cost-benefit analysis, in a short-run the firm's compliance costs will be definitely higher than the benefits due to the high capital nature of any kind of investments done in the field of environmental protection. Using this approach, the loss in competitiveness is inevitable.

On the other hand, the theory also implies that the international competitiveness of the firm should be considered in terms of firm's performance, competitive potential, and management practices which improve and develop the former (Depperu & Cerrato, 2005). Thus, constant improvement, development and changes connected to these processes are inevitable. Porter & Linde (1995) provide a dynamic model of the relationship between environmental regulation and firm's competitiveness taking into the consideration changes in the variables mentioned in the previous section, which might be a better illustration of reality. They argue that innovation and constant changes are the drivers of the firm's competitiveness. This approach might be more appropriate for a long-run analysis since innovation and changes (especially considering the field of environmental protection) need considerable amounts of time to take place and are characterized with low rate of return on investments. Thus, it is possible in the long-run that (stringent) environmental regulation will give incentives for the firm to invest and innovate, which could eventually give a lower net cost of compliance ('innovation offsets'), leading eventually to net benefits.

Compliance costs, productivity measures and changes in trade patterns were used as indicators of the relationship between environmental regulation and firm's competitiveness in empirical studies. The compliance costs were typically found to be a small percentage (less than 3%) of the total costs of production for firms, although there were industries (namely construction, mining, plastics, electrical utilities, chemical, petroleum refining, basic metals) which could suffer from higher costs of compliance. On the other hand, the productivity measures imply that environmentally sensitive industries may suffer from 10-30% decline in the productivity growth, while other industries in general may experience as low productivity decline as 1% or less. Finally, from the studies using the last indicator, the result was the same and implied that there are no or minor changes in the trade patterns especially in the period of 1970's and 1980s' where

a stringent environmental regulations were introduced by the government in the United States. Moreover all the studies confirm to find no significant evidence for the hypothesis that environmental regulation leads to the loss or gain in competitiveness. Therefore, from empirical studies there is no support for any of the hypothesis (the static or the dynamic approach) on the relationship between environmental regulation and firm's competitiveness.

The possible decrease in industries' competitiveness especially in the environmentally sensitive sectors might be a result of the type of policy instruments used in different nations during the period considered by the empirical studies. Steward (1993) states that not only the differences in the stringency of environmental regulations between nations but also the policy instruments used as well as the legal and administrative approaches applied, are the most important factors influencing the firm's international competitiveness. The relatively rigid command and control instruments and highly complex regulatory law are believed to be a source of comparative disadvantage for the United States (Steward, 1993).

One has to realize that these empirical studies have some error possibility and are not fully reliable. The reason for that is that many compliance costs measures provided by the Environmental Protection Agencies are taken directly from firms which might not include all the costs. Furthermore, other regulatory bodies require different costs to be taken into account by firms when information on compliance costs is to be submitted. Additionally, it is hard to assess all environmental benefits gained by compliance. Thus, the data is of a poor quality and for the present, especially under the market-based instruments, costs and benefits are even more difficult to be assessed (Steward, 1993; Jaffe et al., 1995).

While there are many empirical studies that analyze the relationship between environmental regulation and firm's competitiveness, almost each study focuses on a different indicator or on a different time period which make them difficult to compare. Moreover, the indicators used are not the best measurement of the industry's competitiveness (especially the productivity factor is not a good indicator since changes in productivity might be caused by other factors) and a more comprehensive approach should be used. For example more than one indicator might be

analyzed. Jaffe et al. (1995) stated that none of the measures used in empirical studies are good enough and instead ‘a structural econometric model [should be formulated] in which net exports by industry, wages, and exchange rates are determined jointly as a function of regulatory costs and resource endowments’. However, there are no studies that attempted to use such a model and thus available studies are used, with known limitations, as an approximate measurement of international competitiveness.

Another disadvantage of the studies is that the time period used is not recent and reflects only the so-called ‘first phase’ (1970’s and 1980’s) of the environmental regulations imposed in the United States and other nations. It would be much more informative to see the differences between these studies and more recent measures from the so-called ‘second phase’ of more stringent environmental regulations which were implemented during the period of 1990’s and the year 2000.

6.2 Corporate Environmentalism

A closer insight was made using the concept of Corporate Social Responsibilities with a focus on environmental issues, where the following question was formulated: *What are the incentives for a firm to voluntarily initiate improvement of environmental standards?* In order to answer this question, the concept of voluntary approaches was introduced. It was proved that it may be favorable for the firm to use such an approach since it provides flexibility and the firm can negotiate the level of abatement that is supposed to achieve and can individually set the strategy for achieving this goal. The voluntary approach is becoming more attractive for the firms nowadays, when there is a focus of the government to implement more stringent environmental regulations.

Moreover, the Corporate Social Responsibility programme can provide firms with benefits of different types as discussed in the previous sections. It is worth to mention, that the CSR approach can provide with profits and increase the firm’s competitiveness in the long-run. On the other hand, the voluntary approaches can be used by firms in either way – in the short-run in

order to avoid stringent environmental regulation or as a transitional tool before the regulation is implemented; or in a long-run strategy to gain the ‘early-mover advantage’ over its competitors.

6.3 Desirable policy strategy

Finally, taking into the consideration all the above it is interesting to discuss – *What should be the ideal policy strategy – the mandatory regulation by government or the voluntary initiated by the firm or maybe a mix of both?*

There are a lot of important disadvantages of voluntary approaches, and therefore the government cannot base their strategy using this tool only, however it is a powerful tool and it should be continued to be used. Still, the command and control and the market-based instruments should be also used as well, depending on the situation. If there is an urgent need for a regulation, the command and control instruments would be used, which could cause high costs for the firms. Therefore, it is beneficial for the firms to have a good environmental management system and to control their pollution and any waste production because with increasing awareness and boost of research in this field more stringent regulations will be imposed. Thus, if the firm is aware of its impact on the environment it can be better prepared (investment in pollution prevention technology, waste-reduction equipment, etc.) for the forthcoming policies and thus have a comparative advantage over others.

7 CONCLUSIONS

In this paper, the influence on the firm's competitiveness of the implementation of the mandatory environmental regulation by government and the firm's voluntary initiative of abatement was discussed. From the literature review it was found that there are three different approaches towards this 'relationship': inevitable loss in competitiveness; no loss or even gain in competitiveness; and finally gain in competitiveness by imposing environmental standards voluntary by the firm itself.

The first model proposed by Palmer et al. (1995), might not properly reflect the reality, because many variables are being considered constant. Therefore, this model could at most be used for a short-run analysis of the influence of environmental regulation on the firm's competitiveness. Then using a cost-benefit analysis, in a short-run the firm's compliance costs will be definitely higher than the benefits due to the high capital nature of any kind of investments done in the field of environmental protection. Using this approach, the loss in competitiveness is inevitable. The second model, proposed by Porter et al. (1995) might, be more appropriate for a long-run analysis since innovation and changes (especially considering the field of environmental protection) need considerable amount of time to take place and characterize with low rate of return on investments. Thus, it is possible in the long-run that (stringent) environmental regulation will give incentives for the firm to invest and innovate, which in the future could give a lower net cost of compliance ('innovation offsets'), leading eventually to net benefits. A review of the empirical studies was done and it was concluded that there was very little loss of competitiveness during the 'first period' of environmental regulations implementation. However, one has to realize the limitations of these empirical studies, such as difficulties with compliance costs assessment or 'not perfect' indicators used in these studies. Further research using more comprehensive approaches is needed to support any of the hypotheses of the relationship between the environmental regulation and firm's competitiveness.

The CSR approach may provide profits and increase the firm's competitiveness in the long-run. On the other hand, the voluntary approaches can be used by firms in either way – in the short-run in order to avoid stringent environmental regulation or as a transitional tool before the regulation

is implemented; or in a long-run strategy to gain the 'early-mover advantage' over their competitors.

To sum up, no loss or little losses were identified from compliance with environmental regulation for the environmental sensitive industries. On the other hand, gain in firm's competitiveness was observed, when additional environmental standards were set within the firm, under the voluntary approach. Thus it is beneficial for the firm to have a good environmental management system and to control its pollution and any waste production because with increasing awareness and boost of research in this field more stringent regulations will be imposed. Thus, if the firm is aware of its impact on the environment it can be better prepared (investment in pollution prevention technology, waste-reduction equipment, etc.) for the forthcoming policies and thus have a comparative advantage over its competitors.

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