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MASTER'S THESIS

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ENVIRONMENTAL REGULATION AND EXPORT OF POLLUTION INTENSIVE INDUSTRIES: EMPIRICAL ANALYSIS OF CENTRAL AND EASTERN EUROPEAN COUNTRIES

Ljubljana, June 2015 BRANKO STANIĆ

AUTORSHIP STATEMENT

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INTRODUCTION

Growing environmental awareness has led to increasing research on the impact of the economy on environment and vice versa. Besides all the legislative regulations of one country there is one regulation that becomes increasingly important when the question of establishing a proper trade flow is being introduced. Effects of environmental regulations on the economy in general and the establishment of specific environmental policies become a significant issue in today socio-economic relations. According to that, the nature of the environment-trade relationship and also the effects that environmental regulation has on trade flows and export competitiveness are important elements when establishing well designed environmental regulation of a country. However, establishing a proper environmental regulation becomes one of the most important parts of dealing with international politics of any country.

There is a need for coordination in trade and environmental policies and also in impact that environmental policies have on exports and country's competitiveness, which can be positive or negative. Lots of authors investigated this issue and different studies have shown different results. Porter and van der Linde (1995a) said that strict environmental regulation which is adequately designed can spur innovation that will have an impact on better environmental perspective, but also increased exports. Midttun and Koefoed (n.d.) also emphasized that environmental regulation could set an important basis for innovation of manufacturing sector and thus establish an optimum balance between regulation and industrial innovation. On the other side more stringent environmental regulations may increase production costs which will to exporting country make the product less competitive in relation to another country and ultimately lead to a reduction in exports.

Transition process in developing countries brought a significant change in economic structures but also in the way of treating and relating to the environmental regulation. There is a trend that transition countries specialize in the production of pollution intensive goods and based on that gain a comparative advantage in the export of these goods (Wilson, Otsuki, & Sewadeh, 2002). This trend has emerged due to the application of stricter environmental regulation in developed countries where, because of legislation, production of pollution - intensive goods is not economically justified due to high production costs when strict environmental regulations are being introduced.

In this way developed countries will specialize in the production of environmentally friendly products and achieve a competitive advantage in the export of the same, while the transition countries (developing countries) will base their "advantage" on specialization in pollution intensive industries. In literature, this is already known as Pollution Haven Hypothesis which says that developed countries often set up their companies abroad in order to find the cheapest option regarding the land, material, resources and labor (Levinson & Scott, 2008).

Tobey (1990) first explored the impact of domestic environmental regulation on international trade with a sample of several countries. This multi-country analysis showed that stringent environmental regulation has no significant impact on trade and export of five most polluting industries. Cole and Elliot (2003a) have relied on Tobey (1990) and investigated the influence of strict environmental regulations on net exports in pollution - intensive industries using simultaneous equation, but they could not prove the existence of pollution haven effect either.

Many authors such as Harris, Kónya, and Mátyás (2002), Grether and de Melo (2002), Mulatu, Florax, and Withagen (2001), Ederington, Levinson, and Minier (2005) used the gravity model of trade to test the existence of pollution haven hypothesis, but most of them had problems when selecting the appropriate environmental regulation variable. The best theoretical basis for the empirical analysis of impacts of strict environmental regulation on trade and export was presented by Jug and Mirza (2005). They used a structural gravity equation and as a measure of environmental regulation stringency they used environmental expenditure data. Jug and Mirza (2005) found that strict environmental regulations decrease exports and concluded that the reason why previous studies failed to find an effect is endogeneity. However, it seems that the endogeneity, unobservable heterogeneity and aggregation issues are the main econometric problems while using the gravity model of trade.

In summary, impact of environmental regulations on trade in general has positive and negative effects. Positive effects include growth that is accompanied by specialization in the production of environmentally safe goods which mainly affects developed countries. The negative effects are relocation of pollution intensive industries to countries where there is lax environmental regulation and this concerns mainly the countries in transition. Lots of studies measuring the impact of strict environmental regulations on exports as well as in pollution intensive industries show either positive or negative results, but overall results were not found.

Many authors analyzed the impact of environmental regulation on exports, but only some of them used more disaggregated data in their empirics. Recent studies, which mainly use disaggregated data, show more accurate results. McLaughlin and Coffey (2009) used gravity model of trade and survey data to show impact of environmental regulations on export. They have investigated the impact of stricter environmental regulations on EU members' exports and non EU members' exports as well as across income levels of EU countries. In general, regarding the countries with higher income McLaughlin and Coffey (2009) found that stricter regulations increase exports, while in low-income EU countries the effects were negative.

This master thesis also uses disaggregated data and its main purpose is to analyze the impact of environmental regulation on exports of pollution intensive industries in Central and Eastern European countries (hereinafter: CEE). In order to take into account the environmental impact, the basic gravity model has been expanded with added

environmental regulation variable. Therefore, variable of interest in this study is environmental regulation in exporting countries and as a proxy for environmental regulation the thesis uses environmental tax revenue in observed transition countries. The empirical analysis of this thesis uses extended gravity model of trade.

The objectives of the thesis are:

- To explain the relationship between environmental regulation and exports,
- To analyze the impact of environmental regulations on exports of pollution intensive industries in transition countries,
- To provide policy recommendations for transition countries with an emphasis on pollution intensive industries in the context of an impact of environmental regulations on export.

The thesis is organized in the following manner. The first chapter presents a historical review of international trade theories. It refers to the different models of international trade, all of the classical and neo-classical school to the Diamond model and Porter's hypothesis. Porter's hypothesis and Pollution haven hypothesis are presented as a theoretical basis for the determination of country's environmental policy. This chapter puts an emphasis on Porter hypothesis as a new environmental paradigm that links stricter environmental regulation, innovation and competitiveness.

The second chapter shows empirical findings regarding the influence of environmental regulation on trade. The chapter presents recent studies which are mainly based on the theoretical background of the Porter hypothesis with the imposition of stricter environmental regulations and the Pollution haven hypothesis with implications for transition countries.

The third chapter highlights the environmental regulation in general with the imposition of market-based regulatory instruments such as environmental taxes and tradable permits. This chapter also gives an insight into the environmental regulation of the European Union as a community with developed environmental policy in comparison with the environmental regulation of transition countries and stresses the importance of adapting their policies to EU standards.

The fourth chapter relates to the empirical analysis on the impact of environmental regulation on export of pollution intensive industries. This research uses empirical evidence from CEE countries which is presented through the gravity model of trade. Based on previous studies, the chapter presents advantages and disadvantages of gravity model and also shows the sources of collected data, specification and analysis of model used, dependent and independent variables and method of estimation. The conclusion section provides the basis for further analysis and investigations in this field, taking into account the results obtained in this thesis.

1 THEORETICAL FRAMEWORK

This chapter provides an overview of the theory of trade, all of Mercantilism to the theory of Porter and Pollution haven hypothesis. This review presents the theoretical basis for exploring the relationship between trade and environmental regulation. It aims to present the evolution of trade theory with emphasis on the Porter theory and Pollution haven hypothesis while highlighting the arguments for and against these theories.

While Porter supports the introduction of strict environmental regulation saying that these regulations increase innovations and affect exports positively, Pollution haven hypothesis reflects the opposite saying that stricter environmental regulations increase company's production costs and lead to a reduction in exports. Regarding the environmental aspect of view, Porter emphasizes that strict regulations force companies to use environmentally friendly technology thus preserving the environment, while Pollution haven hypothesis indicates that transition countries become a stronghold for dirty industries thus damaging the environment more and more.

Over the centuries, there have been different views of economists on international trade and all of them made some conclusions, although just few were generally accepted. Although it is now clear that free trade occurs when a government does not attempt to influence imports or exports through imposing policies, such as applying tariffs to imports and subsidies to exports the first trade theories were not familiar with the term of free trade. Through history, many economists tried to explain what international trade really is, what does free trade mean, who benefits from it and why some patterns of international trade are easy to understand while others are not.

The first generally accepted view of international trade appeared in the 16th century, a theory called Mercantilism. Proponents of Mercantilism, Mercantilists look at international trade as on the mechanism that stimulates and increases the money supply in the country and prevent the outflow of national wealth outside the country. By maximizing exports through subsidies and minimizing imports through tariffs and quotas, Mercantilism is closely linked to the concept of Protectionism which is one of the reasons why this concept of international trade is not considered reasonable and took no scientific elements.

Mercantilism steadily lost favour during the 18th century when Adam Smith and David Hume appeared with their own international trade theories. However, after Mercantilism, the theories of international trade can be classified into classical (Adam Smith's and Ricardian model), neo-classical (Heckscher-Ohlin model) and new international trade theories.

Theory of international trade which is still being studied and tried to prove in practice is Porter's diamond theory, also known as New Paradigm, which is the reason why it is treated separately from the rest of the theories. With regard to the environmental aspects of Porter's theory, this section also presents the Pollution haven hypothesis as a different

aspect of observing impact of environmental regulations on trade. However, under this chapter are presented the most prominent trade theories as well as their strengths and weaknesses, emphasizing New Paradigm as a theoretical basis for future research.

1.1 Classical International Trade Theories

International trade theories can be represented by classical, neo-classical and new international trade theories. At the end of 18th century as anti-mercantilist thought classical theories of trade appeared. Unlike Mercantilism where in trade terms only export matters, classical theory takes into consideration both export and import.

According to this theory every country should produce and export those products in which it has greater comparative advantage and on the other side import the ones in which it has greater comparative disadvantage. The ones who contributed most to this theory are: Adam Smith, David Ricardo and John Stuart Mill.

It might be said that Adam Smith is one of the most influential economists and 'The Wealth of Nations' the largest, most popular, and perhaps the best his achievement. Davis, Figgins, Hedengren, and Klein (2011) discussed Adam Smith as a father of modern economics and one of the most influential thinkers in the field of economics today. He first described the principle of absolute advantage in the context of international trade and presented theory of absolute advantage in his book 'The Wealth of Nations', from 1776, which mainly represents an attack on Mercantilism.

In his book he argued that trade between countries is beneficial considering different costs in the production of certain products, which is measured as the time required for the final product. Smith described principle of absolute advantage using productivity of labour as the only factor of production and said that one country has an absolute advantage over another if the first country has capability to produce more of a good than the second one, with the same amount of resources.

He emphasized that countries should produce only goods where they are most efficient at and trade for those where they are not efficient. Smith said that absolute advantages of a country can be natural (climate, soil, natural resources, etc.) and acquired (knowledge, skills, etc). However, it should be emphasized that his model of international trade is based on assumptions of perfect competition and full employment which also implies same tastes, technology and constant costs.

The liberalism Smith advocated was the complete opposite to the state control advocated by Mercantilists and his whole book 'The Wealth of Nations' is based on a critique of Mercantilism. After Smith, many economists have relied on his work, comprehend the advantages and disadvantages of his theory. The first of them which considerably contributed to the classical theory of international trade was David Ricardo.

Another classical school representative David Ricardo, unlike Smith, assumed that one of the two countries has an absolute advantage in producing both products. Like Adam Smith, Ricardo was an opponent of protectionism for national economies. In his book 'On the Principles of Political Economy and Taxation', from 1817, Ricardo presented the theory of comparative advantage where he argued in favour of specialization, free trade among countries and about the efficiency of resource utilization. The theory of comparative advantage seeks to explain the structure of international trade where, with perfect competition and undistorted markets, each country specializes and exports only one good which can be produced at relatively low cost.

Ricardo considered that Smith solved the problem of wealth creation very well, which is why he didn't write about wealth creation but about the issue of distribution of wealth. Ricardian model of international trade is based on many assumptions, such as considering the exchange between two products, constant costs of production while transport costs are being ignored and uniformed composition of capital which is why just like Smith's model, was subjected to much criticism.

In spite of being replaced over the years by more complex models which include, among other things, more factors of production and imperfect competition, Ricardian model is still considered useful today. According to Deardorff (2007), Ricardian model often provides the platform for the introduction of today's new ideas. Deardorff (2007) said that Ricardian model, as a new idea, actually came many years after Ricardo. Ruffin (2002) considered that the first appearance of the Ricardian model was presented by John Stuart Mill, another important classical theory representative.

John Stuart Mill significantly contributed to the classical theory of international trade. He explained how the actual terms of trade would be determined in international trade by introducing the Theory of Reciprocal Demand. According to him the actual terms of trade are determined by the relative strength of each country's demand for the other country's product. Mill (1885) said that the theory of reciprocal demand best applies when the countries are of equal economic size.

Otherwise, it is possible that the relative demand strength of the larger country can do the relative demand strength of the smaller country insignificant. In this case an exchange ratio of the larger country will prevail. According to that, a smaller country could export an unlimited quantity, all when the absence of monopoly is assumed (Foundations of Modern Trade Theory: Comparative Advantage, n.d.).

Classical school of international trade has had many critics mainly because of its static approach that involves too many assumptions. However, classical international trade theories in today's turbulent environment can't be applied. The reasons for this are numerous, and some of them are constant developments in technology, frequent changes in all segments of society, an increased number of factors affecting the exchange which make static models no longer applicable.

1.2 Neo-Classical International Trade Theories

While the classical theory relies on labour theory of value and the assumption of constant costs, Neo-Classical international trade theory provides more analysis and studies in a less restrictive manner. The analysis of the neo-classical theory includes more factors of production, increasing costs, increasing number of countries and products observed. This theory is based on the headings of marginal utility while on the other side, in the theory of marginal utility the classical theory of production costs and the labour theory of value are rejected.

While the classical school is based on the assumptions of perfect competition, neo-classical theory recognizes weaknesses of the market mechanism. The neo-classical model of trade says that the opportunity cost of producing a good increases as production of the goods increase which differs from the classical model, specifically Ricardian model, which assumed constant opportunity costs.

However, the most important and most influential theory presented by neoclassical school representatives is Heckscher-Ohlin theory of international trade (hereinafter: H-O). This theory is developed by Eli Heckscher (1919) and Bertil Ohlin (1933). The H-O theory asserts that a country's trade is primarily determined by its endowments of factors and is based on assumptions of perfect competition, absence of transportation and transaction costs, identical tastes and preferences and different relative factor endowments.

The main conclusion of the H-O theory is that a country exports the good which uses its abundant factor intensively and imports the good that uses relatively intensively its scarce factors of production. According to H-O theory the country with abundant capital specializes on (and export) the capital intensive good because of the possibility of producing relatively more of the capital intensive good, while the country with abundant labour specializes on (and export) the labour intensive good by the same reasons.

However, it might be said that the H-O theory was one of the most influential theories of international trade in a first half of 20th century which impelled many authors to base their studies on H-O model. According to that, H-O model is used as a theoretical framework in many studies in this research field. Although empirical results of these studies are mixed, this model has never been completely verified nor rejected.

1.3 Diamond Model – Porter's Analysis

Most recent studies use static approach when analyzing relationship between environmental regulation and international trade. This means that in these studies everything except regulation is held constant. The static view of environmental regulation holds technology, products, processes and customer needs fixed which may be the reason for treating the regulation as aggregating factor following the fact that this kind of

regulation must raise costs. On the other side, a completely different approach appeared which rejected static view of much economic theory and introduced dynamic approach where whole economy operates in the real world of dynamic competition. This dynamic side of international trade is also known as the Diamond Model. Dynamic approach influenced the development of a new theory called the Theory of Competitive Advantage.

The Theory of Competitive Advantage is developed by Michael Porter in which he seeked to address some of the criticisms of comparative advantage set by Ricardo. Porter proposed this theory in 1985 and unlike Ricardo he emphasized the importance of maximizing scale economies of goods and services. In the Diamond model Porter argued that countries can become competitive regardless of whether they possess natural factor endowments such as land and natural resources.

However, it might be said that Porter introduced two approaches in transforming relationships to increase competitiveness:

- He presented business clusters, a number of small industries also known as competitive clusters or Porterian clusters. According to Porter's Diamond model clusters represent a group of interconnected companies in a particular field that operate in a particular location (Porter, 1998, p. 12). He introduced different ways of how these clusters affect competition and said that competition is affected in three ways: increased productivity of the companies in the cluster, promoted innovation and arised new businesses in the field,

- Porter first described a chain of activities where companies operate in order to deliver a valuable product for the market. This chain of activities Porter named value chain where the main idea is treating the manufacturing organization as a system. Porter went a step forward and said that these systems are made up of subsystems. According to him each subsystem is consisted of inputs, transformation processes and outputs which represent decision support tools. Significance of value chain is higher when it comes to the industry level which results in an industry level chain. Porter said that industry level chain is based on the notion of value-added at some stage of production which is a good basis for industry competitive analysis.

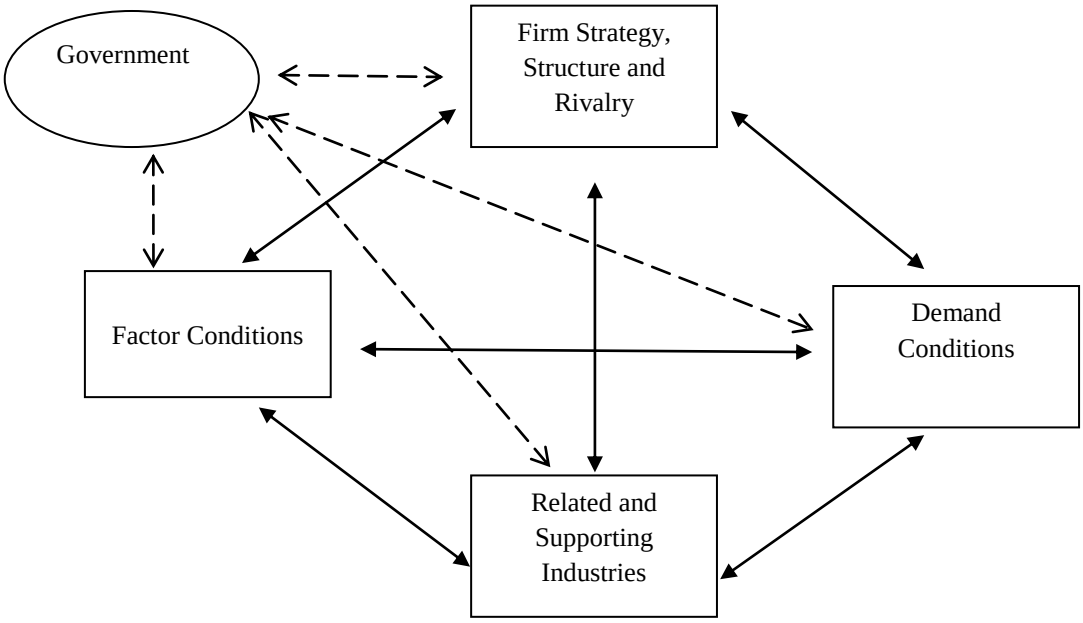
However, in the „Competitive Advantage of Nations“, Porter set the questions about the national competitiveness as well as about competitiveness in general. According to that he put productivity as the only meaningful explanation of competitiveness at the national level. Although there is a lack of a clear explanation what national competitiveness indeed represent, Porter argued that it depends on the capacity of its industry to innovate. He said that few factors affect competitive advantage to arise among companies: challenge, pressure, strong domestic rivals and suppliers and demanding local customers.

According to Porter, availability of information is also very important in the process of innovation and improvement. Different sources of innovation and availability of information are one of the reasons why innovators often come from a different industry or a different country.

However, it might be said that the main question Porter tried to analyze was why some countries are more competitive in particular industries than others. He argued that a nation can create advanced factor endowments such as skilled labor, a strong technology and government support and based on these factors nation can realise the competitive advantages of its industries in global competition. He explained that a country needs to focus on a specific industry in which it may have a competitive advantage because it is not possible for a country to be successful in all industries.

Porter introduced his dynamic approach as a new strategic concept called the Diamond of National Advantage. This concept is consisted of four national determinants of competitive advantage. These determinants are: factor conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry.

Figure 1. Porter's Diamond of National Advantage



Source: M.E. Porter, *The Competitive Advantage of Nations*, 1990, p. 78.

The first determinant, factor conditions, refers to the factors of production of a nation which may be essential in the industrial competition. Traditionally, economic theory mentions land, natural resources and labour as factors of production. These factors can hardly be influenced which represent rather passive (inherited) view of factor endowments. Unlike ordinary definitions of the factors of production, Porter felt it necessary to specify the factors of production in order to clearly determine the competitive advantages. He classified these factors into human resources, material resources, resources of knowledge, capital resources and infrastructure. These factors can be viewed in terms of the following three classifications: basic and advanced, generalised and specialised and the third distinction is whether the factors are inherited or provided by the nation.

Contrary to conventional wisdom, Porter believed that key factors of production which he named „specialized factors“are created. These are skilled labour, capital and infrastructure.

Specialized factors involve sustained investment, they are difficult to duplicate and can easily generate competitive advantage. On the other side, unskilled labour and raw materials which he named „generalised factors“ do not generate sustained competitive advantage since they are readily available.

The second determinant of national competitive advantage is related to demand conditions. Demand conditions represent the pressures on companies that come from demanding customers and they affect the forming of certain factor conditions. Companies are expected to increase their competitiveness through high quality or innovative products if they are facing more demanding customers. These conditions which relate to the nature of consumers have effect on product development and exports in a way that leads to a competitive advantage. This happens when the local market for a particular product is larger than foreign which is why local companies have more reasons for the development of that product. The more demanding the local market the greater chance of getting a competitive advantage.

The third dimension of diamond model refers to the existence of related and supporting industries which advocate new ideas and innovations. Related industries are those industries in which companies produce complement goods and can organize all their activities in the value chain. According to Porter the presence of these industries is very important and when they are already present it is crucial to establish adequate relationships among these industries. When these industries act in synergy they are facing learning, innovation and competitiveness. Porter said that the presence of related industries often results in new competitive industries which encourage exchange of information and technology, promotion of innovation and more cost effective inputs. Synergy effect in these industries is stronger when the suppliers are strong global competitors.

The fourth component of competitive advantage is consisted of three parameters named firm strategy, structure and rivalry. These three parameters observed as the strategy of firms and structure and rivalry of industries affect competitiveness of the sector. Porter argued that different industries have different strategies and leadership and different countries have different management styles. He said that local conditions and national environment in which companies are organized and managed affect international competitiveness.

Although in his model of Five Forces Porter made a link between low rivalry and industry attraction where he said that low rivalry among companies in an industry leads to a disciplined and attractive industry, in Diamond of National Advantage he stressed that over the long run more local rivalry is better. Dynamic conditions and more local rivalry impel companies to improve and increase productivity and innovation required to compete internationally. It might be said that high local rivalry results in less global rivalry.

According to Porter, each of these four attributes depends on the state of others, which is why it is crucial to observe these determinants of national advantage as a system. This

means that weaknesses in any of these determinants lead to a reduction in the competitiveness of the particular industry. In Porter's opinion instead of just one, nations are often home to more competitive industries named clusters, as mentioned above. The industries formed in clusters are connected in vertical and horizontal relationships and are mutually supportive in developing new strategies, skills and innovative solutions which leads to new opportunities and ultimately results in an increased competitiveness. Porter emphasized the importance of the clusters because they support dynamic competition and encourage flexibility and diversity among rivals.

However, these four determinants of national advantage are not only affecting the competitiveness. Porter singled some other factors as a support of four above mentioned that have the capacity to influence the function and dynamic of the Diamond and named them government factors and chance events. The role of government can be affected positively or negatively on the competency of the industry which can improve or impede the national competitive advantage and can play the crucial role in Diamond. Government's proper role is as a catalyst and challenger (Porter, 1990).

Porter said that government policies affect competitiveness through various roles. Among other ways, national advantage is affected through governments' investments in factor creation, through its competition policies and through its role in supporting industries. Many policies and different government roles can affect the competitiveness of industries in different ways but according to Porter governments' main role is to encourage companies to improve their competitive performance and raise their aspirations.

As Porter argued, it is important to say that a successful policy is one that is not directly involved in the process so the role of government is indirect, rather than direct. According to that government through its policies creates an environment that will encourage innovation and move companies to higher level of competitive performance.

Besides the role of government there are some other factors that influence the four Diamond determinants, but which are not determinants themselves. Porter named these factors chance events or random events. Chance events are composed of factors that are not under the control of the company or the industry, but they can significantly affect their competitiveness. Some of chance events differ from location to location which on one side can greatly improve the competitiveness of a nation while completely downgrading the competitiveness of others.

Porter made a list of these random events which are important in influencing the competitive advantage where he included: unexpected discoveries or acts of pure innovation, major technological breakthroughs, discontinuities in input costs resulting in prices fluctuations, large shifts in world financial markets or exchange rates, natural disasters, political decision by foreign governments and wars. According to Porter, the country which manages to transform chance events into an advantage becomes more competitive.

However, Porter highlighted some new issues that previously were ignored, such as the importance of home based suppliers and the importance of local specialized factor markets. He suggested that the good balance between home based and external activities as part of a national or global strategy leads to a higher level of national competitive advantage.

Unlike previous theories of international trade that have looked upon international trade from the perspectives of different countries, Porter put in the foreground the companies and industries which according to him have the power to change the global environment. From this it can be seen that the Diamond Model presents completely different approach based on the dynamic competition which introduced local environment as a potential for global competitive success.

Porter argued that global competitive success of an industry depends on the circumstances in the local activities which must support innovation. In Porter's opinion the industrial competitiveness can only be achieved with a continuous innovation which he presented as a core for every competitive advantage. Therefore, it can be concluded that Porter's main consideration was to create conditions through interaction of the diamond factors where innovation is the basis for gaining competitive advantage.

1.3.1 Porter Hypothesis – New Environmental Paradigm

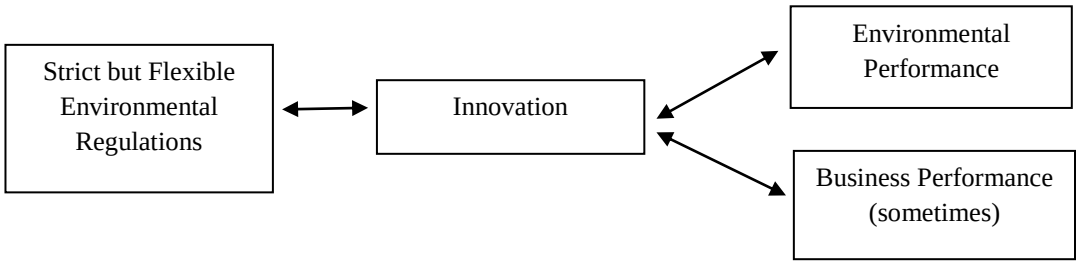
Throughout the second half of the 20th century the establishment of better relationship between industrial competitiveness and environmental goals has become the subject of many studies in this field of research. This relationship has normally been observed as ecology versus economy or as a trade-off between social benefits and private costs. This means that regulation leads to social benefits, where environmental protection is ensured through adequate environmental policies, but on the other side the need for regulation leads to increased industry's private costs which ultimately results in increased prices and reduced competitiveness.

However, an entirely new approach regarding the relationship between industrial competitiveness issues and environmental concerns is presented by Porter (1990). According to Porter (1991, p. 168), „Strict environmental regulations do not inevitably hinder competitive advantage against rivals; indeed, they often enhance it“. Porter said that the traditional view of environmental regulation must raise costs regarding that in this approach technology, products and processes are held constant.

Unlike traditional view Porter introduced his dynamic approach in which companies operate in a dynamic competition where they are constantly involved in innovative processes. Porter and van der Linde (1995, p. 98) said: „More stringent but properly designed environmental regulations can trigger innovation that may partially or more than fully offset the costs of complying with them“. Porter argued that innovations encourage

companies to use their inputs, from raw materials to labour, more productively which results in increased competitiveness.

Figure 2. Schematic Representation of the Porter Hypothesis



Source: Ambec et al., *The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness*, 2011, p. 3.

Porter and van der Linde (1995) made a list of at least four reasons that properly designed environmental regulation may lead to better business performance maintaining the level of environmental performance and these are:

- First, regulation helps companies to recognize the potential for innovation as well as possibly inadequate allocation of resources,
- Second, regulation supports investments in the environment, thus reducing the uncertainty that they will be justified,
- Third, regulation raises corporate awareness,
- Fourth, regulation creates pressure on companies and industries that motivates technological improvements and progress.

According to Porter and van der Linde (1995b) one of the reasons why reducing pollution through strict environmental policy leads to greater competitiveness is that pollution is often a form of economic waste. They said that when resources are used inefficiently the result is unnecessary waste, defects and stored materials and on the other side even when pollution prevention is introduced, companies must go further in the sense that they form environmental improvement towards resource productivity.

Porter argued that some industries, although with the lack of comparative advantage in the traditional sense can be innovative and achieve competitive advantage even with the shortage of basic inputs. An example of this was presented by Porter and van der Linde (1995b) in the case of Dutch flower industry where despite of country's natural disadvantages the Netherlands has managed to become a leader in the export of cut flowers. Porter and van der Linde argued that the lack of basic resources forced the Dutch to compete in another way in which they have developed a high-tech system of greenhouse cultivation that is present throughout the year. With this system the Dutch innovated every

element of the value chain and thereby enhanced resource productivity which ultimately led to achieving competitive advantage and the Dutch flower industry responsible for about 65% of world exports of cut flowers.

However, the importance of dynamic approach seems to be one of the main determinants of Porter's theory. Once again, this is clarified by Porter and van der Linde (1995b) in an example of U.S. car industry when new fuel consumption standards emerged. While the Japanese and German car industry have adapted to the new standards by developing lighter and more fuel-efficient cars on the other side U.S. car industry fought such regulations. Although the U.S. car makers eventually realized that in order to survive they have to compete through innovation this static approach resulted in lost billions of dollars and thousands of jobs. In this example Porter and van der Linde showed the importance of adapting regulations and also stressed the importance of choosing the right type of regulatory instrument.

Porter and van der Linde (1995a) said that if the environmental standards are established to encourage innovation then they are based on three principles: First, they must create the maximum opportunity for innovation. Second, regulation must promote constant development and improvement. Third, any regulation should include some space for uncertainty at each stage.

According to them regulations should encourage product and process changes in order to avoid pollution early and thus reduce costs as opposed to treating pollution in the later stages. Porter and van der Linde (1995a, p. 111) declared the following: „Regulators must consider the technological capabilities and resources available at each stage, because it affects the likelihood that innovation will occur“. They said that the governing principle should be to give more flexibility for innovation in a way that it should begin to regulate the production chain in the later stages, rather than at the beginning.

Porter and van der Linde (1995b) argued that bad regulation can damage competitiveness while good and more flexible regulation can lead to innovation and thus enhance competitiveness. They explained this in an example of U.S and Scandinavian pulp-and-paper sector. In the 1970's strict environmental policy was imposed in U.S. pulp-and-paper sector without any adjustment period, thus forcing companies to adopt the best available technologies quickly.

On the other side, regulations were imposed in Scandinavian pulp-and-paper industry as well, but much more flexible by allowing companies to focus not just on the emission requirements, but also on the process of production. This allowed Scandinavian companies to develop innovative pulping and bleaching technologies which contributed not just to lower production costs but also to better environmental standards.

According to Porter and van der Linde, U.S. companies were unable to take first mover advantages because they have neglected a basic premise of good environmental regulation: „Create maximum opportunity for innovation by letting industries discover how to solve

their own problems“ (Porter & van der Linde, 1995b, p. 129). This resulted in the fact that U.S. companies installed only secondary treatment systems, while Scandinavian producers, on the basis of innovation friendly-approach, introduced new environmental technologies which raised the competitiveness of Scandinavian pulp-and-paper industry.

However, Porter and van der Linde (1995b) concluded that in order to increase their competitiveness companies must start to use resources productively because it is no longer enough just to own these resources. According to them there are two ways of improving resource productivity: by producing existing products more efficiently or by making new products that are more valuable to customers. They also argued that companies innovate to increase resource productivity which is stimulated by environmental progress demands.

This new approach based on dynamic competition brings environmental improvement and competitiveness together. When it comes to companies and industries they must start to recognize the environment as a competitive opportunity and not as an additional cost (Porter & van der Linde, 1995a). It might be said that this new paradigm completely changed the way of observing the relationship between the environment and competitiveness mainly because the new approach is based on regulations that link the environment, resource productivity, innovation and competitiveness together.

1.3.2 Criticisms and Arguments in Favour of Porter Hypothesis

It can be said that Porter's new paradigm changed the way of interpreting the links between environmental regulation and company's or industry's competitiveness. There is much literature that is based on the analysis of Porter hypothesis and conclusions differ from study to study. On one side are the ones who write on behalf of the Porter hypothesis, while on the other side are the studies that make criticism of this hypothesis. However, in their article „Toward a New Conception of the Environment-Competitiveness Relationship“, Porter and van der Linde (1995a) said that the Porter hypothesis is analyzed more than they thought it would be.

While positive comments are mainly from the business community, the biggest criticisms come from economists. These negative comments Porter and van der Linde summarized into three criticisms (whose authors are unknown) and immediately analyzed and presented their response.

The first criticism referred to the 'innovative offsets' saying that it is theoretically possible to treat the strict environmental regulation in an innovative way, but in practise this rarely happens. Porter and van der Linde (1995a) disagreed with this statement. They thought that a company or an industry can deal with strict environmental regulations in a different, innovative way. They argued that costs of poor use of resources can be seen primarily through incomplete material utilization which eventually results in waste, stored material and defects. According to them, emissions are a sign of resource inefficiencies and represent an additional burden on companies and industries.

To further explain the resource inefficiencies Porter and van der Linde cited toxic materials such as heavy metals or solvents that are expensive and difficult to maintain. According to that they said there are several reasons why reducing the usage of these materials can result in greater resource utilization. The main reason for this is that pollution reduction and profit maximization are based on the same basic principles, which are: the efficient use of inputs, substitution of less expensive materials and the minimization of unneeded activities (Porter & van der Linde, 1995a, p. 106). Porter and van der Linde (1995a) stressed that the most cost-effective way to improve the quality of the product is to introduce total quality management program to monitor product quality throughout the production process. According to them besides proper resource utilization, total quality management programs also lead to reduced pollution and innovation offsets.

A second criticism stressed the high cost of environmental regulation and highlighted a trade-off between regulation and competitiveness. On the other side, Porter and van der Linde (1995a) believed that the estimates of regulatory compliance costs are subjective and self-reported by those industries that do not recognize the new rule that links the regulation and competitiveness together. The reason for this way of thinking Porter and van der Linde presented through several examples. One of them concerned the adoption of the 1970 Clean Air Act when the representatives from Ford Motor Company have warned that the adoption of this act can have detrimental effects on the U.S. automobile industry, although in the end these predictions have proved wrong.

According to Porter and van der Linde (1995a) regulatory compliance costs may be exaggerated because its settings do not include the possibility of innovation. This can be seen from the example of the 1991 Federal Clean Air that included the reduction of benzene in the atmosphere for the 98 percent. Coal tar distillers initially considered that benzene, which was located on the tar storage tanks, can be covered with expensive gas blankets. Unlike other distillers, instead of increasing the cost of introducing the gas blankets, Pittsburgh-based Aristech Chemical developed a new innovative way to reduce benzene emissions in the first processing step. This resulted in a saving of 3,3 million dollars (PR Newswire, 1993).

According to the third criticism, the regulation may encourage innovation, but not competitiveness because it can cause possibly more productive innovative investments. Porter and van der Linde (1995a) provided an answer to this criticism. They said that the low marginal benefits of further investment occur because many companies neglect environmental innovation and the importance of linkages between pollution and resource productivity.

In addition to these criticisms, Porter and van der Linde added that not any strict environmental policy lead to increased innovation and competitiveness. They said that only adequately designed environmental regulation and company's orientation towards adequate resource productivity decrease the cost of compliance in most cases.

Besides criticisms that Porter and van der Linde (1995a) presented and analyzed in their article, some other authors also analyzed the new paradigm. One of the major criticisms of the Porter hypothesis was by Palmer, Oates, and Portney (1995). They said that before concluding that strict environmental regulation has to be applied, the question about the possibility of the 'profitability green' in all areas has to be answered first. They concluded that in contrast to the thinking of the Porter, costs of environmental regulation seem to be very high which is why the economic attractiveness of specific programs should be determined by the cost-benefit analysis and not by the false premise of cost-free controls (Palmer et al., 1995, p. 131).

However, on the other side are the authors who agreed with Porter and concluded that the new rules and environmental regulation can stimulate innovation which results in increased competitiveness (Sanchez, 1997; Arimura, Hibiki, & Katayama, 2007; Canon de Garcia, Garces Ayerbe, & Ramirez Aleson, 2007; Ambec & Lanoie, 2008). Sanchez (1997) concluded that if environmental regulation is managed strategically it can stimulate firm's innovation and ultimately result in firm's better performance.

Arimura et al. (2007) said that strict environmental regulations provide more opportunities for development of firm's environmental R&D program. Similarly, in favor of Porter Hypothesis, Ambec and Lanoie (2008) argued that well-established environmental regulations have positive impact on firm's productivity growth rate and found some positive linkages between environmental and economic performance. Besides these studies that speak in favour of Porter hypothesis there is an interesting study presented by Berman and Bui (2001) who said that stricter regulations and investments imply higher abatement costs, but at the same time these investments positively affect productivity.

1.4 Pollution Haven Hypothesis – Findings So Far

The effect of environmental regulation strengthening on an economy gains a different understanding when another argument, besides Porter hypothesis, is introduced. While Porter argued that the strict environmental regulation increases innovation opportunity which enhances competitiveness, on the other side the degree of environmental policy implementation causes the composition change in goods trading which made the countries with loose environmental regulation to become a 'haven' for pollution intensive industry products (Seok-Joon, 2009).

This new argument that links environmental regulation, trade flows and industry competitiveness, posits that liberalization in trade causes relocation of polluting industries from countries with strict regulations to countries with more lax regulations. In practice this means a migration of these industries from developed countries to developing (transition) countries.

However, transition proces in developing countries brings a significant change in economic structures but also in the way of treating and relating to the environmental regulation. There is a trend that transition countries specialize in the production of pollution intensive goods and based on that gain a comparative advantage in the export of these goods (Wilson et al., 2002; Quiroga, Sterner, & Persson, 2007). This trend emerges due to the application of stricter environmental regulation in developed countries where, because of legislation, production of pollution intensive goods is not economically justified due to high production costs when strict environmental regulations are being introduced.

In this way developed countries specialize in the production of environmentally friendly products and achieve a competitive advantage in the export of the same, while the transition countries (developing countries) base their "advantage" on specialization in pollution intensive industries and attract foreign investments in their polluting sectors. According to Fullerton (2006) there are three conditions under which pollution haven appears: if environmental regulations differ between countries, if capital is mobile, and if trade rules allow firms to relocate and still sell their products to the same customers.

However, it seems to be that the general opinion is that pollution haven exists in each country with less strict environmental standards in relation to their trading partner. This could lead to misinterpretation of the definition of what pollution haven really constitutes. In order to avoid this misinterpretation some authors provided more sophisticated definitions of pollution haven.

It might be said that one of the most sophisticated and reasonable definitions was provided by Neumayer (2001, p. 148): "A country provides a pollution haven if it sets its environmental standards below the socially efficient level or fails to enforce its standards in order to attract foreign investment from countries with higher standards or countries that better enforce their standards."

The Pollution haven hypothesis states that the liberalization of international trade affects the polluting producers to abandon their production in countries with strict environmental regulation and begin to produce in countries with lax regulation. Considering this, it damages the environment of the countries with lax regulation which are those with relatively low income per capita while the countries with more stringent environmental regulation benefit (those with relatively high income per capita).

Many studies empirically proved the existence of the Porter hypothesis while on the other side there are also studies that proved that Pollution haven hypothesis makes perfect sense. All these studies are presented in the section Review of empirical studies.

2 REVIEW OF EMPIRICAL STUDIES

Increased awareness of environmental regulation issues and the impact of environmental regulations on certain economic parameters made a lot of empirical studies regarding the relationship between environmental regulation and trade flows. Although more studies are based on the impact of trade on the environment, many authors in this field based their empirical analysis finding and analyzing the impact of environmental regulation on trade flows. Recent studies also introduced the strict environmental regulations and its influence on trade flows, thus dealing with a new concept of stringency of environmental regulations.

Therefore, different environmental regulations of individual countries, i.e. the level of stringency of environmental regulation differently affects trade flows and specifically exports of countries observed. According to Rutqvist (2009) as countries liberalize to trade, differences in environmental regulations will deteriorate comparative advantage for pollution intensive manufacturing industries in high-cost countries, affecting amongst other things industry location and FDI flows.

However, there are two sides of observing the impact of environmental regulation on export, which can represent two main theoretical frameworks. The first one is in literature known as Pollution Haven Hypothesis whose existence is of great importance for the adoption of adequate environmental policy of certain country. According to that the existence of pollution haven effect could be a potential problem in negotiating integration agreements (Martinez-Zarzoso, Vidovic, & Voicu, n.d.).

Although most previous studies have failed to demonstrate the existence of this effect, some recent studies have demonstrated small but statistically significant pollution haven effects. The reason is because earlier studies used cross - sections of data which was not suitable for unobserved characteristics of countries or industries and recent studies have used panels of data and industry or country fixed affects.

To our knowledge, Jug and Mirza (2005) are the first authors who investigated the existence of pollution haven effect in European continent using panel data and focusing mainly on developed countries. They used a structural gravity equation, employed European abatement costs data as the environmental stringency variable and based their theoretical framework on hypothesis that environmental regulation and trade are endogenous to each other. However, their analysis showed that stricter regulations decrease exports, i.e. they found weak evidence in favour of Pollution haven hypothesis and concluded that endogeneity is the main reason why previous studies failed to find an affect.

On the other side, in contrast to the conventional theories there are some opposite views which put stringency of environmental regulation and exports together. Porter (1991) argued that strict environmental regulations affect exports positively and actually increase

innovations. According to him improved environmental performance, induced by stricter environmental regulations, is a potential source of competitive advantage, thus creating new business opportunities. Static mindset of the whole economy system is not helpful anymore and therefore competitive advantage rests not on static efficiency, but on the capacity for innovation and improvement that shift the constraints (Porter and van der Linde, 1995).

Tobey (1990) used multi- factor and multi - commodity extensions of the Heckscher-Ohlin model for the net exports of five most polluting industries and found no measurable impact of strict environmental regulations on trade flows. Although it is based on studies of Tobey (1990), Van Beers and van den Bergh (1997) made some differences in their empirical analysis. They used gravity model of trade which considers bilateral instead of multilateral trade flows. In the sample of 21 OECD countries they noted insignificant effect on dirty trade flows, while in the case of strict regulations and their influence on total trade they found significant negative effect.

More specifically, with Tobey's data for five dirty sectors and similar country sample, empirical analysis showed that stringency of environmental regulation is significantly positive for the paper industry, negative for mining and non-ferrous metal and found no significant effect in the chemicals and steel industry (Van Beers & van den Bergh, 2000).

Since then a lot of authors used gravity model of trade in order to analyze the impact of environmental regulations on bilateral trade flows (Mulatu et al., 2001; Harris et al., 2002; Caporale et al., 2010; De Santis, 2012). One of the most important studies was by Harris et al. (2002) who based their empirical analysis on a sample of 24 OECD countries and relative energy consumption and supply as an environmental indicator. They used a triple indexed fixed effects model which was based on the tree elements: import, export and time effects. In order to avoid aggregation issues Harris et al. (2002) used panel data, focused mainly on developed countries and classified industries into dirty and footloose categories.

According to that, if environmental regulations would have a real impact on international trade flows it is expected their impact to be strongest on dirty industries and in particular on footloose industries (Martínez-Zarzoso, Vidovic, & Voicu, 2012). However, Harris et al. (2002) showed that, once these fixed effects are taken into consideration there is no relationship between strict environmental regulation and trade flows and the impact of environmental stringency on trade flows becomes statistically insignificant.

Some of the empirical analysis included impact of environmental regulations not just on trade but on the investment flows also. Copeland and Taylor (2004) argued that trade is not automatically responsible for environmental damage and in their empirical analysis found that higher incomes affect environmental quality positively. However, the introduction of strict environmental regulations is potentially harmful to international competitiveness, thus leading to delocalization of dirty industries towards countries with less regulated environment (Constantini & Mazzanti, 2012). Despite this, Copeland and Taylor (2004)

concluded that there is no sufficient evidence for a confirmation of Pollution haven hypothesis.

More recent studies also based their analysis on investigating the impact of environmental regulation on trade flows. Cole and Elliott (2007) argued about the impact of environmental regulation on 27 UK industries. They used environmental compliance costs as environmental regulation variable and made a number of tests analyzing relationship between industry performances, environmental regulations and trade. However, they have not found elements of pollution haven hypothesis.

Similar study was presented by Rutqvist (2009) where empirical analysis was based on the impact of environmental regulation on competitiveness of six most polluting manufacturing industries in 48 US states, using pollution abatement costs as a measure of regulatory pressure and employment changes from 1999 and 2005. Instead of together, these industries were observed separately and the impact of environmental regulation on competitiveness was measured by differences in industry employment developments between high-cost and low-cost states. Rutqvist (2009) concluded that the effect of environmental regulation on competitiveness is neither positive nor negative, but it affects industries differently which could be a good basis for adopting adequate environmental policy in each industry.

A very interesting study which was a theoretical background to Rutqvist (2009) was conducted by Levinson and Taylor (2006) who developed a very simple economic model in order to analyze the effect of environmental regulations on trade flows. They chose a simple model to demonstrate how unobserved heterogeneity, endogeneity and aggregation issues bias measurements regarding the impact of environmental regulation on trade. The data were used on US regulations and net trade flows between the US, Canada and Mexico for 130 manufacturing industries from 1977 to 1986 with pollution abatement costs as an environmental regulation variable.

However, Levinson and Taylor (2006) concluded that the results vary across the countries and in different industries results are different. According to that a general conclusion regarding the existence of pollution haven was not found, but they have found a positive and statistically significant relationship between industry pollution abatement costs and net imports.

While Levinson and Taylor (2006) have not found a general conclusion about the existence of PHH, some other authors found to have different results. Caporale et al. (2010) estimated gravity model to establish whether the implementation of more stringent environmental regulations in Romania has indeed affected its competitiveness and decreased exports towards its European trading partners. They included 20 European countries and used a panel data over a period of 9 years, from 1999 to 2007 and analyzed exports of Romanian pollution intensive industries. However, they concluded that

implementation of more stringent environmental regulations in Romania has not affected decreased exports and, according to that, failed to find pollution haven affect.

All of these studies focused on an impact of environmental regulations on trade flows, but some other authors who have based their analysis on a sample of mainly EU member countries (McLaughlin and Coffey, 2009; Costantini and Mazzanti, 2011; De Santis, 2012) investigated how different environmental regulations, whether they are imposed within the country or by other institutions, also affect country's competitiveness.

McLaughlin and Coffey (2009) are the ones who introduced this way of observing the environmental regulation. They said that the nature of environmental regulation effects differ in different conditions, starting from the fact whether the regulations were created by a country itself or introduced beyond an individual country's control (Bešlić, 2012).

McLaughlin and Coffey (2009) tested the effects of increases in environmental regulation stringency ratings on bilateral trade flows and found significant differences in the effects on EU members' exports and non EU members' exports as well as across income levels of countries. They concluded that stricter environmental regulations lead to a dramatic decrease in exports from low-income EU members and increase in exports from high income EU member countries.

Regarding the empirical analysis made for EU member countries, Costantini and Mazzanti (2011) investigated the impact of environmental policies and innovation on EU exports. They used a gravity model to analyze export dynamics of five aggregated manufacturing sectors classified by their technological or environmental content and tested both strong and weak versions of the Porter hypothesis. The results showed the existence of Porter hypothesis in both cases concluding that stricter regulation enhances business performance and leads to more innovation (Ambec, Cohen, Elgie, & Lanoie, 2011).

A very interesting recent study based on McLaughlin and Coffey's (2009) way of introducing environmental regulation was presented by De Santis (2012). He estimated in a gravity setting including 'multilateral trade resistance index', the overall impact of three major Multilateral Environmental Agreements (hereinafter: MEAs) on 15 EU countries' bilateral exports from 1998 to 2008 of three. He concluded that being a member of an MEA in the period from 1988 to 2008 had a positive impact on EU14 exports ranging between 22 and 35%. He argued that joint membership of World Trade Organization (hereinafter: WTO)/EU and MEAs had a further positive 'interaction effect' on exports. According to the results, this study rejected pollution haven hypothesis while accepting the Porter hypothesis, at least for EU members.

At present, there are over 250 MEAs and about 20 of these include provisions that can affect trade (De Santis, 2012). According to this some of MEAs may contain different measures that restrict trade in certain circumstances or prohibit trade of certain products which is one of the reasons why his study was conducted.

3 ENVIRONMENTAL REGULATIONS AND TRADE

In the late 1960s and in 1970s, due to lack of experience in the environmental regulation, weak governance of environmental policies and considering the importance of establishing a proper environmental policy, companies and industries by its internal policies did not consider the costs of environmental damage it created. The government of a country was the one that pointed out these costs, while a set of environmental policy instruments was based on the theoretical estimates. In the late 1970s there has been an increase in awareness of environmental issues when government reacted with direct regulation (such as rationing and prohibition) as for the national environmental strategy.

The first environmental policies relied on technology-based standards and were related to the pollutants that go into the air, water tables, and solid waste disposal. These were the Clean Air Act of 1970 and the Federal Water Pollution Control Act of 1972.Since then, different typology of regulation was introduced but it might be said that the following two environmental policy instruments are receiving increased consideration: command and control and market-based instruments.

However, increasingly scarce resources have prompted policy makers to seek for other solutions that cost less, require less government intervention and, unlike conventional environmental policies, encourage technological development. Unlike other regulatory instruments such as command and control which gives no incentive for firms to innovate, market-based policy instruments encourage technological development which might lead to innovation. While the command and control approach is provided by companies which did not manage to achieve environmental goals, on the other side, market-based mechanisms are provided by companies with greater flexibility in maintaining the desired environmental quality as the economy changes.

During the last couple of decades, European governments have begun to implement a new approach to environmental policy instruments (hereinafter: EPIs) in contrast with traditional forms of regulation. These new types of EPIs are characterized by procedural rationality and involve the use of a wide range of alternative instruments in a systematic and transparent way.

In order to control pollution first it is necessary to make a proper comparison of EPIs that provide real improvements over existing environmental regulations. To make this comparison, Bohm and Russel (1985) suggested several main dimensions: information intensity, efficiency under non-competitive market structure, ease of monitoring (enforcement), flexibility in the face of economic change, dynamic incentives and political considerations.

However, the way in which a particular instrument is designed and implemented determines the range of its use. Technology and skills variations between different firms or industries can have important implications for policy design. Also, it is important to

emphasize that the choice of a particular EPI can largely depend on the nature of specific environmental problems.

3.1 Environmental Taxes and Tradable Permits as Market-Based Instruments

It might be said that there is a significant similarity between tradable permits and environmental taxes considering that both of these EPIs are based on price signals and incentive for emitters to reduce the costs they impose on society. According to Norregaard and Reppelin-Hill (2000) tradable permits and environmental taxes affect the establishment of a market determined price of emissions which causes damage costs and gives emitters financial incentives to respond by reducing emissions.

While the theoretical literature focuses mainly on pure emission tax when it comes to choosing the optimal EPI, the practical reviews seem to be using an environmental tax as a much broader definition. According to McMorran and Nellor (1994) an environmental tax as a broader concept consists of the following:

- Pigouvian taxes, which are based on the units of emissions with specific rates. These rates are set so that the net marginal benefits of reducing emissions by another unit would be zero;
- Indirect environmental taxes, which are based on consumer goods or inputs that are related to environmental damage;
- Environment-related taxes (provisions), including personal and corporate income taxes, fuels and motor vehicle taxes and general sales taxes.

In the sense of the broader concept, environmental taxes (eco-taxes) can be divided into four main categories (Eurostat, 2013):

- Energy taxes (including CO2 taxes and fuel for transport);
- Transport taxes (excluding fuel for transport);
- Pollution taxes;
- Resource taxes (excluding taxes on oil and gas).

Energy taxes are imposed on energy products regardless of the purpose of its use. So this includes taxes on energy products for transport and energy products for stationary purposes. Petrol and diesel are considered to be basic energy products for transport, while on the other side electricity, fuel oils and coal are considered to be products for stationary use. Taxes on biofuels and on any other form of energy from renewable sources, as well as taxes on stocks of energy product belong to the energy taxes. In order not to distort

international comparisons, CO2 taxes are also considered as energy taxes rather than pollution taxes.

A new category within the energy taxes is emissions permits. The most important scheme of emissions permits is the EU Emissions Trading Scheme (hereinafter: EU ETS) which is related to emissions of greenhouse gases.

When it comes to transportation taxes it is important to establish the correct structure of ownership and use of motor vehicles, which are one of the major causes of greenhouse gas emissions and also a significant air pollutant. In the generally accepted definition of environmental taxes can be classified taxes on other transport equipment such as planes and similar transport services such as scheduled flights or duty on charter. In transport taxes should also be included taxes on electric cars regardless of that they are considered as environmentally friendly means of transport.

Pollution taxes are the ones imposed on measured or estimated emission to air and water, management of solid waste and noise. Since they are already included under energy taxes, CO2 taxes do not find their place in this category.

Resource taxation is quite controversial category of taxation considering the question whether the extraction of resources affects the environmental damage. However, it can be said that sometimes resource extraction my cause different environmental problems, such as pollution and soil erosion. Some authors argued about the reasons of resource taxation. Eckermann et al. (2012) cited the rationale for resource taxation which can be summarized as:

- Reduction of dependency on raw materials, promotion of efficiency, use of alternative technologies through a provision of price signals and stabilization of market prices;
- Restructuring of the tax system through a shift of tax burden from labour to consumption of resources in order to encourage economic growth;
- Existence of external effects that are not reflected in current resource prices;
- Inefficient inter-temporal allocations (intergenerational equity).

Eckermann et al. (2012) concluded that resource taxes affect change in price systems and are observed as incentives for economic agents to increase resource efficiency. When it comes to revenue aspects of environmental taxes there can be introduced a hypothesis in literature known as the ‘double-dividend hypothesis.’ This hypothesis suggests that environmental taxes can provide some benefits which can be summarized into two dividends.

While the first dividend is based on achieving environmental goals, the second dividend represents achievement of economic goals from the use of environmental tax revenues to reduce other distorting taxes on labour supply, investment, or consumption (Fullerton &

Metcalf, 1998; OECD, 2004; Fullerton, Leicester, & Smith, 2008). However, a greening of tax systems can be seen as a first step of a new approach called double dividend given that such tax reforms may provide benefits beyond environmental improvement such as economic efficiency as mentioned above.

Since the 1990s, some EU countries have commenced reforms of green taxes. These reforms were comprehensive and implied a reduction of existing taxes, but with the introduction of new environmental taxes that were their offset. In OECD (2004) Jean-Philippe Barde presented an overview of green tax reforms in OECD countries. This can be summarized as follows:

The tax on carbon was first introduced in Finland in 1990. After that, the whole system of taxation in Finland is reformed, and has become greener. Among other things reforms included a new tax on landfill waste, beverage containers and motor vehicles. In 1996 as part of the reforms taxation Finland introduced a charge on electricity and nuclear power plants. However, although one of the aims of the reforms was to reduce unemployment, increase green taxation partly influenced the reduction of income tax and contributions for social insurance.

Netherlands started with reforms of environmental taxes in 1988. In the Netherlands the first environmental legislation changes are related to five charges including: charges for industrial noise, air pollution, traffic, lubricants and chemical waste. After reforms these five charges are embedded in a general fee called general fuel charge. Greening of the environmental reforms in the Netherlands had an impact on reducing social security contributions, especially with the introduction of energy regulation tax. As in the case of Finland, one of the main objectives of these reforms was the reduction of unemployment.

The main goals of a German environmental tax reform were to stimulate energy savings and to increase employment. Accordingly, Germany's environmental tax reform began in 1999, when taxes on electricity and mineral oils were introduced. This increase in taxation, in particular energy taxation has affected the reduction of the tax wedge on labor. The end result of reforms was the reduction of social security contributions, not only for employees but also for employers.

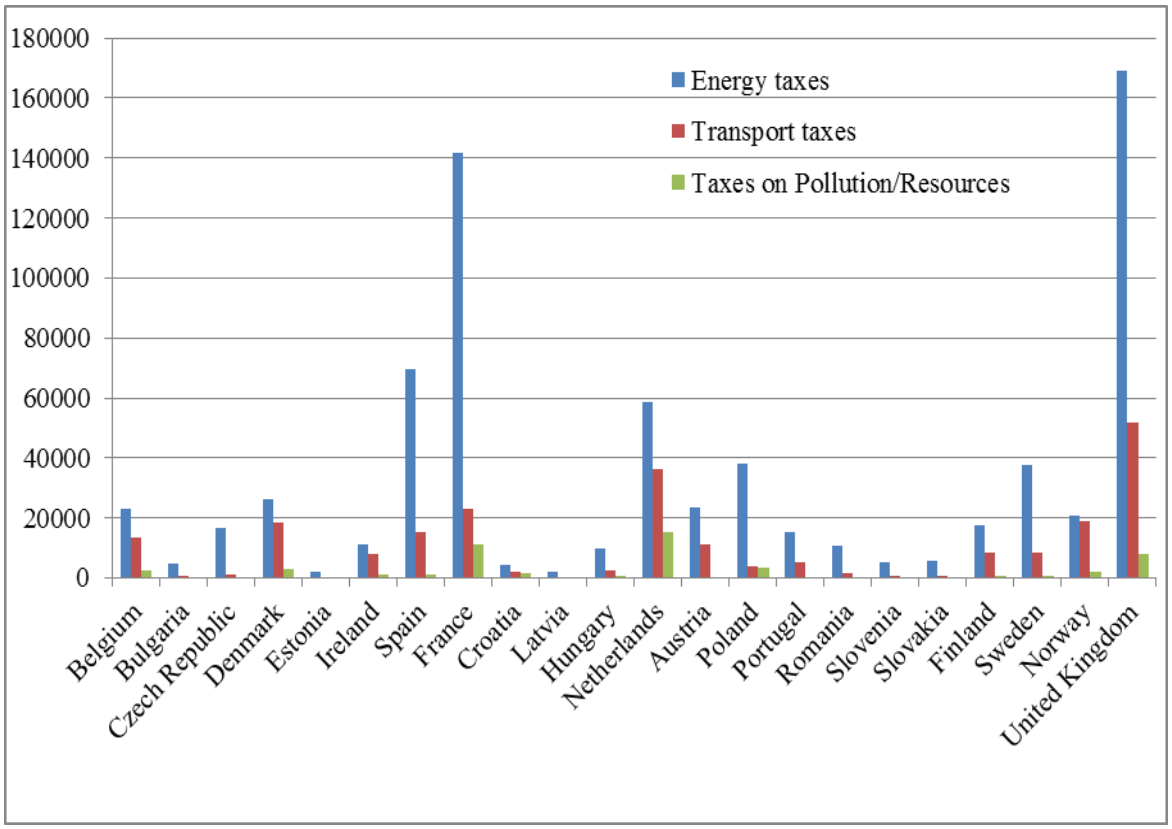
Switzerland joined the environmental tax reforms in 1998 by introducing taxes on extra light heating oils and on volatile organic compounds. The revenue was returned to households in the form of reduced compulsory sickness insurance premiums (OECD, 2004).

In the UK, the reforms started in 1993 when ‘road fuel duty escalator’ was introduced in order to reduce CO_2 emissions and to influence some other environmental issues. It could be said that the reforms of environmental taxes in the UK have had the positive effect. There are provided revenues from taxes through three main entries: lower employers' National Insurance Contributions, tax breaks for renewable energy sources and tax breaks for investments in the energy sector.

However, it seemed to be that the introduction of environmental tax reforms in most OECD countries was accompanied by reduced some forms of social contributions and income taxes which is already known under the term of 'tax shifts'. These tax shifts imply that the introduction of environmental taxes will be accompanied by a reduction of some other taxes (OECD, 2004). According to Smith (1998) tax shifts can even prove to be highly regressive.

Figure 3 gives an overview of revenues from environmentally related taxes. The data relate to a period of four years, from 2009 to 2012, expressed in million euro. Classification of environmental taxes is taken from Eurostat (2012).

Figure 3. Environmental Tax Revenues



Source: Statistics A-Z. (n.d.) In Eurostat. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

It can be seen that the revenues, in each country observed, are the highest from energy taxes. Among other environmentally related taxes, revenues from transport taxes are much lower, while revenues from pollution taxes and taxes on resources are very limited in relation to total tax revenues. When it comes to environmental tax revenues by countries, United Kingdom, France and Spain have the highest revenues; Netherlands and Poland are in the middle, while the environmental tax revenues are the lowest in Estonia, Croatia and Latvia.

The following Table 1 gives an overview of revenues from environmentally related taxes in percent of GDP over a period from 2008 to 2012.

Table 1. The Percentage Rate of Environmental Tax Revenue in GDP

Country/Year	**2008**	**2009**	**2010**	**2011**	**2012**	**Average**
Belgium	2,12	2,19	2,22	2,26	2,16	2,19
Bulgaria	3,45	3,04	2,92	2,88	2,82	3,02
Czech Republic	2,35	2,40	2,38	2,47	2,35	2,39
Denmark	4,21	3,95	4,00	4,03	3,87	4,01
Estonia	2,34	2,95	2,96	2,77	2,78	2,76
Ireland	2,40	2,37	2,58	2,51	2,49	2,47
Greece	1,95	1,97	2,51	2,76	2,85	2,41
Spain	1,67	1,66	1,67	1,60	1,57	1,63
France	1,78	1,80	1,76	1,81	1,83	1,80
Croatia	3,44	3,35	3,68	3,32	3,18	3,39
Latvia	1,96	2,33	2,40	2,46	2,42	2,31
Hungary	2,73	2,69	2,67	2,54	2,55	2,64
Netherlands	3,76	3,80	3,83	3,73	3,56	3,74
Austria	2,40	2,41	2,38	2,46	2,44	2,42
Poland	2,60	2,56	2,58	2,55	2,52	2,56
Portugal	2,56	2,51	2,50	2,36	2,18	2,42
Romania	1,78	1,87	2,01	1,89	1,94	1,90
Slovenia	3,01	3,56	3,64	3,45	3,82	3,50
Slovakia	2,05	1,95	1,87	1,85	1,75	1,89
Finlad	2,69	2,64	2,78	3,13	3,07	2,86
Sweden	2,71	2,84	2,74	2,53	2,49	2,66
Norway	2,58	2,65	2,67	2,50	2,38	2,56
United Kingdom	2,43	2,60	2,64	2,62	2,62	2,58

Source: Statistics A-Z. (n.d.) In Eurostat. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

It can be seen that Denmark, Netherlands and Croatia have the largest share of environmental tax revenues in GDP. Also, Italy and Finland follow them, while Lithuania, Romania and Slovakia have the lowest share of environmental tax revenues in GDP.

In recent years, tradable permit systems have become an important environmental subject when it comes to market-based instruments of environmental regulation. It might be said that it appeared as a supplement or alternative to environmentally related taxes. Considering that the environmental and fiscal properties of environmental taxes and tradable permits are closely-related and that both use flexibility and innovation incentives in the formation of environmental policy, there is a significant similarity between these two market-based instruments. Besides the fact that environmental taxes and tradable permits are both market-based instruments, their similarity is also that both instruments impose

costs to society. Accordingly, both instruments use the incentives for emitters and price signals in order to reduce these costs.

According to Parry (2002) both tradable permits and environmental taxes, in general, reduce overall economic activity by increasing the costs of production. Therefore, if a company that pollutes increases its production it can react in two ways: buy permits to cover the extra emissions or forgo sales of its own permits to other companies (Parry, 2002). It might be said that in either way as a result of producing polluting output there comes a financial penalty.

One of the first examples of the use of tradable permit systems in practice was SO_2 trading scheme. This trading system was introduced in the United States in 1995 as a result of 1990 Clean Air Act Amendments. The Clean Air Act Amendments' goal was to reduce annual SO_2 emissions by 10 million tons below 1980 levels which was based on a two-phase restriction tightening placed on fossil fuel-fired power plants. Reductions in SO_2 emissions are facilitated through a tradable permit system for capping which is a part of EPA's Acid Rain Program. In this way, energy efficiency could be achieved at the lowest cost to society which is one of the Acid Rain Programs' goals.

Another large-scale example of introducing a tradable permit scheme is the common EU ETS for CO_2 emissions permits that was introduced from 2005. The EU ETS works on the 'cap and trade' principle which is based on the number of emission allowances, so the volume of greenhouse gases emitted by the power plants is limited.

When it comes to the introduction of tradable permit systems in the public sector, England was the first country that introduced these tradable schemes specifically targeted at the public sector. The *landfill allowance trading scheme* was introduced in 2005 with the aim of reducing landfill of biodegradable municipal waste. An innovative instrument based on the allocation of tradable landfill allowances to each waste disposal authority was thus chosen with the Waste and Emissions Trading Act 2003 as a legal framework for this tradable scheme. However, the choice between environmental taxes and tradable permit systems requires some specific considerations such as the competitiveness of the permit market and the administrative cost of the two instruments.

3.2 Environmental Regulations in European Union and Transition Countries

Public awareness of environmentally problems and specifically pollution began to grow during the 1960s and 1970s. Scientists became aware that environmental issues can directly affect human health. Man's right to healthy environment became a significant issue and currently in EU this is regulated through the primary and secondary sources of environmental protection. Primary sources are consisted of environmental policies which are included in Treaties of European Union. Among others, this group includes the Treaty

of Paris from 1951, Treaties of Rome from 1957, the Single European Act from 1986 and the Treaty of Maastricht from 1992. The idea of a common environmental policy of the European Union is deemed to have started in October 1972 in Paris, when the leaders of the European Economic Community (EEC) have met. This meeting, known as the Paris Summit, initiated introduction of the first Action Programme for environmental protection which has been taken by the European Commission, after the introduction of declaration on environmental policy.

The first Environmental Action Programme (EAP) was decided upon in November 1973. It might be said that this programme involved many aspects and determinants of what is today called‘ Sustainable Development’. In the period from 1973 to 2002, the European Commission has implemented six action programmes that have defined environmental policy of the EU in that time period. The Seventh Environment Action Programme imposed by the European Community entered into force in January 2014, and will represent a general guide of managing the EU environmental policy until 2020. It might be said that this Action Programme of the European Commission is most comprehensive so far, and is a long-term plan of the European Union, all up to2050. According to the programme, in 2050 none of the resources will be permanently disposed, but will be managed in the circular economy of natural resources. The programme also emphasizes importance of biodiversity and its appreciation that will enhance resilience of society (European Commission, 2014).

In the Seventh Environmental Action Programme three main objectives are conceived that European Commission should implement by 2020. The first objective relates to the conservation of natural resources of the European Union, and also improvement and enlargement of natural capital in general. The second objective of the programme is to revive the utilization of resources of each EU member in terms of circular green and competitive economy with the least amount of carbon. The third objective is the protection of human health from the effects of environmental destruction. The European Commission under this objective implies a good standard of living of its citizens and seeks to prevent health risks of environmental damage.

Also, additional goals that emphasize sustainability and challenges related to climate change are set. The programme emphasizes importance of the sustainability of each city of the European Union, as well as greater involvement in the direction of international environmental regulations.

The European Commission has set certain activators, so-called ‘enablers', through which will more easily accomplish the tasks for each member state. The first activator refers to the improvement of the existing legal framework, as well as the adoption of new and their implementation. Improving availability of information through greater use of the knowledge base is another ‘enabler’. It is important to notice that knowledge base is designed to be constantly improved. In the third activator European Commission encourages greater investment in environment and financial expenditure for environment,

as well as adequate guidance of climate policy. Fourth and last enabler refers to the complete connectivity and association of environmental policies and challenges with other policies and requirements. However, the action plan of the Seventh Environment Action Programme implies that by 2020 waste will be treated as a resource, the total waste will be reduced in a way that waste per capita will be reduced, and also landfills for materials that can be recycled will disappear.

European Unions' secondary legislation on environmental issues is consisted of two groups of secondary sources: the first group includes regulations, instructions and decisions while resolutions, opinions and recommendations constitute the second group. Primary EU legislation delegates some authority to lower levels which are called secondary or subordinate legislation. Accordingly, executive authority dictates the structure of secondary legislation. When it comes to environmental requirements, certain topics fall under the same EU legislation, such as management and protection of water, biodiversity, climate change, waste management and air pollution.

European Unions' environmental protection is also incorporated in EU's trade policies since the policy is designed in a way that encourages economic growth and development, the establishment of adequate protection of the environment, and the development of society in general. The Treaty of European Union set a basic objective regarding the EU's internal policies and external action which implies the application of sustainability in different segments of economic and social policy all the way to environmental regulation and environmental policies. These dimensions have to be considered in equal measure at the political level. Thus, EU trade policy encourages sustainable development, both between EU member states and on a global level.

During the past two decades the European Union increased their efforts to become a leader on global environmental governance and it can be said that this is achieved, especially in international environmental politics on different issues such as climate change, waste management, biodiversity and regulation of persistent organic pollutants. The European Union gives more and more importance to the so-called green trade regime, pointing out certain institutions that support this regime, such as the WTO. The main objective of the WTO is to set standards where discrimination in international trade relations is rejected and to neutralize or at least reduce trade barriers. In accordance with sustainable development, these objectives include the utilization and optimization of resources according to the principle of circular economy, as well as the preservation of the natural environment.

Kelemen (2009) said that the EU decisively positioned itself as the leader of the global environmental policy. However, according to him, this leadership has its roots in the management of domestic policy within the EU and also in the management of international trade relations within the political economy.

Home (2007) stressed that the scope of EU environmental regulation continues to grow with recent initiatives and draft directives covering such matters as environmental crime, soil, and mining waste. He emphasized that these initiatives can become an additional burden since they appeared at the time when there is a gap in the implementation of specific environmental policies in European Environmental Law (hereinafter: EEL). On the other hand, aggravating circumstance is the increase of bureaucracy, more complex system of managing the projects and programs because of their significant growth. Consequently, the demand for scarce resources is becoming more and more complex, while there are less and less resources present.

Home (2007) said that there is a common opinion that EEL actually represents a huge aggravating factor in manufacturing or in certain industrial elements and affects companies to relocate to countries with less regulation and lower production costs. On the other side, European Commission considers that environmental policies that are implemented through EEL have no impact on industrial trends and they even slightly increase employment. However, it can be concluded that a series of political and legal reforms and the EU's efforts to strengthen common foreign economic policy significantly increased EU capabilities in the field of global environmental perspectives.

Unlike EU countries, transition countries with weak institutional capacities much harder and slower implement their environmental policies. This can be understood by considering that transition countries, until recently, operated with centrally planned economies. With the collapse of the communist system in Central and Eastern Europe market conditions are beginning to change. Command economies could no longer answer to all market demands, and the CEE countries in the post-communist period soon transitioned to a market-oriented economy. It can be said that it was a logical sequence of events, given that command economies could not answer many market demands including the environmental requirements.

In accordance with this, after the transition to a market oriented approach, CEE countries have experienced economic crisis, because for them the changes came rapidly. However, a ten-year period of adaptation provided a sufficient time for these countries to make small progress in their economies. The gradual recovery of economies of these countries was first noticed in the reduction of unemployment and economic growth. Changes in economic structure and different market conditions as a result of transition events in CEE countries has led to the neglect or slower progress in some other spheres. These countries need better environmental policies, which should be in accordance with the policies of the developed EU countries. Pollution in the CEE countries has become much more noticeable than in the case of developed EU countries. The reason for this can be found in the development and expansion of heavy industries in the area of these transition economies.

This has led the transition countries to start establishing cost-effective regulations. One of the reasons why cost-effective regulations emerged is the introduction of stricter

environmental regulations. The issue is whether imposition of these regulations reduces a country's export and competitiveness.

However, it can be said that there is a common thought that the costs of introducing new regulations as well as compliance costs will ultimately result in reduced country's competitiveness (Loayza, Oviedo, & Serven, 2005). On the other side there are different thoughts which stated that relatively high environmental standards have no significant impacts on international competitiveness (Jaffe et al., 1995).

Regardless of the effect that regulations produce, the introduction of stricter environmental regulations in transition countries, specifically in the CEE countries, seem to be inevitable in order to be compatible with the EU's environmental policies. On the other hand, the harmonization of environmental policy in transition countries with EU environmental policies takes an aggravating circumstance. This is because certain transition countries remain lax environmental regulations in order to specialize in the production of pollution intensive goods and based on that gain a comparative advantage in the export of the same (Wilson et al., 2002). Another reason for maintaining lax environmental regulations may be attracting foreign investments in so called 'dirty' sectors (Xing & Kolstad, 2002). In this way, already endangered, the environment of transition countries is additionally degraded.

Another limitation of the introduction of stricter environmental regulation in transition countries might be directed to technological conditions, given that transition countries have mostly old technology with which it is impossible to develop new production methods. Given that most EU countries base their production on so-called 'green' technology this is another segment in which countries in transition lag behind developed countries.

However, according to Golub, Dudek, and Strukova (2003) transition countries should first establish adequate management control of scarce resources to revive the environmental perspective. In addition to resource management, transition countries need more investments, which could be increased through the innovation and technological progress (Golub et al., 2003). They argued that environmental considerations of transition countries can be incorporated into investment decisions if there is an adequate legal framework for the regulation of the environment in the beginning of eventual technological progress.

Transition countries also faced institutional constraints of the centrally-planned economies. In accordance with that there were no correct methodologies in environmental damage estimation and determining the value of natural resources which could provide a good basis for environmental policy analysis. Golub et al. (2003) considered environmental valuation as a very useful tool for environmental concerns and decision-making that, among others, can serve as a tool for prioritization in the planning of economic development at different governmental levels and selection of alternate policy options.

It might be said that the countries in transition are also faced with a political affairs and corruption which can affect the quality of institutional setting. Here comes the importance of proper regulatory environment and regulatory burden that transition economies face.

Observing the transition countries and their regulatory environment, Petreski (2014) concluded that there is a similarity between Southeast Europe (SEE) and the Commonwealth of Independent States (CIS). On the other side, he said that the countries of CEE have regulatory environment that best supports the business.

However, it can be noticed that recently all transition countries and especially CEE countries seek to establish a more efficient environmental policies. In search of the most efficient environmental policies for transition economies, it seems to be that the most suitable option is pollution charges. Environmental policy in transition countries which is based on pollution charges, according to Soderholm (1999) is supported by the advantages of economic, market-based instruments over previous command and control approaches. Among others, pollution charges encourage investments in cheaper instruments and technologies to reduce emissions, and not just to meet the minimum compliance (Milliman & Prince, 1989).

In order to have positive effects of introducing pollution charges, transition countries should have adequate technical equipment and other support to reduce the level of emissions. This is especially important to establish at the company level where there should be coordination of companies' efforts to reduce emissions with the financial markets aware of environmental investments. It can be said that the main objective of pollution charges in transition countries might be an increase in revenue for environmental protection projects thus ignoring the cost effectiveness and the efficiency of environmental policies introduced.

This can be seen from the Russian example from 1991 when through the Law on Environmental protection Russia introduced an extensive pollution charge system. It seems that the poor functioning of the capital markets, the lack of information about the various technological options for pollution control, little finance provided for environmental investments and institutional obstacles are the main reasons why Russia has had an irrational use of natural resources which made pollution charges not working in a cost-effective way (Soderholm, 1999). Given that there are different political views of Russia and the EU and typical regulatory principles, it can be said that there are also different approaches to environmental regulations with respect to their environmental laws.

However, this can't be applied to the CEE transition countries since they seek to adjust their environmental laws and practices to EU standards. According to Andonova (2004) political institutions of transition countries are important in creating government commitment to the harmonization with EU environmental standards. Considering the environmental harmonization process, three institutional factors can be presented: the veto position of regulated actors, the capacity for interest mediation and compensation, and the strength of environmental movements (Andonova, 2004, p. 20).

Although CEE transition countries seek to harmonize institutional framework with EU standards, this process is slow and it is still at a level that allows environmental

degradation. However, it can be said that environmental regulations in transition countries need improved environmental standards that will lead to a best available technology. Imposition of stricter environmental policies must be resolved through improved institutional capacity, considering the importance of building markets and environmental institutions simultaneously.

Observing the European Union candidate countries, if they want to become an EU member they must speed up the pace of their institutional and technological development, since it is evident that one of the conditions of joining the EU is implementation of adequate environmental policy.

4 EMPIRICAL ANALYSIS: EXPORTS OF POLLUTION INTENSIVE INDUSTRIES IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

4.1 Methodology

The main objective of the empirical analysis is to analyze the relationship between export and environmental regulations, i.e. what impact environmental regulations have on exports of pollution intensive industries. As already mentioned, this analysis involves the use of extended gravity model of trade. Although in the 80's and 90's of last century gravity model of trade was not much used or has been used in its simplest form, recent empirical studies in this field are mainly based on gravity model of trade, which may be one of the most suitable models when analyzing the bilateral trade flows. Many authors have expanded the basic gravity model of trade with different variables such as environmental regulation variable in order to more accurately show the effect of environmental regulations on trade in different conditions (Harris et al., 2002; Grether & de Melo, 2002; Mulatu et al., 2001; Ederington et al., 2005; Mc Laughlin & Coffey, 2009).

When analyzing the impact of environmental regulation on trade the most common burden of most empirical studies comes in terms of choosing a proper environmental regulation variable that could in an adequate manner measure the strictness of environmental regulations. Many authors in their empirical analysis used environmental tax revenue (Constantini & Crespi, 2008; Martinez-Zurzoso et al., 2012) and environmental protection expenditure (Jug & Mirza, 2005; Caporale et al., 2010) as a proxies for environmental regulation variable.

However, this thesis uses environmental tax revenue as a variable for environmental regulation stringency. All the data on environmental regulation variables relate to a sample of 11 CEE countries. It should be said that the data for Serbia, Macedonia, Montenegro and Albania are excluded due to lack of data.

The research in this thesis uses average data of four years, from 2009 to 2012 for both, dependent and independent variables. However, by using gravity model of trade, the thesis seeks to prove the hypothesis that stricter environmental regulations have a negative impact on the export of pollution-intensive industries, i.e. the stricter environmental regulation becomes we expect the smaller export of pollution-intensive industries. Since the environmental tax revenue has been used as a variable for environmental regulation stringency we could set the following sequence: the higher tax revenue-the higher environmental regulation stringency-the smaller the export of pollution-intensive industries is expected.

As noted above, many authors in this field of research used the gravity model in their empirical analysis. This model was first used by Dutch economist Jan Tinbergen in 1962. At the time, he used the basic gravity model of trade which was consisted of two parameters. The first parameter are bilateral trade flows which are proportional to the countries' economic sizes (often used as GDP measurements) and inversely proportional to the distance between them. Since then, many authors in their empirical analysis have used a gravity model of trade, some of which have used an extended model with one or more added variable in it. Some of these authors are presented in the section Review of Empirical Studies.

4.2 Data Sources

Our analysis employs bilateral trade data on pollution-intensive industries from 11 exporting CEE countries and their EU-15 trading partners over the 2009-2012 period. Each observation of empirical analysis in this thesis represents bilateral relationship between the CEE countries *i* and their trading partners *j* from EU-15. In this analysis a gravity model is developed to empirically analyse the relationship between environmental regulations and export. The dependent variable in this empirical research is the export of pollution-intensive industries from *i* to *j*. As for the sample of countries the analysis considers a sample of 11 exporting CEE countries, of which are 10 EU members and their trading partners which are EU-15 members. Eleven exporting countries from a sample include: Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, Slovakia and Croatia.

The period to which all observations in this study are related to is from 2009 to 2012. Accordingly, the data in this analysis are constructed as an arithmetic average for this period of four years by which the thesis tries to overcome the potential problem of bias in the results if the data would have been used for only one year of observation.

As for the availability of data there have been some difficulties regarding the environmental tax revenue as a measure for environmental regulation stringency. For this variable there is no adequate data for the observed period for the FYR of Macedonia,

Montenegro, Serbia and Albania which are, due to lack of data, excluded from these observations.

Regarding the classification of pollution-intensive industries different authors defined it differently. Some of them defined pollution-intensive sectors as those which incurred high levels of abatement expenditure per unit of output (Robison, 1988; Tobey, 1990), while the others defined it as the ones who incurred abatement costs of approximately 1 percent or more of the total value of sales (Low & Yeats, 1992; Xu, 1999).

However, this thesis uses a classification with more direct approach for determining emissions intensity which has been already used by Quiroga et al., 2007. This approach is based on the 3-digit Standard International Trade Classification (SITC) level, revision 3. The selection of pollution-intensive industries in this thesis is based on two environmental variables which include emissions of sulfur dioxide (SO_2) and emissions of organic matter in wastewater, measured as biological oxygen demand (BOD). A description of the industries considered in the estimations is given in Table 2.

Table 2. Pollution-intensive industries included in the study (SITC Rev. 3)

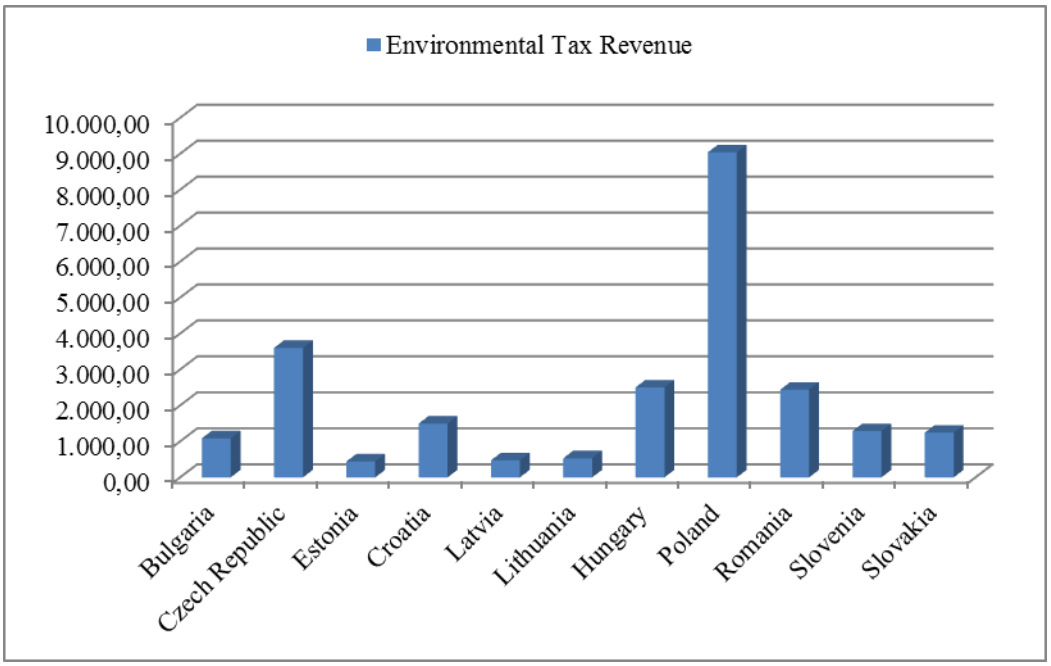
Rank	**Industry**	**Description**
1	Iron and Steel (67)	Pig iron, spiegeleisen, sponge iron, iron or steel granules, and powders and ferroalloys, etc. (671); Ingots and other primary forms of iron or steel; semi-finished products of iron or steel (672); Flat-rolled products of iron or non-alloy steel, not clad, plated, or coated (673); Flat-rolled products of iron or non-alloy steel, clad, plated, or coated (674); Flat-rolled products of alloy steel (675); Iron and steel bars, rods, angles, shapes, and sections (including sheet pilling) (676); Rail or railway track construction material of iron and steel (677); Wire of iron or steel(678); Tubes, pipes, and hollow profiles, and tube or pipe fittings of iron or steel (679)
2	Nonferrous Metals (68)	Silver, platinum, and other metals of the platinum group (681); Copper (682); Nickel (683); Aluminium (684); Lead (685); Zinc (686); Tin (687); and Miscellaneous nonferrous base metals employed in metallurgy and cermets (689)
3	Industrial Chemicals	Organic chemical (51); Inorganic chemical (52); Fertilizers (56); and Chemical materials and products, n.e.s. (59)
4	Pulp and Paper	Pulp and waste paper (25); Paper and paperboard (641); and Paper and paperboard, cut to size or shape, and articles of paper or paperboard (642)
5	Non-metallic Mineral Manufactures (66)	Lime, cement, and fabricated construction materials (except glass and clay materials) (661); Clay construction materials and refractory construction materials (662); Mineral manufactures (663); Glass (664); Glassware (665); Pottery (666); Pearls and precious or semiprecious stones, unworked or worked (667)

Source: Quiroga et al.,*Have Countries with Lax Environmental Regulations a Comparative Advantage in Polluting Industries?,* 2007, p. 25.

The principal variable of interest in this analysis is environmental stringency, which describes the strictness of environmental regulations in export country. We opted for the environmental tax data provided by Eurostat as the main source of data for the dependent variable. All data for the export of selected pollution-intensive industries are based on the Standard International Trade Classification (SITC) made by United Nations Statistics Division.

Figure 4 shows CEE countries ranked according to data on environmental tax revenue, expressed in million Euros.

Figure 4. Central and Eastern European Countries According to Data on Environmental Tax Revenue



Note: *Data in Figure 4 represent average values of observed data for a period from 2009 to 2012.

Source: Statistics A-Z. (n.d.) In Eurostat. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

In Figure 4 it can be seen that Poland has the highest tax revenue, followed by Czech Republic, Hungary and Romania. On the other side, Lithuania, Latvia and Estonia seem to have the lowest tax revenues of countries in the sample.

However, when the size of the country is considered the data might differ. Therefore, as an indicator for environmental regulation stringency the thesis uses environmental tax revenue as a percentage of GDP of a country concerned.

Table 3 shows CEE countries according to data on environmental tax revenue as a percentage of their GDP.

Table 3. Central and Eastern European Countries According to Data on Environmental Tax Revenue (% of GDP)

Country	**Environmental Tax Revenue (% of GDP)**
Bulgaria	2,92
Czech Republic	2,40
Estonia	2,87
Hungary	2,61
Lithuania	1,81
Latvia	2,40
Poland	2,55
Romania	1,93
Slovenia	3,62
Slovakia	1,86
Croatia	3,38

Source: Statistics A-Z. (n.d.) In Eurostat. Retrieved from http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

Note: *Data refers to the average values from 2009 to 2012.

It can be seen that the data differ from Figure 4 to Table 3. According to Table 3 the highest revenues have Slovenia and Croatia, while Lithuania, Romania and Slovakia have the lowest environmental tax revenues. Since the data in Table 3 take into account a countries' size, the thesis uses environmental tax revenues expressed as a percentage of GDP as an indicator for the stringency of environmental regulation.

Empirical analysis of this thesis also includes GDP's of countries from the sample. The observed time period for a GDP data of exporting and importing countries is also from 2009 to 2012, with taken average values for further analysis. The data on GDP is expressed in million euros. However, it is expected that coefficient on these independent variables will have a positive sign, which would mean that an increase in GDP of the exporting countries in a sample cause an increase in exports of pollution intensive industries. All the data concerning these variables were taken from Eurostat online database.

Since the definition of the gravity model of trade says that bilateral trade between two countries is inversely proportional to the geographical distance between them it is important to include another independent variable in order to set the gravity equation properly. As another independent variable the thesis includes distance between exporting countries 'i' and importing countries 'j' which represents a proxy for transportation costs,

tariffs, non-tariff barriers and informal barriers. The distance represents air distance also known as great circle distance between the capitals of countries observed. It is known that greater geographic distance typically diminishes trade flows between countries which have been already used in many empirical studies (Caporale et al., 2010; Bešlić, 2012; Chaney, 2013). Therefore, it is expected for this independent variable to be negative, which would mean that, greater distance between observed countries indicate decrease in exports of CEE countries. All the data on distance between the observed countries were calculated with Distance calculator, extracted from www.timeanddata.com.

In our model we include information on labour cost. Labour cost is measured as gross wages and salaries in 11 CEE countries. The data on wages for these countries refer to average monthly wages for the period from 2009 to 2012 and represent wage differences among countries concerned. The source of data for this variable is EUROSTAT.

Further, we incorporate one dummy variable - Common Border. Dummy variable Common border takes a value 1 if the country *i* and country *j* have a common border and 0 if they do not. However, it is expected that this variable have a positive effect on the exports which would mean that the export from the country *i* to country *j* is higher if these countries have a common border. The common border data are obtained from the CEPII database.

Table 4 provides the results of measurement for all variables used in the gravity model in this analysis.

Table 4. Results of Measurement

Variable	**Observ -ations**	**Mean**	**Standard deviation**	**Minimum value**	**Maximum value**
Export	152	1.61e+08	4.26e+08	537198	4.26e+09
GDP i	154	88726.86	94383.49	15493.1	354407
GDP j	154	869690.9	945231.1	161729.7	7561688
Distance	154	1398.623	677.9439	56	3317
Common Border	154	.0519481	.2226462	0	1
Wage i	154	1221.388	618.8433	429.2889	2576.413
Wage j	154	3694.532	1028.348	1691.206	5510.608
Env. Tax i	154	2.577273	.5676615	1.81	3.62

The Correlation Matrix can be seen in Table 5.

Table 5. Correlation Matrix

	EXPORTln	GDPiln	GDPjln	DISTANCEln	CB	ENTAXi	WAGEdiff
EXPORTln	1.0000						
GDPiln	0.5044	1.0000					
GDPjln	0.4927	0.0225	1.0000				
DISTANCEln	-0.5440	-0.0673	-0.0345	1.0000			
COMMON BORDER	0.3615	0.0976	0.0266	-0.5447	1.0000		
ENTAXi	-0.1680	-0.2439	-0.0022	-0.0549	0.0704	1.0000	
WAGEdiff	-0.0199	-0.1162	0.0728	0.1524	0.0661	0.0406	1.0000

4.3 Model Specification

The main task of the empirical analysis in this thesis is to determine whether stricter environmental regulations of the CEE countries cause a decline in their exports of pollution-intensive industries. Accordingly, we specify the following model to be estimated:

$$lnEXPij = \beta_0 + \beta_1 lnGDP_i + \beta_2 lnGDP_j + \beta_3 STREN_i + \beta_4 lnDIS_{ij} + \beta_5 WAGE_{ij} + \beta_6 CB_{ij} + \varepsilon_i \quad (1)$$

where

ln denotes natural logarithm;

EXP_{ij} denotes the exports of pollution-intensive industries from country i to country j;

GDP_i denotes gross domestic product of the exporting i;

GDP_j denotes gross domestic product of the importing countries j;

$STREN_i$ denotes environmental stringency measures in countries i;

DIS_{ij} denotes distance between capital cities of the country i and country j;

$WAGE_{ij}$ denotes wage difference between country i and country j;

CB_{ij} denotes dummy variable for the existence of common border between country i and country j;

ε_i = error term

As mentioned above, the value of each variable except distance and dummy for common border relates to the average value in a given time period. The principal variable of interest in this analysis is the stringency of environmental regulation in the exporting countries which is presented by environmental tax revenues. It is important to say that the higher revenue in the exporting country implies stricter environmental regulation in that country.

It should be noted that we distinguish variables which relate only to export or import country (denoted i and j variables respectively), and those which concern the level of the bilateral relationship between countries (i.e. variables denoted ij). Each variable is constructed as the arithmetic average value over the three year period of our sample except for the distance and common border variables.

The main hypothesis in this analysis says that stricter environmental regulations of exporting countries negatively affect their exports of pollution-intensive industries. In accordance with this and in case of environmental tax revenue, it is expected that coefficient β_3 has negative sign which would mean that stricter environmental regulations in exporting countries cause a decline in exports of pollution-intensive industries of these countries to their trading partners, other factors remain the same.

On the other side, if the coefficient β_3 would take a positive sign it would indicate that stricter environmental regulations in exporting countries actually increase exports of pollution-intensive industries of these countries. This eventual outcome could be explained that due to stricter regulations companies may use more innovative solutions to maintain their current competitive advantage in industries observed and therefore through innovations they seek to overcome the cost of production and even increase exports of pollution-intensive industries.

This result could be attributed to the Porter hypothesis, which was briefly explained in the previous sections. Since the thesis analyzes cross-sectional data, an Ordinary Least Squares (OLS) is found to be an appropriate technique of estimation.

4.4 Results

Table 6 reports the results of the econometric analysis of the model specifications presented above. The printout of the OLS regression estimation is available in Appendix 1.

Table 6. Results of Gravity Model

Independent variables		**Coefficients**	**(t–stat.)**
GDPILN		0,939***	10,89
GDPJLN		0,889***	11,74
DISLN		- 1,476***	-10,31
STREN		- 0,258*	-1,91
WAGE		0,000	1,29
CB		0,257	0,64
Number of observations	152		
Adjusted R-squared	0,76		
Diagnostic tests:			
F test stat. (6, 145) = 78,63		Prob> F	0,000
Skewness tests for Normality		Prob> F	0,035
Ramsey RESET test for correct functional form		Prob> F	0,066
Breusch-Pagan test for heteroskedasticity		Prob> F	0,364

Notes: 1 *Significance level=0.10; **Significance level=0.05; *Significance level=0.01

The diagnostic tests suggest that we cannot reject the assumptions of heteroscedasticity and correct functional form at 5% level of significance and normality at 10% level of significance. Given the relatively small number of degrees of freedom we consider significance at the 10% as well as the 5% and 1% levels. Interpretation of variables' coefficients refers to on average, ceteris paribus conclusions.

As it can be seen from the Table 6, all variables have expected signs and are statistically significant, with an exception of variable Wage. Considering the specification we find that both exporter and importer country market size proxied by GDP levels have positive signs and they are significant at level 1%.On the other side, coefficients on environmental regulation stringency variable and distance have negative values. Regarding environmental regulation stringency variable the results indicate that the stricter environmental regulations in exporting countries decrease exports of pollution-intensive industries of these countries to their trading partners, which is in accordance with the main hypothesis of this thesis. The results for the geographical distance were also expected, since they show that with the greater distance, exports from country *i* to country *j* decreases. According to

Table 6 it can be concluded that the main hypothesis is confirmed which states that stricter environmental regulations of the exporting countries have a negative impact on the export of pollution-intensive industries.

CONCLUSION

In regard with climate changes the preservation of the environment has never been much discussed as in the past two decades. Increased awareness of environmental protection and the establishment of adequate environmental policies and their effective implementation is becoming increasingly prominent. Thus, the development of the country is no longer expressed only in economic indicators, but also in ability of the country to harmonize economic growth with environmental protection.

Many authors have investigated the relationship between environmental regulations, trade flows and competitiveness in order to prove Porter hypothesis or Pollution haven hypothesis. This thesis investigates the relationship between environmental regulation and exports of pollution-intensive industries where the common thought is that strict environmental regulations represent a burden to a countries' competitiveness since these regulations increase production costs, which ultimately leads to a reduction in exports.

The theoretical part of the thesis is represented through the basic features and representatives of classical and neo-classical school of international trade with special reference to Porter's Diamond model and his hypothesis as to the new environmental paradigm. On the other side, the thesis presented Pollution haven hypothesis, which together with the Porter hypothesis make basic theoretical framework of this study.

When it comes to the previous empirical research in this field the results are mixed. According to some empirical research, stricter environmental regulations have a positive effect on the export of pollution-intensive industries, while the results of other empirical studies have shown that stricter regulations decrease the export of pollution-intensive industries. However, general conclusions regarding the impact of stricter regulations on export of pollution-intensive industries can't be adopted.

Considering the previous studies in this field, empirical analysis were mainly based on the impact of environmental regulations on exports in general. To our knowledge only few studies investigated the impact of environmental regulations on export of dirty industries, out of which are studies conducted by Caporale et al.(2007), Quiroga et al., (2007), Reed and Babool (2010). Therefore, in this thesis we attempt to fill the gap in the literature and go beyond recent studies by investigating relationship between environmental regulation and export of pollution-intensive industries in selected countries of observation.

Since transition countries with weak institutional capacities much harder and slower implement their environmental policies, special attention in the thesis is devoted to the

environmental regulation in the EU as well as in transition countries. Therefore, less developed transition countries with weaker environmental regulation become a stronghold of heavy industries, while more developed EU countries specialize in industries that pollute less.

Regarding the empirical analysis the main goal of the master's thesis was to investigate the relationship between environmental regulation and exports of pollution-intensive industries in selected Central and Eastern European countries. The sample in the analysis includes 11 CEE exporting countries and EU-15 as their trading partners, while the observed period of time is from 2009 to 2012.

The analysis uses extended gravity model of trade. As a dependent variable data were used for the exports of pollution-intensive industries from CEE countries to the EU-15, for which the data were available and provided by Eurostat. As independent variables data were used for GDP, geographical distance, wage, common border and environmental regulation stringency. As a variable of interest the empirical analysis uses environmental tax revenue as an indicator for environmental regulation stringency.

The main hypothesis of the thesis says that stricter environmental regulations decrease exports of pollution-intensive industries and according to the empirical analysis the main hypothesis is confirmed. The results showed that stricter environmental regulations decrease exports of pollution-intensive industries which can be interpreted through the greater production costs that transition countries might have in the export of pollution-intensive goods, when stricter regulations are introduced. An increase in the production costs make exporting country less-competitive which ultimately leads to a reduction in exports.

However, in order to maintain their main competitive advantage, there is a 'fear' that exporting countries will try to maintain their current regulations without introducing more stringent regulations, which might be a better tool in the preservation of their environment. In general, our findings show that stricter environmental regulations in observed CEE countries actually decrease exports of pollution-intensive industries.

In regard with the results it could be said that more lax environmental regulations might increase exports of pollution-intensive industries. In accordance with this, empirical results of this thesis can be attributed to the Pollution haven hypothesis.

It can be said that many factors influenced the trend that transition countries become 'havens' for dirty industries. These factors could be viewed through the transition process, political and social instability, old and developing technologies as well as undeveloped market structures. This could be especially attributed to transition countries. However, the results in this thesis showed that there is an existence of pollution-haven affect where less-developed countries become stronghold of heavy industries.

The results obtained indicate that the policy makers in transition countries should promote activities such as potential exports which use environmental regulation as competitive advantage. In spite of that, it should be emphasized that environmental policies should be designed in the context of sustainable development, which takes into account both the environment as well as the development aspects of human needs.

The results of this study should be treated with caution due to study limitations. When it comes to research limitations, it can be said that the non-use of panel data analysis is the basic limitation of the research, given that this master thesis uses cross-section data.

Thus, the cross-sectional analysis among countries could serve as recommendations for future research. Further research could be based on the impact of environmental regulations on export of certain products (lower level of NACE aggregation), less or more polluting. Also, extension of the sample of countries, as well as use of other indicators to measure the strictness of environmental regulation could be significant incentives for future research.

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APPENDIXES

TABLE OF APPENDIXES

AppendixA: The Results of OLS Regression Estimation

```
Linear regression

regress EXPORTln GDPiln GDPjln DISTANCEln CB ENTAXi  WAGEdiff


      Source |       SS       df       MS              Number of obs =     152
-------------+------------------------------           F(  6,   145) =   78.63
       Model |  392.769974     6  65.4616624           Prob > F      =  0.0000
    Residual |  120.710876   145  .832488802           R-squared     =  0.7649
-------------+------------------------------           Adj R-squared =  0.7552
       Total |  513.480851   151  3.40053543           Root MSE      =  .91241


------------------------------------------------------------------------------
    EXPORTln |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      GDPiln |   .9388359   .0861761    10.89   0.000     .7685123     1.10916
      GDPjln |   .8887029   .0757238    11.74   0.000     .7390379    1.038368
  DISTANCEln |  -1.476093   .1432322   -10.31   0.000    -1.759186   -1.193001
          CB |   .2574094   .4049834     0.64   0.526    -.5430239    1.057843
      ENTAXi |  -.2578113   .1350148    -1.91   0.058    -.5246626    .0090399
    WAGEdiff |   .0000827   .0000642     1.29   0.200    -.0000443    .0002097
       _cons |   6.679611   1.827794     3.65   0.000     3.067049    10.29217
------------------------------------------------------------------------------
```

Appendix B: Diagnostic Tests

```
Skewness/Kurtosis tests for Normality

                                                       ------- joint ------
    Variable |    Obs    Pr(Skewness)    Pr(Kurtosis)  adj chi2(2)    Prob>chi2
-------------+-------------------------------------------------------------------
         res |    152      0.0346          0.0001        16.54          0.0003


. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of EXPORTln

         chi2(1)      =     0.82
         Prob > chi2  =   0.3648

. estat ovtest

Ramsey RESET test using powers of the fitted values of EXPORTln
       Ho:  model has no omitted variables
                 F(3, 142) =      2.45
                  Prob > F =      0.0657
```