

A Literature Review of the Factors Affecting the Compliance Costs of Environmental Regulation and Companies' Productivity

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ABSTRACT

Purpose: The aim of the paper is to identify potential factors that influence the relative size of environmental compliance costs through a literature review and propose a conceptual holistic model of the indirect impact of these factors on companies' productivity levels. In the literature, the connection between costs associated with environmental regulation and companies' productivity has been thoroughly tested within what is known as the Porter hypothesis, or simply PH.

Design/methodology/approach: The paper applies the methods of integrative review of scientific literature and qualitative research with a document study.

Findings: The results point to several key findings. First, the identified potential factors can be divided into two main categories, namely internal factors (size, sector, age, environmental awareness, etc.) and external factors (relevance of environmental regulation for businesses, environmental stimulus measures, quality of institutions, etc.). Second, the wide use of compliance costs within the indicators of stringency of environmental regulation suggests that the relative size of environmental compliance costs is likely to affect companies' productivity.

Practical Implications: The identification of factors affecting the size of compliance costs provides valuable insights to policy makers for the implementation of environmental regulation and making it more effec-

tive while not being discriminatory in terms of presenting an excessive burden to certain types of companies.

Originality/significance: There has been a gap in the literature on environmental regulation compliance costs, as so far no study has comprehensively addressed all the potential factors influencing the relative size of environmental compliance costs for companies.

Keywords: compliance costs, environmental regulation, productivity, Porter hypothesis, digital maturity

JEL: H23, O13, O44

1 Introduction

Public administration reforms in Central and Eastern Europe brought several policy initiatives like e-government, civil service reform and red tape reduction, among others (Dečman, 2018; Hodžić et al., 2021; Zankina, 2020). In connection with the later, there are numerous studies that examine the costs of complying with regulations alone (Do Céu Colaço Santos and Bilhim, 2018; Nemeč et al., 2017; OECD, 2001; Priyadarshini and Gupta, 2003; Solilova et al., 2019). Costs incurred by the state include not only taxes, fees or penalties paid by companies and individuals, but also indirect administrative costs (Joshi et al., 2001; Nemeč et al., 2017; Slabe-Erker and Klun, 2012). Tran-Nam et al. (2000) argue that each regulation incurs three types of costs: efficiency costs, administrative costs, and compliance costs. Efficiency costs are the costs from tax-induced changes in relative prices, distort producer and consumer choices, which affect the overall output, while administrative costs comprise of the costs to the government of collecting taxes. Compliance costs are related to the companies' compliance with regulatory obligations which include reporting time, consultancy costs, planning and impact assessments, and cognitive costs related to studying and understanding of regulation, among others (Harju et al., 2019), as well as costs that businesses make to comply with the content obligations, that legislation and regulations require of a production process or a product (SCM Network, 2006). The former costs are significant and many times suboptimal as they represent unnecessary, excess costs while at the same time they are generally inevitable and irreducible (Tran-Nam et al., 2000). When focusing on environmental regulation specifically, some authors (e.g., Joshi et al., 2001; Schaltegger and Müller, 1998) even call them hidden costs, as companies are often not fully aware of all the costs associated with meeting environmental regulations as accounting systems do not perceive them as environmental administrative costs. Therefore, optimization of these costs can spur positive effects if savings in compliance costs are further invested, leading to higher productivity of companies, while not affecting the positive effects these regulations have on environment. Still, to make a systematic effort to reduce the administrative burdens you need to know where the burdens come from and how you can reduce them (SCM Network, 2006). More specifically, for optimization of costs, one needs to know which

are the factors that influence their relative size for the companies. Thus far, literature has addressed the issue by focusing on one particular or a smaller set of factors (Eichfelder and Schorn, 2012; Fauziati and Kassim, 2018; Kotnik et al., 2020; Schoonjans et al., 2011; Slabe-Erker and Klun, 2012) while by our knowledge no holistic methodology has been developed in administrative, public or economic policy or other related fields that could fully encompass the issues outlined above. Therefore, the aim of this article is to address the gap and demonstrate the need for a comprehensive analysis concerning the factors of compliance costs. Furthermore, as the literature often uses the size of compliance costs as a proxy of environmental regulation stringency (Ambec, et al., 2013) when analysing interlinkage with companies' productivity, the later was added to a model as well. There have been two opposing sides in the economic literature regarding the effect of environmental regulations on productivity. According to neoclassical economic theory, strict environmental regulation impairs competitiveness and productivity due to the constraints imposed by regulation (e.g., Gollop and Roberts, 1983). Elaborating on this view, the pollution haven hypothesis was formed, which claims that companies, as rational economic agents, will shift their production to countries with less stringent environmental regulation to lower their compliance costs and consequently reduce potential negative impact of environmental regulation on their productivity (Cole and Fredriksson, 2009; Dechezleprêtre and Sato, 2017; Iraldo et al., 2011). However, on the contrary, Porter (1991) hypothesized that tighter environmental regulation, if properly designed, could trigger innovations whose effect would cover the compliance cost through increased productivity. Later, Porter hypothesis was further developed and tested by various researchers, different versions of the hypothesis were formed, and consequently different combinations of the effects of innovation and forms of environmental regulation emerged. Several recent studies of Porter's hypothesis yield mixed results (e.g. Ambec et al., 2013; De Santis et al., 2021; Dechezleprêtre and Sato, 2017; Hojnik et al., 2021; Huiban et al., 2018; Iraldo et al., 2011; Lanoie et al., 2011; Peng, 2020; Ramanathan et al., 2017; Rubashkina et al., 2015), while effects mainly depend on industry of inquiry and production method (Zhao et al., 2018).

The aim of the paper is twofold, namely: (i) based on a literature review to identify potential factors of environmental compliance costs; and further on (ii) to propose a conceptual holistic of the indirect impact these factors have, through the relative size of environmental compliance costs, on companies' productivity levels. The list of potential factors made in this article can already provide insights to policy makers when implementing changes of environmental regulations, while the proposed model can serve as a basis for future empirical research. The paper is structured as follows: after the introduction, the methodology and research questions are briefly presented. Then, the main part consists of literature review and description of all potential factors of compliance costs as well as the importance of holistic measurement of compliance costs and their impact on productivity. Deriving from the findings, we propose a conceptual holistic model for estimating factors of environmental compliance costs, and theoretically predict the impact of environmental com-

pliance costs on companies' productivity levels. In the discussion, we present general finding and potential for future research.

2 Methodological approach and research questions

this paper applies the method of integrative review of scientific research literature and sources. According to Snyder (2019) this method aims to assess, critique, and synthesize the literature on a research topic in a way that enables new theoretical frameworks and perspectives to emerge, rather than simply making an overview or description of a research area. It follows a four-phase approach: (i) designing the review, (ii) conducting the review, (iii), analysis, and (iv) writing the review.

The first phase, designing the review, includes explaining the aims of this paper, which has been described in the introduction. Furthermore, three research questions have been formed, namely:

(RQ 1) Which company's characteristics (internal factors) potentially impact the level of compliance costs of environmental regulations?

(RQ 2) Which other factors (external factors) potentially impact the level of compliance costs of environmental regulations?

(RQ 3) Does the level of compliance costs of environmental regulations impact the productivity of the company?

In the second phase, conducting a review in order to find relevant compliance (administrative) costs factors, we used the Scopus database, in which we applied various search query including titles, abstract and keywords "compliance cost", "administrative cost", "compliance burden", "administrative burden", and "factor" limited to subject area "social sciences", "business, management and accounting", "economics, econometrics and finance". This literature review yields limited results, since only a limited number of studies focused specifically on measuring impact significance of potential factors of companies' compliance costs (Eichfelder and Schorn, 2012; Fauziati and Kasim, 2018; Klun and Blazic, 2005; Kotnik et al., 2020; Schoonjans et al., 2011; Tran-Nam et al., 2000). To broaden that list of potential factors, we expanded our literature review to other related fields as well. For example, environmental awareness of companies has not been mentioned as a factor in compliance costs studies so far, while related literature finds companies with higher environmental awareness less pressed by environmental regulation (Díaz et al., 2013). In the second part of conducting a review, the focus was on factors used as proxies of environmental stringency to find out, whether they are directly or indirectly related to the compliance costs of environmental regulation. For this reason, we used the Scopus database, in which we applied a search query including titles, abstract and keywords "porter hypothesis". We analysed the prevailing factors used to measure stringency of environmental regulation in the most cited articles.

In the third phase, analysis, we identified a total of eight potential internal factors and five potential external factors that impact the relative size of company's compliance costs of environmental regulation. Further, the theoretical background that links the costs of environmental regulation and the productivity of companies was analysed. We have combined factors of compliance costs with the interlinkage between compliance costs and productivity and formed a holistic model, which represents a basis for future empirical research.

In the fourth phase, writing the final review, we have followed the IMRAD methodology, focusing on clear communication of aims, methods, results, and discussion of the paper. The following section addresses identified factors and their anticipated impacts on compliance costs and productivity.

3 Results

A preliminary review of the literature highlights various types of factors, namely: normative, institutional, economic-financial, strategic, organizational, and procedural aspects related to costs of complying with environmental regulations and thus the overall burden on companies. In general, these factors could be divided into a group of internal factors, that are related to characteristics of each specific company, and a group of external factors, which are related to characteristics of business environment in which companies operate (RQ 1 and RQ 2). Based on these defined factors, which present independent variables, the conceptual holistic model of factors affecting environmental compliance costs (dependent variable) and further its indirect effect on productivity has been formed (RQ 3).

3.1 Internal factors

The most exposed factor affecting the relative size of compliance costs is the company's size, due to its most obvious impact through economies of scale. OECD distinguishes between four different sizes of companies¹ that are most used in research. Studies mainly confirmed that relative compliance costs are much smaller for large companies compared to small ones (Crain and Crain, 2010; Fauziati and Kassim, 2018; Klun and Blazic, 2005; Kotnik et al., 2020; Lama and Anderson, 2015; Lewis et al., 2014; Nemeč et al., 2017; OECD, 2001; Ropret et al., 2018; Sandford et al., 1989; Schoonjans et al., 2011; Solilova et al., 2019; Tran-Nam et al., 2000). The European Commission's survey results (European Commission, 2004) demonstrated a clear inverse connection between company size and their compliance costs. In the case of small companies, compliance costs can make up a considerable part of turnover (in several studies more than 10%) implying a significant reduction of profitability (Eichfelder and Vaillancourt, 2014). On the contrary, Ropret et al. (2018) found in their study of companies' perception of administrative burden that larger enterprises are exposed to sectoral regulation, financial and accounting reports, inspections and building permits to a greater degree than other

¹ Micro enterprises (fewer than 10 employees), small enterprises (10 to 49 employees), medium-sized enterprises (50 to 249 employees). Large enterprises employ 250 or more people.

enterprise groups. Still, they argue that this is probably because enterprises with higher turnover have more financial resources available and therefore, they can afford to perform financial, accounting, and other reporting functions internally, while smaller companies often outsource particular activities. These arguments suggest smaller companies are more likely to experience relatively higher compliance costs than large ones. The size factor can be measured by the company's turnover or the number of employees. In general, it is expected that an increase in firm size, initially, has a positive effect on productivity levels, due to economies of scale and scope. However, when a firm grows beyond a certain size, diseconomies of scale may have a dominating effect, thereby negatively influencing productivity levels (Halkos and Tzeremes, 2007), which is why lower productivity can be predicted at least for micro and small companies versus larger ones.

Second most common factor of the environmental regulation compliance costs is the sector of economic activity. Literature suggests that the size of environmental compliance costs differs among economic sectors in which companies operate (J. N. Baldwin, 1990, 1990; Eichfelder and Schorn, 2012; Fauziati and Kassim, 2018; Kotnik et al., 2020a; Le Roux et al., 2008; Ropret et al., 2018; Schoonjans et al., 2011; J. Wu, 2009), while there are substantial differences in sectors that are a subject of comparison. Some authors compare private vs. public sectors (Bozeman, 1993; Kotnik et al., 2020; Lan and Rainey, 1992), others (Schoonjans et al., 2011; J. Wu, 2009) focus on sectors derived from different classifications of activities (for example NAICS² or ISIC³), while Ropret et al. (2018) compared sectors by primary, secondary, tertiary, and quaternary⁴. Higher compliance costs were estimated in public sector compared to private sector (Bozeman, 1993; Lan and Rainey, 1992). On the contrary, a recent study (Kotnik et al., 2020) found no differences in environmental compliance costs between economic sectors. Schoonjans et al. (2011) estimated total compliance costs to 3.5% relative to assets in services industry compared to only 1.5% in the manufacturing industry. Eichfelder and Schorn, (2012) also found that the service sectors maintained higher tax compliance costs (including the time burden) than the building sector. As these findings yield mixed results, we conclude that sector of activity may be a significant factor of environmental compliance costs, but the direction of impact is difficult to predict. Similarly, as productivity varies substantially across sectors, there is a need to consider both technological and economic factors in the explanation of productivity differences (Castellacci, 2007), which makes anticipations of relation between sectors of economic activity and productivity very unfavourable.

The size of compliance costs may also depend on the company's age (Fauziati and Kassim, 2018). Younger companies or existing older companies that have expanded their business into new activities that require more environmental-related administration are found to experience higher compliance costs in comparison with companies that have a longer tradition of environmental business,

2 The North American Industry Classification System

3 International Standard Industrial Classification of All Economic Activities

4 This classification was also derived from NACE classification which is commonly used in EU.

e.g. have improved financial reporting practices over time (Al Mutawaa and Hewaidy, 2010; Loosemore and Andonakis, 2007). Similarly, decreasing effect on compliance costs with company's age was found in the studies, for example of Slovenia (Ropret et al., 2018), New Zealand (Owusu-Ansah and Yeoh, 2005) and for Gulf Cooperation Council countries (Al-Shammari et al., 2008). Therefore, we may anticipate a decreasing effect of company's age on environmental compliance cost. There is no unilateral relationship between firm age and total factor productivity but rather a positive relationship due to the "survival effect"⁵ or a negative relationship due to the "vintage"⁶ or "inertia"⁷ effect (Dong, 2021).

With an increasing use of information systems and information communication technology (IS/ICT) as one of the dimensions of digital maturity of the company (Teichert, 2019), literature demonstrates that IS/ICT may have a stimulating effect on the reduction of environmental compliance costs. Studies (Klun, 2011; Kochanova et al., 2020; Zuurmond and Robben, 2009) demonstrated that increasing use of IS/ICT and more advanced support system companies have, higher the probability of lower compliance costs. Thus, the use of IS/ICT is another potential factor, as arguments from the literature suggest that more advanced and frequent use of IS/ICT diminishes environmental compliance costs of companies. Accordingly, it is also to expect a positive effect of the use of IS/ICT on productivity, as the use of ICT is among the most common factors that explain improvements in productivity levels (Dong, 2021).

Companies also differ whether they have in-house resources to ensure regulation requirements or outsource the obligations. As outsourcing is promoted as one of the most powerful trends in human resources management (Belcourt, 2006), it includes financial savings, an increased ability to focus on strategic issues and access to technology, among others. Researchers (Eichfelder and Schorn, 2012; Schoonjans et al., 2011) found out that outsourcing services related to compliance costs leads to the reduction of the latter and at the same time gives the company a chance to focus more on the core business. On the contrary, Ropret et al. (2018) argue that mostly younger companies and companies with lower turnover use outsourcing more often as they lack knowledge and resources in house to deal with regulatory requirements. Based on this fact, we assume that more outsourcing may lead to lower regulatory costs, including environmental compliance costs. As Abraham and Taylor (1996) argue that firms contract out business services to smooth production cycles, to benefit from availability of specialized skills possessed by the outside contractor, and realize labour cost savings, therefore, outsourcing is expected to positively affect productivity.

The relative size of environmental compliance costs may also depend on company's international activity. Strong international collaboration and internationalisation of the company are typically reflected through higher number of branches offices abroad, share of profit from sales abroad, franchising and acquisition (Ariff, 2001; Crain and Crain, 2010; European Commission, 2004;

5 As firm becomes more mature, it accumulates knowledge and experiences.

6 New firms can use more recent and innovative methods or technologies than old ones.

7 Old firms are unable to adjust their structure and strategies in a dynamic environment.

Klun and Blazic, 2005; Ropret et al., 2018; Tran-Nam et al., 2000). Doing business abroad also means more formalities for company, which leads to higher compliance costs. Based on the findings of previous research, we anticipate higher environmental compliance costs due to the existence of international activity of the company. Further, there are two explanations in favour of a positive relationship between productivity and participation of a firm in exporting activities; (i) higher productivity and higher efficiency may be required if plants are to enter export markets, and (ii) by exporting, plants may learn of superior technologies and management techniques and increase their productivity (J. R. Baldwin and Gu, 2003; Halkos and Tzeremes, 2007).

Environmental awareness indicates the company's responsible behaviour towards the environment. It encompasses the number of eco-licenses granted, company's inclusion in the EMAS scheme, recycling rate of registration packaging waste, etc. Literature (Díaz et al., 2013; European Commission, 2011; Sankar, 2006; Steger et al., 2002) suggests that companies with higher environmental awareness, also feel less pressed by changes of environmental regulation. Therefore, we anticipate that companies with more responsible environmental behaviour will record lower levels of environmental regulation costs. The effect of environmental awareness on productivity is less straightforward. According to neoclassical theory corporate environmental responsibility increases costs of the firms, through which it negatively affects profits. On the contrary, there are mechanisms related to positive effects of environmental awareness: customers are more willing to buy the firm's product if the firm is known to have a good environmental profile; environmentally responsible firms save labor cost as they (a) can hire at lower wages and (b) get more productive employees; and firms choose responsible behavior independent of the concern for customers or employees in order to gain investor trust (Brekke and Pekovic, 2018).

Study of Fauziati and Kassim (2018) found that risk management is one of important factors influencing the relative size of compliance costs. They determine risk as the possibility of deviation from a planned outcome or goal, while risk management is defined as an ability of companies to deal with different type of risks. Capability of companies to plan and assess costs to fulfil its tax obligations thus influence the total size of compliance cost. Still, the effect of risk management on productivity seems to be less straightforward. According to the research of Viganí and Kathage (2019) effects can be positive or negative depending on different risk management strategies and between different levels of risks.

Table 1 demonstrates information on theory-based internal factors and their estimated impact on environmental compliance costs and productivity, which also present answers to RQ 1. To obtain empirical data on internal factors (use of ICT, international business operations, environmental awareness, outsourcing of services, and risk management) we propose to perform a specially tailored survey questionnaire across companies affected by environmental regulation. Financial and general data on the analysed business entities (revenues, expenses, net profit, company's age (date of registration), size of the company, economic sector, number of employees) can be obtained through various national registers, e.g., Business Register of Slovenia – AJPES.

Table 1. List of internal factors and anticipated influence on the relative size of environmental compliance costs.

Factor	Author(s)	Predicted impact of factor on the size of compliance costs	Predicted impact of factor on company's productivity
Size of the company.	Crain and Crain, 2010; Fauziati and Kassim, 2018; Kotnik et al., 2020; Lewis et al., 2014; Sandford et al., 1989; Schoonjans et al., 2011; Tran-Nam et al., 2000.	Micro and small companies are more likely to experience higher relative compliance costs than larger companies.	Micro and small companies are predicted to have relatively lower productivity than larger companies.
Economic sector.	Baldwin, 1990, 1990; Fauziati and Kassim, 2018; Le Roux et al., 2008; Schoonjans et al., 2011; Wu, 2009.	Mixed results, sectors of activity may conditionally play an important role in estimating environmental compliance costs.	Productivity varies substantially across sectors, thus prediction about the influence of sector on productivity in not possible.
Company's age.	Al Mutawaa and Hewaidy, 2010; Fauziati and Kassim, 2018; Loosemore and Andonakis, 2007; Schoonjans et al., 2011.	Younger companies or existing older companies that have expanded their business into new activities that require more environmental-related administration are more likely to experience higher relative compliance costs than older companies or companies with more experience with regulation.	Mixed results, prediction about the influence of age on productivity is not possible.
Use of IS/ICT (part of digital maturity of company).	Klun, 2011; Kochanova et al., 2020; Zuurmond and Robben, 2009.	Less digitally mature companies are more likely to experience higher relative compliance costs than the more digitally mature.	Companies that use more advanced and more frequently IS/ICT are expected to have higher productivity.
In-house resources vs outsourcing.	Slemrod and Blumenthal, 1996; Schoonjans et al., 2011.	Companies that use outsourcing more commonly, are less likely to experience higher relative compliance costs than companies that deal with regulation in-house.	Outsourcing is expected to positively affect productivity.

Factor	Author(s)	Predicted impact of factor on the size of compliance costs	Predicted impact of factor on company's productivity
International business operations (number of branches, level of internationalization, share of revenue from sales abroad)	Ariff, 2001; Crain and Crain, 2010; European Commission, 2004; Klun and Blazic, 2005; Ropret et al., 2018; Tran-Nam et al., 2000.	Companies that do business abroad are more likely to experience higher relative compliance costs than companies that operate only in one country.	Positive relationship between productivity and participation of a firm in exporting activities is expected.
Environmental awareness	Díaz et al., 2013; European Commission, 2011; Sankar, 2006; Steger et al., 2002.	Companies with more responsible environmental behaviour are more likely to experience lower relative compliance costs than companies with less environmentally engaged behaviour.	Mixed results, prediction about the influence of environmental awareness of the company on productivity is not possible.
Risk management (infrastructure, employees, internal processes, etc.).	Fauziati and Kassim 2018.	Companies, more capable to plan and assess costs to fulfill its regulation obligations are more likely to experience lower relative compliance costs than companies with smaller capacity to assess its regulation requirements.	Mixed results, prediction about the influence of risk management on company's productivity is not possible.

Source: own

3.2 External factors

The costs of environmental regulation are influenced by several external factors. Literature suggests environmental compliance costs depend on financial and non-financial measures (Blumenthal and Slemrod, 1992; Department of Finance, Services and Innovation, 2016; Hoque, 2003; Ittner and Larcker, 1998; Kotnik et al., 2020; Prause and Olaniyi, 2019; Sandford et al., 1989; Tran-Nam et al., 2000; Vaillancourt, 1986; J. Wang et al., 2012). Financial measures incorporate refund of environmental payments, exemption from environmental tax for energy efficiency and excise duty for biofuels, and grants for implementation of environmental legislation. Whereby non-financial measures include enhancements for voluntary systems (e.g., adoption of EMAS scheme or ISO14001 standard), the energy performance certificates, environmental labelling of technologies and products, information, and awareness-raising programmes, etc. For the company to gain a competitive advantage, it must resort to various financial (Ittner and Larcker, 1998) measures, while non-financial instruments usually serve as a complement to selected financial instruments (Hoque, 2003). Many literature sources (Blumenthal and Slemrod, 1992; Hoque, 2003; Prause and Olaniyi, 2019) indicate that both financial and non-financial measures have the effect on increasing the costs of environmental regulations. A more recent study (Kotnik et al., 2020) found that financial measures increase total compliance cost, while they found the effect of non-financial measures to be insignificant.

The next external factor influencing the occurrence of environmental compliance costs are environmental consents. Companies that cause environmental damage need to obtain environmental consents. Despite the adoption of various cost-cutting measures (European Commission, 2012; OECD, 2003), e.g., the new Industrial Emissions Directive (Le Roux et al., 2008) obtaining multiple environmental consents and reporting is still expensive and time consuming for companies. Whereby the additional requirements of individual countries in obtaining these consents lead to additional costs. These arguments would suggest that more environmental consents result in higher environmental compliance costs. Furthermore, as more obligations represent additional costs to companies it is to expect a negative relationship between this variable and productivity.

Quality of institutions is an important cost driver (Chittenden et al., 2003; Deitz et al., 2009; Eichfelder and Vaillancourt, 2014; Garneau and Shahid, 2009; OECD, 2001; Slabe-Erker and Klun, 2012). It includes the customer-orientation of tax authorities encompassing the understandability of tax forms, the availability of official staff members, the reliability of administrative statements and suggestions, the appropriateness of compliance obligations, and the proportionality of audit processes. Researchers (Eichfelder and Vaillancourt, 2014; Slabe-Erker and Klun, 2012) found out that low institutional quality is a major obstacle to business development which can be reflected in higher total compliance costs. These arguments suggest that higher institutional quality leads to lowering environmental compliance costs. Agostino et al. (2020)

found strong evidence that better local institutions help especially small and medium-sized enterprises to become more productive. They mention channels through which productivity could be increased: stimulating companies to innovate and adopt new technologies and to invest more in research and development; shorten the technology distance and accelerate the process of convergence to the productivity levels of the leader in the domestic market.

Compliance costs also depends on interventional measures. Literature proposes that interventional measures such as extended deadlines for reporting obligations (Prause and Olaniyi, 2019; Sandford et al., 1989; Tran-Nam et al., 2000; J. Wang et al., 2012) lead to less pressure on the company. Therefore, it can be anticipated that interventional measures mitigate the total environmental compliance cost for companies. In general, it is to expect positive effect of interventional measures on productivity, while Seidu et al. (2022) warn that interventional measures vary across sectors, while the measures can be deemed inadequate in many cases, so there is a risk of late implementation, which is why the effect on productivity can also be insignificant.

Based on economic geography, the region of companies' activity can be another important external factor of environmental compliance costs. Regions may differ in terms of economic development (e.g., more developed vs. less developed regions) as well as in environmental cost standards (Liu et al., 2021). Literature suggests that geographical clustering of industries generates collective efficiency through knowledge and experience spillovers (Zhu et al., 2014). Thus, it is assumed that companies from more economically developed regions, where clustering is more present, have lower relative compliance costs due to more interactions between companies. The similar argument can be proposed in terms of productivity, which is expected to be higher in more developed regions compared to less developed ones.

The information on external factors and their estimated impacts on environmental compliance costs and productivity is presented in Table 2, which also present answers to RQ 2. As data on internal factor, most of the data on external factors can be obtained through a survey questionnaire for companies, except of data regarding economic development of regions which can be obtained from the publicly available data on NUTS-3 regions in Eurostat database (Eurostat, 2022).

Table 2. List of external factors and anticipated influence on the relative size of environmental compliance costs.

Factor	Author (s)	Predicted impact of factor on the size of compliance costs	Predicted impact of factor on company's productivity
Financial measures and non-financial measures	Blumenthal and Slemrod, 1992; Department of Finance, Services and Innovation, 2016; Ittner and Larcker, 1998; Prause and Olaniyi, 2019; Tran-Nam et al., 2000; Wang et al., 2012.	Financial measures and non-financial measures increase environmental compliance costs for companies.	Financial and non-financial measures increase the productivity of companies through their impact on TQM.
The relevance of environmental regulations for business operations (number of environmental consents required)	Le Roux et al., 2008.	Higher number of environmental consents is reflected in higher environmental compliance costs for companies.	As more environmental consents represent additional costs to companies it is to expect a negative relationship between this variable and productivity.
Quality of public institutions	Eichfelder and Vaillancourt, 2014; Slabe-Erker and Klun, 2012.	Higher institutional quality decrease environmental compliance costs for companies.	It is to expect positive effect of the quality of institutions on productivity.
Interventional measures (e.g., extended reporting deadlines)	Klun, 2011; Kochanova et al., 2020; Zuurmond and Robben, 2009.	Interventional measures decrease environmental compliance cost for companies.	It is to expect positive effect of interventional measures on productivity.
Economic development of regions	Zhu et al., 2014.	More economically developed regions, where clustering is more present, decrease environmental compliance cost for companies.	Higher productivity is expected in more developed regions.

Source: own

3.3 Impact of environmental compliance costs on productivity

A systematic study of the impact of environmental regulation on companies' productivity began in the 1980s when the prevailing neoclassical view considered environmental obligations as costly, ultimately decreasing productivity and competitiveness of the companies (Christainsen and Haveman, 1981)

through detrimental effect on investment opportunities i.e., structuralists approach (Iraldo et al., 2011). For example, Jorgenson and Wilcoxon (1990) estimated that combined effect of mandatory pollution abatement costs and investments to comply with standards reduced average growth rate of real GNP by 0.2% in the US. Dufour et al. (1998) analysed the impact of environmental regulation on the growth of total factor productivity of the manufacturing sector in Quebec and found small but significant negative impact of environmental regulation on the Canadian productivity growth, decreasing it by 0.1%. On the one hand companies are faced with investment costs needed to comply with environmental standards, on the other hand environmental regulation presents opportunity costs of time spent and resources spent that could be more productively used elsewhere (Rubashkina et al., 2015).

Nevertheless, the negative relationship between environmental regulation and productivity has been challenged by the Porter hypothesis (Porter, 1991; Porter and Van der Linde, 1995) which in general argues that environmental regulation, if properly designed, can enhance economic performance as it stimulates companies to change production routines. This leads to increased compliance and reduced costs due to decreased resource inputs or increased efficiency (Slabe-Erker and Klun, 2012), meaning that the benefits outweigh the costs of regulation. Thus, environmental regulation can enhance innovation which leads to competitive advantages on the market and increases productivity of companies which at the end, on aggregate level positively affects productivity on the national level (Kozluk and Zipperer, 2014). Considerable amount of empirical research in the last decades have tested different versions of Porter hypotheses, analysed numerous sectors, and used various methods and indicators of measuring stringency of environmental regulation and productivity (Albrizio et al., 2014). The growth in the number of environmental policies worldwide as well as increased availability of data have enabled researchers to improve their empirical analyses in this field.

In this paper we focus on proxies used to measure stringency of environmental regulation. The purpose of analysis is to show that compliance costs can be used as a proxy for stringency of environmental regulation, which is in line with a claim of Ambec et al. (2013) that environmental regulation is frequently measured by the size of compliance costs. This gives support to the hypothesis that the compliance costs and productivity are interrelated⁸. Iraldo et al. (2011) made a list of indicators used as proxies for environmental stringency in various research. Most of the indicators are directly linked to the compliance costs (for example, costs of pollution control, pollution abatement costs, pollution control operating costs, etc.) implying the relevance of the size of compliance costs on productivity. More recent important research of PH used indicators such as EPS⁹ index (Albrizio et al., 2017; Martínez-Zarzo et al., 2019) or PACE¹⁰ data (Rubashkina et al., 2015), which are also directly

⁸ At this point it is trivial whether the connection is positive or negative.

⁹ Environmental Policy Stringency index is a composite index developed by the OECD.

¹⁰ Pollution abatement and control expenditures.

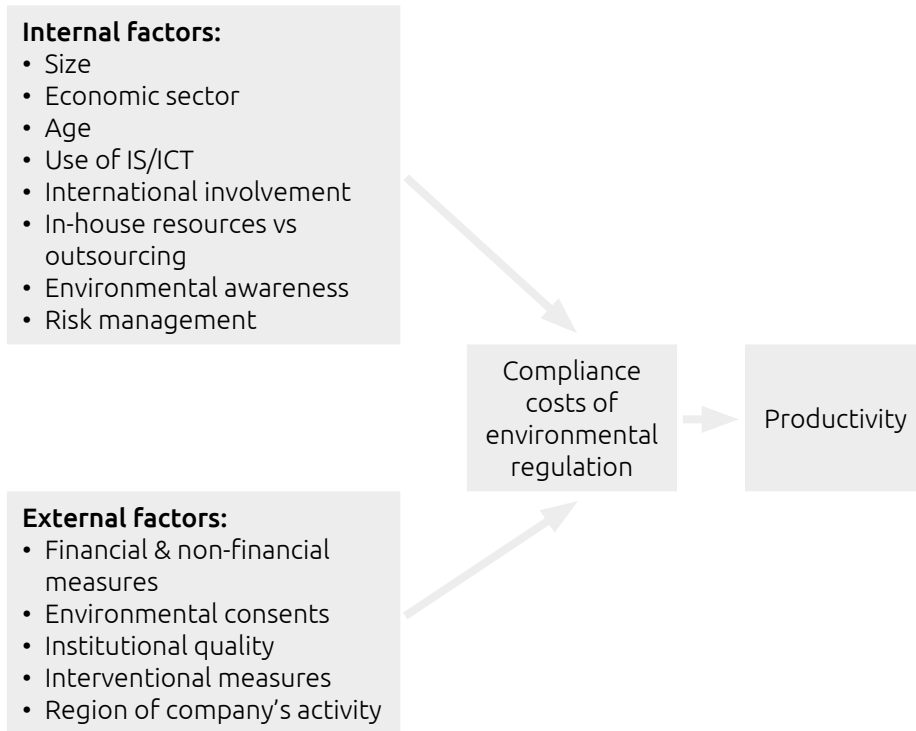
(PACE) or indirectly¹¹ (EPS index) related to the compliance costs of environmental regulation. Xie et al. (2017), suggest that adequate measures of environmental regulation stringency play a pivotal role in testing PH, while it is not only the stringency, but also design or instruments of the regulation that need to be considered. Usually, the literature differentiates between three types of instruments, namely (i) the command-and-control (environmental standards), (ii) the market-based or economic (taxes and tradable permits) and (iii) the informal regulation or soft instruments (Ambec et al., 2013; Iraldo et al., 2011; Xie et al., 2017), while most of the studies examine only one type of regulation (Xie et al., 2017). Therefore, measuring holistically the size of compliance costs related to environmental regulation, both obligatory and voluntary, could provide the most comprehensive measure of the regulation stringency. One of a few studies that uses the size of compliance costs more holistically as a proxy for stringency of environmental regulation is the one of Manello (2017), in which he analysed different responses to environmental regulation on a smaller sample of Italian and German firms in chemical sector. His results demonstrated that firms suffering higher compliance costs in the first period, react and achieve higher productivity growth in later periods, giving support to the validity of the strong PH.

Based on these findings, we can propose a theoretical holistic model that includes various factors (independent variables) that potentially affect companies' environmental compliance costs while the latter can be further associated with the level of companies' productivity (dependent variable). Referring to the definition of researchers (Slabe Erker and Klun, 2012), productivity is defined as company's turnover divided by the number of companies' employees¹². Data on turnover and the number of employees is available through publicly available data, e.g., for Slovenia, Agency of the Republic of Slovenia for public law records and services. Data on this can also be obtained through a specially tailored structured questionnaire for companies. The graphical presentation of our conceptual model is presented in Graph 1. Based on this, we answered a RQ 3 on whether the level of compliance costs of environmental regulations impact the productivity of the company.

¹¹ More stringent regulation implicitly means higher compliance costs.

¹² Unit: in 1.000 € per number of employees.

Graph 1. Conceptual model of internal and external factors impacting compliance costs of environmental regulation and its indirect effect on productivity



Source: own

4 Discussion and conclusion

Throughout the literature review we have identified eight internal and five external potential factors and made predictions about their impact on the relative size of environmental compliance costs and productivity, thus, providing answers to first and second research questions. Internal factors comprise of company's characteristics, namely: size of the company, economic sector of activity, company's age, use of ICT, outsourcing, environmental awareness, international involvement, and risk management. For example, micro and small companies are expected to bear higher environmental compliance costs than larger companies, the same is expected for younger companies or existing older companies that have expanded their business into new activities. Companies that use less ICT, those which are not keen to use outsourcing of services, have not been engaged in environmental activities, have expanded its business internationally or have not been implementing risk management are expected to face higher environmental compliance costs as well. Still, although the literature mentions economic sector as a potential factor, the results of its effect are mixed, making any predictions unfavour-

able. External factors are the ones which are not determined by the business of companies, namely: financial and non-financial measures, environmental consents, institutional quality, interventional measures, and region of activity. Among external factors, financial and non-financial measures are expected to increase environmental compliance costs for companies, as well as more environmental, lower institutional quality, and less interventional measures. Similarly, companies in more developed regions might face lower environmental compliance costs if we assume that geographical clustering of industries generates collective efficiency through knowledge and experience spill overs. Based on the analysis of indicators used in the research related to the impact of environmental regulation stringency on companies' productivity we have answered to the third research question; total size of compliance costs is expected to be a significant factor of companies' productivity. Deriving from the answers to the research questions we have proposed a holistic model of internal and external factors affecting the relative size of compliance costs of environmental regulation, and further their indirect impact on productivity. It can form a basis to analyse further the effects of environmental regulation on productivity of companies i.e., testing the Porter hypothesis.

Our findings and results can be considered as a professional basis for future institutional reforms of environmental regulation as well as for governmental programs intended to administrative burden reduction, better regulation and quality in public administration and special training for civil servants. Identifying factors of compliance costs and measuring their impacts on costs and productivity provides insights to policy makers for implementation of environmental regulation. Environmental regulation is a critical instrument for achieving sustainable economic and social development, recognizing effects of different policy instruments represent valuable information to policy makers. It broadens the understanding of why regulation can be detrimental to some particular types of companies. This aspect is often overlooked as policy makers usually focus on environmental measures to improve environment (less pollution, better air, water, etc.) as the main purpose of environmental policy is to improve living conditions for the society in general. For companies such changes in regulation may cause major obstacles for further development or raising profits, which could result in decreased investments and consequently lower productivity. Still, companies that are willing and able to adapt to new or modified regulation will probably improve and innovate, while the process of adaptation to new requirements depends significantly on how environmental policy is implemented. Administrative burden should be as low as possible and policy makers should pay more attention to avoid or minimize requests that are not necessary (i.e., double reporting, high frequency of reporting, many required registrations) and consequently decrease compliance costs of enterprises. According to the literature review, simplifications of procedures are especially relevant for micro and small enterprises which are subject to the same legal formalities as larger enterprises, while incur higher relative costs. However, as this paper points out, size is not the only factor that influences the differences in the relative size of compliance costs for the companies yet, some limitations of the study need to be considered.

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Although we did a comprehensive literature review, there might be literature and factors that we did not cover in our analysis. Further, our model is based on the literature review, that needs further empirical testing.

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