Environmental compliance costs: A comparison of methodological approaches

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Abstract
The main purpose of environmental regulation that normally takes the form of taxes, duties or standards is to decrease or limit negative externalities that operations of companies have on environment. Complying with regulation represents additional costs for companies, including compliance costs. The latter are the costs incurred by regulations in addition to the actual paying of tax and complying with standards, i.e., the time spent to comply with the obligation, the cost of consultants, as well as the cost of equipment used to treat measure or dispose of emissions and wastes from production. Literature labels them also hidden costs as accounting systems often do not separately capture them as costs of environmental compliance. By being “hidden”, it makes it more difficult to accurately measure them, while results of research may vary significantly according to the methodology used. In the past, several studies have been published on the costs of complying with environmental regulations, while there has been a vast literature related to Porter hypothesis (PH) as well. The hypothesis claims that environmental regulation can ultimately increase productivity of regulated companies, while the size of compliance costs could be used as a proxy of environmental stringency. Research on measuring compliance costs or testing Porter hypothesis differ in several aspects: period of data collection, country or area of costs estimates, methodological approaches, different legislative framework, sample size, etc. Therefore, methodological approaches can be crucial in ensuring the reliability and validity of final estimates. The purpose of this paper is to identify different methodological approaches used in literature to evaluate the costs of compliance with environmental regulations. Based on a critical assessment of the results, we propose that measuring compliance costs of environmental regulation is an important determinant when testing PH, which is why these costs need to be measured comprehensively. Deriving from the literature on measuring compliance costs, we believe that smaller sample detailed surveys could present an alternative way of measuring environmental stringency in PH analyses, as opposed to using other proxies of environmental stringency usually in the form of composite indexes or business survey data, that have been prevailing indicators in the PH literature so far.

Keywords: costs of compliance, environmental regulations, methodology, public administration, Porter hypothesis

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1. Introduction

Economic studies of environmental regulation mainly focus on the effect that stringency of environmental regulation has on productivity, competitiveness, or innovation levels of firms, thus, validating or opposing the controversial Porter hypothesis (widely known simply as PH). The PH claims that tighter environmental regulation, if properly designed, could trigger innovations whose effect would cover the compliance cost and even increase company’s productivity. This implies that the regulation would be socially desirable, even overlooking the environmental concerns it is designed to address (Kneller & Manderson, 2010). Therefore, a better regulation is the one which reaches its purposes at a reduced cost. Since the introduction, the hypothesis has been further developed and tested by various researchers, different versions of PH were formed, and consequently different combinations of the effects of innovation and forms of environmental regulation emerged. Findings vary substantially (Huiban et al., 2018; Ramanathan et al., 2017) and research over the past five years has shown that effects depend on industry of inquiry and production method (e.g., Zhao et al., 2018). Furthermore, results vary also depending on the used indicator of environmental regulation stringency. A major implication from the PH is that a regulatory framework must contain flexible and dynamic elements if it is to stimulate companies’ innovation activities and performance, as dynamic policy instruments should induce innovation by allowing regulated industries to flexibly develop new technologies within a rather generous time frame (Weiss et al., 2018). More “flexible” policy instruments should have a greater effect on innovation and productivity than more “prescriptive” policy instruments, as the latter give little incentive to identify the most efficient way to meet a given environmental objective, whereas more flexible instruments provide incentives for “search” (Lanoie et al., 2011). Therefore, as environmental regulation is of a great importance when studying PH, its use of measure presents one of the main determinants of the results.

In general, there are two different approaches to analysing the impact of environmental regulation. The first approach uses the comparison between regulated and non-regulated sectors (for example Weiss et al., 2018), focusing mainly on the efficiency of regulation in terms of enhancing innovation and productivity of companies. The second approach directly measures the stringency of environmental regulation by using different proxies to evaluate it, which can be according to Brunel & Levison (2016) classified into five categories: (1) private sector abatement costs, (2) direct assessments of the regulations themselves, (3) composite indexes, (4) measures based on pollution levels and changes or energy use, and (5) measures based on public sector expenditures or enforcement. They argue that although the literature mainly exposes data collection as the main challenge of measuring the stringency of regulation, other deeper conceptual problems, such as multidimensionality, simultaneity, industrial composition, and capital vintage, exist. Furthermore, researchers use different indicators to measure these different categories of proxies. In the case of private abatement costs, there are different methods to evaluate them. The earliest and most comprehensive data on private-sector pollution abatement costs in the United States come from the U.S. Pollution Abatement Costs and Expenditures (PACE) which appears to be ideal for measuring stringency because the survey directly asks managers at industrial facilities how much their establishments spent on pollution abatement. Although these kind of abatement cost surveys have some drawbacks (for example, asking managers to answer difficult conceptual questions they may be incapable of answering), it is
important to note that, in aggregate terms, reported abatement costs vary over time and across industries and jurisdictions in ways that are consistent with intuition (Brunel & Levison, 2016).

In this paper, we will focus on different methodological approaches to measure compliance costs as part of the total abatement costs, with a goal to find out prevailing methods of measuring different types of compliance costs, namely production and administration. According to the European Commission each regulation generally incurs two different types of costs, financial (dues, taxes, charges, etc.) and compliance costs. Thus, compliance costs are the costs incurred by regulations in addition to the actual paying of tax (i.e., the time spent to comply with the obligation, the cost of consultants, costs of adapting products to comply with standards, etc.) (Kotnik et al., 2020), also known as indirect expenses of the private sector. According to Standard Cost Modelling (SCM) methodology, which is widely used in the EU, compliance costs are defined as ‘stern from the requirements of the legislation, such as costs induced by the development of new products or processes that meet new social and environmental standards’ (SCM Network, 2006). Smulders & Stiglingh (2008) argue that total compliance costs typically include four elements: the time spent by business owners, managers, staff, and others on understanding and applying the rules, record-keeping costs, the payments for the expertise of professional advisors such as consultants, lawyers, and accountants, and incidental costs such as postage, telephone, and travel in communicating with advisors or the tax authorities. These compliance costs are generally inevitable and irreducible (Tran-Nam et al., 2000). Definitions of compliance costs seem to be relatively vague, while additional problem is to measure them comprehensively, which stems from the fact, that accounting systems do not separately capture them as costs of environmental compliance. Literature also labels them as hidden costs (Joshi et al., 2001) which indicates the difficulty of separating them from other costs as well as accurately measuring them. Consequently, the results of research that include measurements of the size of compliance costs may vary significantly according to the methodology used. As Bruce-Twum & Schutte (2021) argue: The impact of tax compliance costs (TCC) studies therefore depends on the rigour and suitability of the research methodology, as the choice of design, data analysis and validation of construct could affect the conclusions of researchers. It is thus essential that researchers of TCC assess the methods they use occasionally. For this reason, differences between estimated costs should be interpreted cautiously as they might be driven by methodological issues, among which are differences in the definition of the compliance cost and the design of the survey instrument (Eichfelder & Vaillancourt, 2014). Further, it should also be noted that different organizations and researchers use terms administrative burden, administrative costs, compliance cost, etc. interchangeably, although they do not always fit into the same conceptual category.

The rest of the paper is divided into following sections. The second section presents the literature review about different methodologies used for measuring compliance costs. The third section describes the overview of the methods for measuring compliance costs as well as proxies used when testing PH. In the last section, we summarize key findings and present our recommendations on the future of measuring compliance costs, specifically in terms of testing PH, when the size of compliance costs are used as a proxy of stringency of environmental regulation.
2. Literature review with methodology

The problem of accurate measurements of tax compliance costs has been already mentioned in the first half of the 20th century. In 1936, Haig did the first attempt to measure tax compliance costs. Later, Martin (1944), for example, exposed the issue of separating taxation requirements from other expenses of doing business. He argued that because of different forms of business organizations and its ways of meeting tax requirements, there were cases where compliance costs can be easily separated and measured, while on the other hand, tax compliance can be integrated within its production processes, fragmented among different departments, making it difficult to measure them. In later cases, estimations or even guessing of the size of compliance costs is the only way. Furthermore, as he noted that the greatest costs of tax compliance were personnel expenditures, he proposed that a daily time report of each employee should be held to divide time devoted to tax compliance and other activities. Until 1990s, compliance costs of taxation were mainly perceived as insignificant at least until the seminal work of Stanford (1995) was published, in which he identified a few reasons why compliance costs have grown in importance. It was due to changes in technology, introduction of VAT in number of countries, the growth of enterprise cultures and increasing complexity of tax systems. Along with a growing importance of the topic, more attention has been devoted to different measures of compliance costs. Tran-Nam et al. (2000) argue that three different sources of data are required for measuring tax compliance, namely:

- macro statistics on the cross distribution of taxpayers (personal taxpayers by gross and taxable income, or business taxpayers by legal for and annual turnover) and distributions of tax revenues by various characteristics,
- information about taxpayers’ tax compliance costs, such as time spent on personal tax affairs, time spent by unpaid helpers, actual or perceived wages, time spent by different levels of personnel on different tax activities or tax types, fees paid to tax advisers, etc.,
- and other information, such as market wages for different occupations and interest rates.

While the first and the third type of data could be available through various register analyses, collecting the second type of data presents the main issue. Several strategies for collecting these kinds of information have been proposed which include large-scale mail surveys, log-book case studies, face to face or telephone interviews, and document analyses. Although surveys have some drawbacks, usually in terms of low response rates, smaller samples, subjectivity, incompetence of respondents, etc. the most popular method of collecting data for compliance costs research are large scale mail structured surveys (Bruce-Twum & Schutte, 2021; Eichfelder & Vaillancourt, 2014; Tran-Nam et al., 2000). Diary or log-book studies seem to be solving problems of potential under or over estimations of costs of the surveys, still, they are typically limited to small scale research while it is also debatable whether use of stopwatches is appropriate to measure the “true” burden of all cost elements. In general, compliance costs studies can be divided into two groups. The first group focuses on compliance costs in terms of abatement activities which impose additional costs on businesses, such as product or production modification to meet required standards. For these groups, accounting reports analyses and surveys seem to be the prevalent method of data collection. The second group of studies focuses on compliance costs in terms of increased obligations of companies related to tracking their pollution activities (Bruce-Twum & Schutte, 2021; Eichfelder & Vaillancourt, 2014; Kotnik et al., 2020). The most common data collection methods for this group of costs are surveys, in depth
interviews, as well as time logs. Similar division of compliance costs can be found in DEFRA, which differentiates between environmental operating expenditure, defined as the in-house operating costs of a company’s own environmental protection activities and “end of pipe” pollution control expenditures (production). These are defined as expenditures on equipment used to treat, handle, and measure or dispose of emissions and wastes from production.

Nowadays, the most used methodology for measuring the costs of environmental regulations is the Standard Cost Model – SCM, which has become the regulatory reform tool of choice in EU and OECD countries for identifying and reducing regulatory compliance costs. It is an activity-based measurement of the businesses’ compliance costs, breaking down regulation into a range of manageable components, named information obligations. An information obligation does not necessarily mean that information has to be transferred to the public authority, but may include a duty to have information available for inspection or supply on request (Torriti & Ikpe, 2015). As World bank states (World Bank, 2010) SCM is one of tools available to benchmark and monitor compliance costs and does not have the potential, nor the ambition to replace other tools such as the Doing Business Indicators or Business Survey, while it presents a convenient tool to measure compliance costs of environmental regulation. Still, this kind of analyses are scarce.

This paper uses a systematic and in-depth review of the literature and investigation of numerous sources containing problem-related content. On the basis of exploratory and explanatory analysis of the literature we identified, categorise and critically evaluate data collection and methodological approaches used to measure compliance cost with environmental regulations. In the next section, a few of the most important works of measuring compliance costs and their methods used, will be discussed.

3. Results

One of the most recent studies on environmental compliance costs is a work of Do Céu Colaço Santos & Bilhım (2018), in which they use SCM methodology to envisage the evaluation of the impact of “environmental law” on the administrative costs of Portuguese companies, using the standard cost model methodology. They found out that the administrative charges for the companies arising from the time spent on the fulfilment of information obligations resulting from the law exceed what is acceptable and that this spent time encompasses the irritation costs and lost opportunities for companies. Furthermore, Fauziati & Kassim, (2018) evaluated the effect of business characteristics (age, size, sector, and risk management) on the size of compliance costs. With the application of Self Assessment Systems (SAS), the results of the researcher-administered questionnaire survey among 100 companies indicate that only risk management has a potential impact on the size of compliance costs. A similar study was conducted by Schoonjans et al., (2011) in which they performed an electronic Internet-based anonymous survey among 151 Flemish SMEs. The survey was very detailed, asking respondents about costs per category at a disaggregated level to decrease possibility of overlooking some of the costs. As the survey proved to be very time consuming, they stimulated participation by direct calculation of compliance costs for the company. Nevertheless, the focus was on total tax compliance costs, not environmental compliance costs specifically, the results showed that VAT represented the highest share of compliance costs (around 50%), while the share of
environmental taxes compliance costs was only 2%. Still, in some cases, environmental regulation can play a substantial role. Kramer et al., (2020) describe the issue of high costs and time associated with acquiring environmental permits and governmental regulation in the case of Marine and hydrokinetic (MHK) industry in the U.S. Technologies that convert energy of waves, tides, rivers, and ocean currents into electricity represent alternative energy sources for the future, but as the industry is relatively new, companies suffer from high costs to comply with federal, state, and local regulations. The latter represent a key challenge to advancing an economically competitive U.S. and global MHK industry in which the unpredictability of permitting costs remains an issue, and many projects likely exceed predicted costs. Joshi et al., (2001) analysed U.S. steel industry environmental costs, reported by firms’ accounting systems. They found out that 1$ increase in visible operating expenditure is accompanies by an increase of 9.23$ of total costs, arguing that 8.23$ of costs is not tracked as environmental costs as it should be, which indicated that compliance costs of regulation are highly underestimated when using accounting data. When asking managers to validate assumption of high degree of “hidden” environmental cost, they were aware of these underestimations. Managers indicated that PACE data represent the best available internal cost data for environmental expenses.

There are several drawbacks regarding analyses based on “own performed surveys”, namely, samples are usually small, focusing on a specific sector in a specific region or country, there is a lack of common methodology, usually these are one-time surveys, making longitudinal research impossible. Although, as compliance costs are usually not reported continuously as part of public statistics offices, there is a lack of panel data on compliance costs in general (Eichfelder & Vaillancourt, 2014). That is why, data from international organizations seems to be more reliable, while their drawback is a lack of potential deeper insights, which is not the case when doing individual survey on the specific topic.

The study from the OECD (OECD, 2001) has been one of the most comprehensive cross country surveys measuring environmental compliance costs. The latter were estimated by using values provided by the enterprises. Final estimates revealed that total compliance costs presented around 0.6 % of GDP in observed countries, among which environmental regulations were expected to account for, on average, 19% of all compliance costs related to tax, environmental and employment regulations. The share of compliance costs of environmental regulations was estimated as the lowest except in Sweden and Finland where these costs presented 30% and 35% of the total compliance costs, respectively. On average, the compliance costs of environmental regulation stood at approximately EUR 5,600 per enterprise, which accounted for 0.9% of the turnover of the observed enterprises. To reduce administrative burden, which was estimated to 3.5% of GDP in EU, the European commission proposed an action plan to reduce costs stemming from EU legislation by 25% until 2012, which was expected to increase the level of EU GDP by approximately 1.4% (European Commission, 2007). Still, according to final report of European Commission (2012) administrative burden stemming from environmental legislation presented only one percentage point of the estimated total administrative burden, while it was noted in the report that the low share was probably due to confusion with compliance costs in the environmental area and to the high visibility of certain requirements.
One of a few cross country research on the PH that was based on own survey data is the one from Lanoie et al., (2011). Data was collected by postal survey in seven OECD countries among facilities with more than 50 employees in all manufacturing sectors. Most other studies that test PH uses proxies for measuring environmental stringency, usually composite indexes of environmental stringency. For example, Albrizio et al., (2017) and Martínez-Zarzoso et al., (2019) use a relatively new EPS (environmental policy stringency) index, developed by the OECD which covers 24 countries in the 1990-2012 period. The advantage of such indicators is that they reduce a complex set of multi-dimensional policies into a comparable country-specific proxy (Albrizio et al., 2017). Rubashkina et al., (2015) use PACE indicator that includes the flow of industry investment and current expenditures directly aimed at pollution abatement and control. It provides information on the response of each sector to the pressure of environmental policy. Weiss et al. (2018) criticized studies on PH that measure environmental regulation through proxy variables that do not adequately capture elements of a well-designed regulatory mix. Their knowledge of Swedish environmental regulation gave them confidence that regulation proxies measure a proper regulatory design, and their empirical results imply more trustworthy test of the PH (Weiss et al., 2018). One of the few studies that is cross country while it uses reports rather than indexes of international organizations 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 Porter’s HP, thus, being also one of a rare analysis that confirmed the strong version of the PH.

Table 1: An overview of the studies of different types of compliance costs and methodology applied

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Type of compliance costs</th>
<th>Data collection/Methodology</th>
<th>Variables used to measure CC or environmental stringency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Céu Colaço Santos &amp; Bilhim (2018)</td>
<td>Administration</td>
<td>SCM methodology</td>
<td>Time spent to fulfil obligations</td>
</tr>
<tr>
<td>Fauziati &amp; Kassim, (2018)</td>
<td>Administration</td>
<td>Survey across SMEs; Self-Assessment System (SAS)</td>
<td>Tax compliance costs</td>
</tr>
<tr>
<td>Schoonjans et al., (2011)</td>
<td>Administration</td>
<td>Electronic Internet-based anonymous survey</td>
<td>Compliance cost per category; costs and time</td>
</tr>
<tr>
<td>Joshi et al., (2001)</td>
<td>Administration &amp; production</td>
<td>PACE data</td>
<td>Environmental costs</td>
</tr>
<tr>
<td>Weiss et al., (2018)</td>
<td>Production</td>
<td>Data from statistics Sweden – Community Innovation Survey (CIS)</td>
<td>Environmental innovations due to environmental regulations or taxes it expects to be introduced in the future</td>
</tr>
</tbody>
</table>
### 4. Conclusions

This article demonstrates different methodological approaches that have been applied in the literature for measuring the costs of compliance with environmental regulations. Results of in-depth literature analysis demonstrate that measuring compliance costs of environmental regulation is an important determinant when testing Porter hypothesis (PH). Most of the studies testing PH use proxies for environmental stringency, usually composite indexes of environmental stringency or large-scale business survey data. Although these methods enable bigger sample sizes as well as panel data, they are not optimal, as according to Weiss (2018), they do not adequately capture elements of a well-designed regulatory mix. Research findings imply several conclusions, particularly, that apart from established composite indexes or business survey data to measure environmental stringency in PH analyses, and smaller sample surveys may also present an adequate methodological instrument for this purpose.

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3 Stringency is defined as the degree to which environmental policies put an explicit or implicit price on polluting or environmentally harmful behaviour (OECD).
The research results further revealed the lack of literature on the PH that focuses directly on measuring compliance costs instead of using different proxies of environmental stringency. On the other hand, relatively rare studies related to estimation of compliance costs mostly use small-scale survey data, structured interviews, or business reports directly targeted to measure these types of costs. The greatest benefit of these approaches is to measure compliance costs comprehensively so that we do not run the risk of not including some types of costs. Further, results also demonstrate that such methods enable estimations of productivity of these companies as well. Therefore, elaborating on the theory of the PH, in which the compliance costs of environmental regulation play a decisive role it can be claimed that detailed cost-oriented surveys could be an appropriate data collection method of measuring stringency of environmental regulation.

Bibliography


