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Productivity, digital footprint and sustainability in the textile and clothing industry

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Abstract

In recent years, there has been a shift from the linear economic model on which the textile and clothing industry is based to a more sustainable model. However, to date, limited research on the relationship between sustainability commitment and firm productivity has focused on the textile and clothing industry. This study addresses this gap and aims to explore whether the digital footprint of small and medium-sized textile companies in terms of their sustainable performance is related to their productivity. To this end, the paper proposes an innovative model to monitor the companies' commitment to sustainable issues by analyzing online data retrieved from their corporate websites. This information is merged with balance sheet data to examine the impact of sustainability practices, capital and human capital on productivity. The estimated firm's total factor productivity is explained as a function of the sustainability digital footprint measures and additional control variables for a sample of 315 textile firms located in the region of Comunidad Valenciana, Spain.

Keywords: *Productivity; Digital footprint; Web scraping; Sustainability assessment; Textile and clothing industry.*

1. Introduction

Sustainability has gained growing attention in the textile and clothing (T&C) industry as it has turned into one of the most polluting industries in the world. After the oil industry, it is responsible for 10% of carbon emissions (Manshoven, et al. 2019). In Europe, apparel, footwear, and home textiles are the fourth most pressured sector in terms of primary resource and water use, after food, housing, and transport (Ellen MacArthur Foundation, 2017). According to Euratex, in 2021, the entire EU-27 T&C industry represented a turnover of € 147 billion and 143000 companies, mainly micro and SMEs (EURATEX, 2022). In this context, the textile and clothing industry has started to develop forward-looking business models to reconcile competitiveness with sustainability.

The idea that adopting sustainable practices leads to improved corporate performance is well supported by the literature. The link between sustainability and the economic performance of firms has been investigated from theoretical and applied points of view. Russo and Fouts (1997) argued that improvements in environmental performance lead to competitive advantages in terms of cost reduction, enhanced reputation, and increased competitiveness. Focusing on Spanish SMEs, Jorge et al. (2015) suggest that environmental performance has a positive impact on competitive performance as well as the mediating effects of image and relational marketing. Other studies (Aragon-Correa et al., 2008; Galdeano-Gomez et al., 2008) also confirmed the existence of a direct and positive relationship between financial performance and environmental strategies.

A critical debate in the literature concerns the measurement of the sustainability at the corporate level (Pranugrahaning et al., 2021), particularly in SMEs, whose reporting practices have been scarcely researched (Martins et al., 2022). In the lack of a standardized framework for assessing corporate sustainability, many companies, including SMEs, have chosen to report their engagement in sustainable practices through their corporate website (Palma et al. 2022; Lodhia, 2010).

The purpose of this paper is to analyze how textile firms' commitment to sustainability, measured through web content analysis, impacts productivity. The research addresses two main questions: Is it possible to measure the commitment to sustainability of textile companies through their digital footprint? Has the sustainability commitment of textile and apparel firms a positive effect on productivity performance? The research measures the intensity of firms' sustainability commitment by applying web scraping techniques to their corporate websites. The impact on productivity is measured by means of the Total Factor Productivity (TFP), estimated using Levinsohn and Petrin (2003) estimator. To the best of our knowledge, this is the first time that the relation between sustainability commitment, measured with web scraping techniques, and productivity is studied.

2. Corporate sustainability assessment

The demand for sustainable development is challenging for companies both socially and institutionally. In recent years, there has been significant progress in aligning business objectives with the Sustainable Development Goals (United Nations and Development, 2015) since the UN established the 2030 Agenda in 2015. This has led to a growing interest in the academic community on corporate sustainability assessment as a new field of research, which provides tools that can support businesses transitioning towards sustainable development (Pranugrahaning et al., 2021).

There are two major approaches to assessing sustainability at the corporate level: norms and standards and single and composite indicators. Sustainable norms and standards include the Global Reporting Initiative (GRI), the OECD Sustainable Manufacturing Toolkit, and the ISO 14001 Environmental Management Systems (EMS). The GRI produces a comprehensive Sustainability Reporting Framework, which sets out the principles and indicators that organizations can use to measure and report their economic, environmental, and social performance. The OECD Sustainable Manufacturing Toolkit includes an internationally applicable common set of indicators to help businesses measure their environmental performance at the level of a plant or facility. ISO 14001 EMS is considered the leading management tool for addressing environmental degradation. Companies that become certified as complying with these ISO standards by third-party audit can demonstrate their commitment to sustainability by monitoring, managing, and improving their environmental performance. ISO 50001 is the most widely used corporate energy management standard in the world.

In addition to these standards, public and private organizations are increasingly promoting voluntary and non-profit initiatives in favor of sustainability, particularly within the textile industry. The Better Cotton Initiative (BCI), the Recycled Claim Standard (RCS), the Organic Content Standard (OCS), and the Global Recycled Standard (GRS) are some of the most relevant initiatives for promoting sustainability in the textile industry.

Single and composite corporate sustainability indicators are another approach to assessing sustainability. However, measuring corporate sustainability is multidimensional, and there is no clear consensus on which set of indicators to use to manage and measure corporate sustainability performance (Montiel and Delgado-Ceballos, 2014). Despite international recommendations, every different case in the academic literature states its own criteria and indicators, which leads to confusion among practitioners (Buyukozkan and Karabulut, 2018). Furthermore, the need for practical guidance to measure and sustainability performance has been suggested by Moldavska and Welo (2019).

Studies on sustainability performance indicators for the textile industry are recent. Ren (2000) suggested a methodology for developing sector-specific environmental performance

indicators for textile processes and products. According to Luo et al. (2021), the measurement of sustainability performance in the textile and apparel industry can be categorized into four main methodologies: life cycle assessment, environmental footprint, eco-efficiency, and the Higg-Index. The Higg-Index, developed by Sustainable Apparel Coalition (SAC), is a comprehensive set of ratings to track and measure the environmental and social impact of apparel and footwear products and companies on a scale of 0 to 100.

3. Company websites as a source of information

Company websites are a valuable source of information that reflects a company's behavior and identity. Analyzing website content can provide insights into a company's market orientation, innovative behavior, and survival rates (Axenbeck and Breithaupt, 2021; Heroux-Vaillancourt et al., 2020; Blazquez et al., 2018). Technological advancements have enabled the automation of website analysis through web crawling and web scraping techniques, which can extract data from websites and convert it into structured data suitable for analysis (Kumar et al., 2017; Diouf et al., 2019).

The benefits of using company websites as a research tool include their public accessibility, convenience, objectivity, granular data, and up-to-date information (Gok et al., 2015; Blazquez and Domenech, 2018; Hillen, 2019). However, limitations include potential biased or incomplete information, limited data availability due to anti-bot techniques, or legal and ethical concerns (Basso and Sicco, 2009; Krotov and Johnson, 2022; Luscombe et al., 2022).

Despite the limitations, the use of company websites as a research tool remains advantageous, especially for analyzing specific companies in detail. The availability of data also allows for the tracking of changes in company behavior over time. Researchers should be aware of the limitations and take measures to ensure the accuracy and ethics of the data collected through web scraping techniques. Overall, the use of company websites as a research tool is a valuable and convenient method for gathering insights into a company's activities, intentions, and strategies.

4. Methods

4.1. Empirical model

The Cobb-Douglas production function is a widely used theoretical framework in the productivity literature to describe the relationship between factors of production and output in a production process. This production function takes the form:

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} \quad (1)$$

where Y is the output of the production process of firm i in period t, A is the total factor productivity, K, and L are inputs of capital and labor, respectively. This function is easily linearized by taking natural logarithms. The estimation of the production function is affected by simultaneity bias due to the fact that productivity is not directly observable. The Levinsohn and Petrin (2003) estimator addresses this issue by expressing the unobserved productivity as a function of observable variables such as intermediate materials and capital stock. Once Equation (1) is estimated, the productivity analysis involves the regression of TFP, measured as $log(A_{it})$, on various web measures of corporate sustainability and additional control variables:

$$TFP_{it} = \alpha_t + \gamma_S S_i + \gamma_X X_{it} + u_{it} \quad (2)$$

where α_t are time-specific effects, S_i is a vector of variables related to corporate sustainability, and X_{it} is a vector of control variables with firms' characteristics affecting their productivity level. Sustainability was measured by counting the number of different sustainability-related words that were found on the website. Three word lists were considered: i) an extensive list of general and specific concepts (*nkeywords*), ii) a short list of general concepts (*nkwgeneral*), and iii) a list of certifications related to sustainability (*ncertif*). The control variables were chosen based on the productivity literature and included export orientation, firm age, and the gender of the manager.

4.2. Data

The sample for this study covers 315 textile firms located in the Comunidad Valenciana region in Spain, with data for the years 2020 and 2021 considered. The productivity and control variables were retrieved from the SABI database. As for the sustainability variables they were extracted from the websites of the companies after crawling the complete website.

5. Results

Equation (1) was estimated using the *prodest* R-package (Rovigatti, 2017), and its results were employed to estimate the TFP at the firm level. Four different specifications were considered to examine the association of sustainability reporting with a company's productivity. The estimation results are presented in Table 1.

Model I includes *nkeywords* as a measure of sustainability intensity. The results suggest that the TFP increases by 1.1% for each additional sustainability-related keyword found on the company's website. This remains robust, even after controlling for other variables in the regression, as Model III indicates.

Model II distinguishes between two categories of sustainability-related terminology: broad concepts (*nkwgeneral*) and certification-related (*ncertif*). The estimation results indicate that

the use of certification-related words has a more substantial impact on TFP compared to broad sustainability terms. Specifically, the presence of certification-related words is associated with a 16% increase in TFP, while the presence of each different broad sustainability term is associated with a 4% increase in TFP. These effects are slightly more pronounced when control variables are included in the equation (Model IV).

Table 1. Effect of sustainability on productivity

	Model I	**Model II**	**Model III**	**Model IV**
nkeywords	0.011** (0.003)		0.012** (0.003)	
nkwgeneral		0.040** (0.012)		0.041** (0.013)
ncertif		0.160* (0.054)		0.174* (0.053)
Export			0.011 (0.041)	0.010 (0.041)
Woman			–0.057 (0.057)	-0.055 (0.057)
log(Age)			–0.132*** (0.043)	-0.135*** (0.042)
(Constant)	1.507 *** (0.036)	1.493*** (0.036)	1.938*** (0.148)	1.937*** (0.149)
N	608	608	587	587
R^2	0.025	0.041	0.043	0.061

Dependent variable: TFP. Robust standard errors in parentheses. Time-specific effects included.
*** p < 0.001; ** p < 0.01; * p < 0.05

6. Conclusions

This study provides some evidence about the impact of adopting sustainable practices on the productivity of T&C companies. One of the key contributions of this paper is the way in which the firm's intensity of sustainability is measured by analyzing online data retrieved from their corporate websites. Secondly, the estimation of TFP uses the Levinsohn and Petrin methodology. Next, we related TFP with the intensity of firm'sustainability and additional control variables.

Our findings on a sample of 315 small and medium-sized enterprises of the T&C industry located in the Comunidad Valenciana confirm that the association of different measures of sustainability reporting with firms' total factor productivity is positive and significant. Results are robust after controlling for other variables. The main limitation of the study is that the sample refers only to companies in the Comunidad Valeniana region, therefore, as a

future line of research, it is proposed to extend the sample to companies in the national and international context.

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