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Firm size as a moderator of stakeholder pressure and circular economy practices: Implications for economic and sustainability performance in SMEs

***Tarlan Ahmadov*[1], *Susanne Durst*[2], *Wolfgang Gerstlberger*[3], *Quang M. Nguyen*[4]**

Abstract

PURPOSE: *This study examines the interplay between stakeholder pressure (internal and external), circular economy (CE) practices, firm size, and their impact on the sustainability and economic performance of Small and Medium sized Enterprises. This research underscores firm size as a key moderator in the relationship between stakeholder pressures and CE adoption, aiming to provide a comprehensive understanding of this dynamic in SMEs.* ***METHODOLOGY:*** *Based on a cross-sectional survey of 124 SMEs in Estonia, Latvia, and Lithuania, with respondents primarily being owners and managers of firms, a three-step approach tested the proposed model for CE practices. First, Confirmatory Factor Analysis (CFA) was used to ensure that the observed variables represented latent constructs. Second, Ordinary Least Squares (OLS) and Weighted Least Squares (WLS) regression methods were used to control for factors influencing CE adoption. Finally, the interaction terms assessed the moderating role of firm size.* ***FINDINGS:*** *The research shows that firm size moderates these effects, with external stakeholder pressure significantly influencing CE adoption more than internal pressure. These finding underscores how firm size shapes SMEs' responses to stakeholder pressure when adopting CE practices.* ***IMPLICATIONS:*** *This study provides empirical evidence that stakeholder pressure significantly influences SMEs in the Baltic States to adopt CE practices, thus impacting economic and sustainability performance. Smaller firms can enhance CE practices by strategically managing stakeholders, whereas larger SMEs should align with external stakeholder expectations for more effective CE initiatives, leading to improved organizational performance.* ***ORIGINALITY AND VALUE:*** *This study demonstrates how stakeholder pressures drive CE practices and impact organizational sustainability and economic performance. Firm size plays a crucial role as a moderator amplifying the influence of external stakeholder pressure on CE practices.*

Keywords: *Stakeholder Pressure, Circular Economy Practices, Small and Medium-sized Enterprise, Sustainability Performance, Economic Performance, Baltic States*

1 Tarlan Ahmadov, PhD Candidate, School of Business and Governance, Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia, tarlan.ahmadov@taltech.ee & Visiting Researcher at RISE, Research Institute of Sweden, Gothenburg, Sweden (ORCID: 0000-0002-6010-9097)

2 Susanne Durst, Dr. Prof., Department of Business and Economics, Reykjavik University, Menntavegur 1, 102 Reykjavik, Iceland & School of Business and Governance, Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia, e-mail: susanned@ru.is (ORCID: 0000-0001-8469-2427).

3 Wolfgang Gerstlberger, Dr. Assoc. Prof., School of Business and Governance, Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia, wolfgang.gerstlberger@taltech.ee (ORCID: 0000-0001-6200-5737).

4 Quang M. Nguyen, PhD Candidate, Department of Economic Analysis, University of Valencia, Avd. Tarongers sn, Valencia 46022, Spain, quangm.nguyen@outlook.com (ORCID: 0009-0009-2346-2420).

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INTRODUCTION

The European Commission's ambitious vision outlined in "A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" emphasizes the goal of achieving carbon neutrality by 2050 (European Commission, 2018). However, this objective hinges on the active involvement of larger companies integrating small and medium-sized enterprises (SMEs) into their carbon reduction strategies. The European Union defines SMEs as businesses that employ up to 250 people with an annual turnover of up to EUR 50 million (European Commission, 2020) and play a pivotal role in global business, accounting for about 90% of all businesses and over 50% of global employment (World Bank, 2021). In the European Union alone, around 25.1 million SMEs employ over 94 million people, constituting about 66% of the workforce (Statista, 2021).

However, despite their economic significance, SMEs are also responsible for a considerable portion of industrial pollution, contributing 60–70% of Europe's industrial pollution, particularly in the manufacturing sector (Koirala, 2019; OECD, 2019). For instance, manufacturing SMEs are responsible for 64% of air pollution; however, only 0.4% of these enterprises adhere to environmental management schemes (Bonner, 2019). Given that SMEs allocate a substantial share of their revenue to materials and services (Krajewski & Malhotra, 2022), their operational choices significantly impact global resource consumption, pollution levels, and waste generation. Therefore, the integration of SMEs into sustainability initiatives is essential for the success of global environmental strategies, such as those outlined in the EU Green Deal and other carbon reduction policies (Chatzistamoulou & Tyllianakis, 2022).

SMEs face intense competition, demand uncertainties, cash flow challenges, and skill shortages, which complicate their adoption of environmentally and socially responsible practices (Dey et al., 2020). Their financial performance heavily influences decisions related to practices, such as lean methodologies, eco-friendly design, and sustainable procurement (Dey et al., 2022; Łasak, 2022). Additionally, external pressures from clients, policymakers, and market dynamics significantly shape strategic choices. However, several obstacles, such as insufficient financial backing, outdated information systems, inadequate technology, and limited access to technical expertise, hinder SMEs from integrating advanced environmental practices(Ahmadov et al., 2023; Prieto-Sandoval et al., 2018). This constellation can have adverse effects on the long-term sustainability of SMEs, which is crucial for economic progress, mitigating environmental harm, and complying with low-carbon strategies set forth by policymakers (such as the EU carbon tax and EU ETS in 2021). Failure to do so can impede global efforts to address climate change.

The concept of a circular economy (CE) has emerged as a transformative approach to address the environmental and resource challenges posed by traditional linear economic models (Cagno et al., 2023; Knable et al., 2022). CE aims to decouple economic growth from resource consumption and environmental degradation by promoting practices such as recycling, reuse, repair, and efficient use of resources (Franzo et al., 2021). Governments, companies, and influential figures from various sectors are increasingly recognizing the importance of transitioning to CE to combat resource scarcity (Maher et al., 2023) and mitigate environmental impacts (Yang et al., 2023). This urgency stems, among other things, from the pressure exerted on the global economy by the continuous consumption of finite resources (Ibn-Mohammed et al., 2021). However, despite growing attention and efforts, the global economy's circularity remains low, with only 8.6% being circular, and resource recycling rates generally insufficient (Circle Economy, 2020).

While several large enterprises and governments have started adopting CE practices (Garces-Ayerbe et al., 2019), it is more difficult for smaller enterprises, as they seem to face distinct challenges caused by limited resources and expertise (Ahmadov, Durst, & Gerstlberger, 2024; Mura et al., 2020). Existing literature has shed light on various aspects of SMEs' transition to CE. Castro-Lopez et al. (2023), for example, examine the effects of external pressures and organizational agility on adopting circular business models and specific circular practices and found that both factors drive strategic and practice-level changes in manufacturing firms. Sahoo's (2024) research supports the notion that stakeholder pressure influences firms to develop capabilities, such as green data analytics, which indirectly impacts environmental performance. John et al. (2023) focused on the construction sector, identifying logistics infrastructure and market share as critical factors for organizational growth transition towards CE.

Baral et al. (2023) explored the antecedents of CE capability in Indian MSMEs and found that social pressure and green economic incentives are significantly associated with CE capability mediated by environmental commitment and sustainable supply chain design. Bello-Pintado et al. (2023) analyzed the differentiated response of manufacturing companies to stakeholder pressures regarding sustainability practices, suggesting selective adoption based on stakeholder group and country development context. Ul-Durar et al. (2023) proposed a framework linking environmental innovation

with CE through organizational learning and orientation dynamics, emphasizing the role of knowledge resources in the transition towards CE. Hernández-Arzaba et al. (2022) investigated the impact of stakeholder pressure on the adoption of CE principles in Mexico, highlighting the significant role of external stakeholders in enhancing economic and environmental performance through CE. Fobbe and Hilletofth (2023) explored stakeholder engagement practices in Swedish manufacturing organizations, advocating for a shift from linear to circular stakeholder engagement to facilitate CE implementation. A recent study by Ahmadov et al. (2024), involving Estonian micromanufacturing firms demonstrates the significance of stakeholder pressure in driving the adoption of CE practices, highlighting the distinction between internal and external pressures. However, the scope of this study is limited, as it focuses exclusively on micro firms and considers company export status as the sole contextual factor.

Despite recent progress in the study of CE practices, such as research highlighting the importance of external pressures and organizational agility in driving CE adoption (Castro-Lopez et al., 2023), the role of stakeholder pressure in fostering environmental capabilities (Sahoo, 2024), and sector-specific factors influencing CE transitions (John et al., 2023), there is still a gap in understanding how firm size moderates the relationship between these pressures and CE adoption. This potential relationship is particularly relevant in resource-constrained SMEs (Baral et al., 2023; Bello-Pintado et al., 2023). In addition, much of the current research has been conducted in larger economies. In Europe, it can be seen that the eastern countries, in particular, are lagging behind in terms of development towards CE (Mazur-Wierzbicka, 2021). This trend is also evident in the Baltic States, as noted by Ahmadov et al. (2024). Despite progress in sustainability initiatives, SMEs in these countries face structural and policy-related barriers to fully transitioning to circular models. Our study addresses these limitations by investigating the moderating role of firm size in the relationship between stakeholder pressure and CE practices, with a specific focus on SMEs in the Baltic States. Considering recent conceptualizations and empirical studies, this study addresses the following research questions (RQs):

RQ1) How does firm size moderate the relationship between stakeholder pressure (internal and external) and the adoption of circular economy practices in manufacturing small and medium-sized enterprises?
RQ2) What impact does this relationship have on sustainability and economic performance?

The remainder of the paper is structured as follows. The next section delves into the background of CE, the role of stakeholders in the CE context, and the significance of firm size. This is followed by an explanation of the research methods used in this study. The next section presents the findings, followed by a discussion of the results. Finally, the paper concludes with recommendations for future research.

LITERATURE BACKGROUND AND HYPOTHESIS DEVELOPMENT

The literature emphasizes the crucial role of stakeholder pressure, which involves the influence exerted by various stakeholders to align a company's operations with their interests and expectations in shaping the adoption of CE practices (Baah et al., 2023; Jakhar et al., 2019). Stakeholders can effectively drive CE initiatives by promoting awareness, establishing governance policies, implementing regulatory actions, fostering stakeholder collaboration, and utilizing digital technologies, such as blockchain (Ahmadov, Durst, Mendoza, et al., 2024; Munaro & Tavares, 2023; Senaratne et al., 2023). Stakeholder involvement plays a key role in creating resilient and adaptive value creation networks (Durst et al., 2020). Baah et al. (2022) and Rodríguez-Espíndola et al. (2022) stressed the obstacles faced by SMEs in voluntarily embracing CE, highlighting the vital impact of external pressures. This study asserts that the absence of stakeholder pressures impedes the adoption of CE practices in industrial settings. This aligns with growing awareness among stakeholders about ecological and social issues, leading to increased calls for companies to align their operations with environmental and social concerns (Jakhar et al., 2019; Winans et al., 2021).

According to Govindan and Hasanagic (2018), the government plays a vital role in pressuring firms to implement CE. This finding is supported by Genovese et al. (2017) argument that external stakeholder pressure encourages the adoption of CE practices, emphasizing the importance of stakeholder pressure in integrating CE practices (Ahmadov, Gerstlberger, & Rahman, 2024; Baah et al., 2022; Chiappetta Jabbour et al., 2020; Winans et al., 2021). Internal stakeholders, also have a significant influence, potentially surpassing that of external stakeholders in promoting CE business models (Chiappetta Jabbour et al., 2020). Failure to address stakeholder pressures regarding CE can result in a loss of trust and reputation,

which are critical for business sustainability (Hernández-Arzaba et al., 2022; Souza Piao et al., 2024). Therefore, it is crucial for SMEs to respond to stakeholder pressure to avoid these consequences.

To further develop a nuanced understanding, it is crucial to distinguish between internal and external stakeholder pressure. While the literature has extensively documented the impact of stakeholder pressure on the adoption of CE practices, most studies tend to aggregate these pressures without considering the differing roles and influences of internal versus external stakeholders. Understanding the interplay between internal and external stakeholders is essential, as these groups exert different types of pressure that uniquely shape a company's sustainability and competitiveness (Ahmadov, Gerstlberger, & Rahman, 2024; González-Rodríguez et al., 2019). Recognizing these distinctions is essential for comprehending the complex dynamics that influence the adoption of CE practices. Building on these insights, we propose the following hypotheses:

H1: Internal stakeholder pressure has a positive effect on the CE practices of SMEs.
H2: External stakeholder pressure has a positive effect on the CE practices of SMEs.

The impact of CE practices on the economic performance of SMEs is a subject of increasing interest in the academic literature (Dey et al., 2022). Recent studies have shown that the adoption of CE practices, including waste reduction, reuse, and recycling, can lead to improved economic performance for SMEs (Feng & Goli, 2023; Mazzucchelli et al., 2022). This is attributed to potential cost savings from resource efficiency and the creation of competitive advantages offered by CE practices (Tan et al., 2024).

However, the relationship between CE and economic performance is not always direct. Some studies suggest that the positive impact of CE on economic performance may be mediated by factors such as brand reputation (Mazzucchelli et al., 2022), supply chain practices (Khan et al., 2023), or information systems (Natrajan et al., 2024). Additionally, the role of transformational leadership and fintech adoption has been highlighted as important for enhancing the sustainable performance of SMEs within a circular framework (Hidayat-ur-Rehman & Alsolamy, 2023). Given this context, we propose the following hypothesis:

H3: The adoption of CE practices positively influences the economic performance of SMEs.

In addition to economic performance, the adoption of CE practices along with sustainable supply chain practices, has been shown to significantly enhance SMEs' sustainable performance (Khan et al., 2023). Similarly, green logistics management, when mediated through circular economy practices, positively affects sustainability performance (Zhou et al., 2023). Moreover, circular economy practices have been found to be effective leverage for sustainable corporate development, with innovation and digital transformation strategies amplifying this positive impact (Chau et al., 2023). However, a specific gap exists in the understanding of how the relationship between CE practices and sustainability performance is influenced by firm size. Larger firms often have more resources to implement CE practices effectively and meet stakeholder demands more easily, while SMEs may face significant challenges due to resource constraints despite facing intense pressure from stakeholders (Ali & Johl, 2023; Carchano et al., 2023). Furthermore, prior research has not sufficiently differentiated the effects of internal and external stakeholder pressures on firms of varying sizes, which could provide critical insights into how CE practices can be tailored to enhance sustainability performance (Seroka-Stolka et al., 2020). Therefore, it is important to explore whether CE practices can directly enhance firms' sustainability performance.

H4: The adoption of CE practices positively influences the sustainability performance of SMEs.

In prior literature, firm size as a moderator has gained the attention of researchers (Ali & Johl, 2023; Farooq et al., 2021). Prior research has demonstrated that firm size moderates the relationship between CE practices and stakeholder pressures (Ali & Johl, 2023; Latip et al., 2022). Larger firms often face more intense stakeholder pressure owing to their higher visibility and more substantial environmental impact, leading them to adopt proactive environmental strategies (Seroka-Stolka et al., 2020). Additionally, larger firms are more likely to disclose carbon emissions and engage in environmental practices in response to regulatory and organizational stakeholder pressures (Chithambo et al., 2022). These dynamics highlight the need to understand how firm size shapes the relationship between external pressures and CE practices, as the larger the firm, the more it moderates stakeholder pressure.

By contrast, smaller firms experience different dynamics. They are typically more influenced by internal motivations than by external pressures when adopting CE practices (Carchano et al., 2023). However, when external pressure occurs, SMEs may struggle to respond effectively because of limited resources (Tyler et al., 2024). Research in various regional contexts, including China and Malaysia, highlights that firm size influences the integration of industry 4.0, sustainability practices, and CE capabilities (Courrent & Omri, 2022). In Malaysia, SMEs in the food manufacturing sector face varying levels of pressure from customers, regulatory bodies, and the social community regarding environmental behavior, which moderates the relationship between customer pressure and the intention to adopt Environmental Management Practices (EMPs) (Vidal et al., 2023).

These findings emphasize the importance of considering firm size as a moderating factor in the adoption of sustainable practices in response to stakeholder pressure, particularly in the context of CE principles and environmental performance. Understanding the moderating effect of firm size on stakeholder pressure and CE practices is crucial because SMEs, particularly in different regional contexts (such as the Baltic States), face unique challenges and resource limitations that influence their response to these pressures. By examining firm size as a moderator, this study aims to provide tailored insights into how SMEs can effectively navigate stakeholder demands and adopt CE practices to enhance sustainability performance.

H5: Firm size moderates the relationship between internal stakeholder pressure and the adoption of CE practices.
H6: Firm size moderates the relationship between external stakeholder pressure and the adoption of CE practices.

To comprehensively understand the dynamics influencing the adoption of CE practices in SMEs, it is essential to employ both Stakeholder Theory and Resource-Based View (RBV) as theoretical lenses. Stakeholder Theory posits that any party with an interest in a business can influence its decisions, practices, and value creation processes (Freeman et al., 2010). These stakeholders are categorized into primary stakeholders, who are vital to an organization's continued existence, and secondary stakeholders, who may not directly influence a firm's operations (Sarkis et al., 2010). Thus, stakeholders can be both internal and external based on their fundamental roles and attributes (Govindan & Hasanagic, 2018). This theoretical framework helps elucidate how various stakeholder pressures, both within and outside the firm, drive the adoption and implementation of CE practices, shaping the firm's sustainability and competitive performance.

However, to fully capture the complexity of stakeholders' influence on CE practices, it is crucial to integrate the RBV perspective. RBV theory suggests that a firm's ability to respond to stakeholder pressures depends on its internal resources and capabilities (Barney, 1991). Firm size plays a pivotal role here as it affects the availability and strategic management of these resources. Larger firms generally have more financial capital, human resources, and technological capabilities, enabling them to better absorb and respond to stakeholder pressures, including those advocating for CE practices (Conrad, 1999; Nandi et al., 2021). In contrast, smaller firms, while often resource-constrained, can leverage their agility and innovative potential to implement CE practices effectively (Bassi & Guidolin, 2021; Rangone, 1999). Thus, the RBV provides a nuanced understanding of how firm size moderates the relationship between stakeholder pressure and CE adoption, suggesting that the impact of such pressure may vary depending on a firm's internal resource base.

Examining this study from these two theoretical perspectives is essential, as this dual-theoretical approach not only helps explain why firms of different sizes respond differently to stakeholder demands, but also provides deeper insights into the mechanisms through which stakeholder pressures can lead to the implementation of sustainable business practices. By considering both perspectives, this study aims to offer a holistic understanding of the factors that drive CE adoption in SMEs. This understanding contributes to the development of tailored strategies and policy interventions that address the unique challenges faced by firms of varying sizes. The hypothesized relationships are summarized in Figure 1.

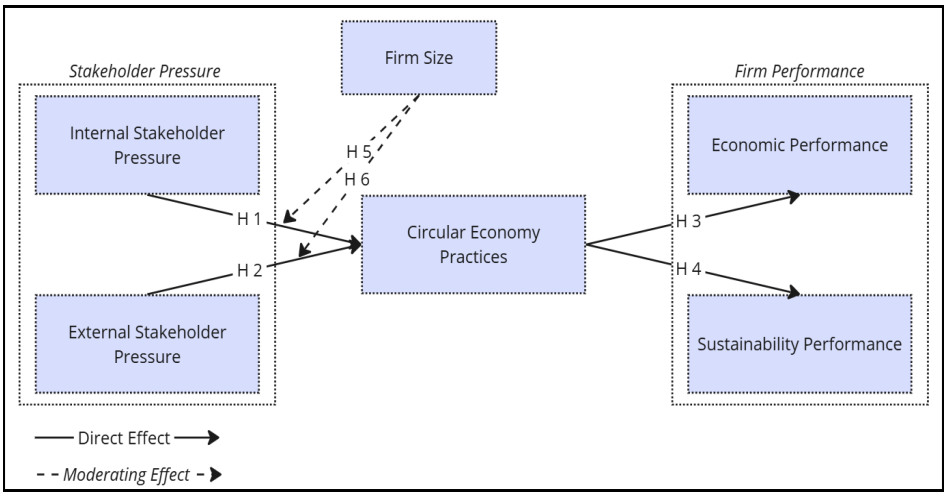

Figure 1. Research model

METHODOLOGY

Sampling strategy and data collection

A survey using standardized questionnaires was conducted to gather data to test the research hypotheses. The target population comprised of small and medium-sized enterprises operating in the manufacturing industry. For this study, SMEs are defined as firms with fewer than 250 employees, where micro firms have up to nine employees, small-sized firms have between 10 and 49 employees, and medium-sized firms have between 50 and 249 employees. We chose to survey Estonian, Latvian, and Lithuanian SMEs because of their unique geopolitical positions, shared history, and contemporary strategic concerns. These countries share a common history and geographical location and have undergone significant political and economic transformations since regaining independence in the early 1990s (Mälksoo, 2023). Their strategic positioning at the crossroads of the Eastern and Western markets, coupled with their EU membership, makes them an interesting case for examining the interplay between regional dynamics and business development (Kascian et al., 2024).

Obtaining data through questionnaires can be challenging, especially when respondents are required to have specialized knowledge, as was the case in this study on sustainability and CE. To ensure the feasibility of our survey, the researchers sought assistance from the local industry chambers. A representative sample of 1,500 SMEs was randomly selected from the Orbis Europe database. An invitation email was sent to these firms on November 14, 2023, explaining the research purpose and requesting their consent to participate in the survey via an online survey software (Qualtrics).

Follow-up and reminder emails were sent to encourage high response rates. In total, 521 surveys were started by respondents, but using the "complete case analysis" method to handle missing data (Hughes et al., 2019), incomplete and missing data questionnaires were discarded by the research team, resulting in 124 usable questionnaires being obtained with a response rate of 8.3% (124/1500), which is comparable to other survey-based firm-level studies (Holzer et al., 2021; Kitsis & Chen, 2020). Detailed profiles of the sampled firms are listed in Table 1.

Table 1. Sample profile

	Count	%		Count	%
Respondents profile			**Education level**		
Female	48	38.71	Diploma/certificate	34	27.42
Male	72	58.06	Undergraduate	37	29.84
Prefer not to say	4	3.23	Master's degree	48	38.71
Position in company			Doctorate	5	4.03
Owner	62	50	**Firm size**		
Production manager	21	16.94	Micro	20	16.13

	Count	%		Count	%
Marketing manager	7	5.65	Small	74	59.68
Supply chain manager	2	1.61	Medium	30	24.19
Quality manager	7	5.65	**Firm ownership**		
Other	25	20.15	Family business	21	16.94
Firm age			Sole proprietor	8	6.45
Old	104	83.87	Partnership	4	3.23
Young	20	16.13	Limited company	91	73.39
			State-owned	0	0.00

Measures

All the items in this study were drawn from the existing literature and modified slightly to fit the current research context. Each item is measured on a five-point Likert scale from "1 = strongly disagree" to "5 = strongly agree." A five-point Likert scale is common and has been frequently used in business management research (Bag et al., 2021; Dubey et al., 2019).

To capture CE practices, six items were adapted from Ali and Johl (2023) and Rodríguez-Espíndola et al. (2022). For internal pressure, including the influence of shareholders and employees, the items were drawn from Miras-Rodríguez et al. (2018) and Waxin et al. (2019). External pressure, representing the influence of customers, suppliers, and competitors, was assessed using items sourced from Chowdhury and Quaddus (2017) and Permatasari and Gunawan (2023).

In measuring sustainability performance, items were adapted from Nureen et al. (2023), and economic performance measures were drawn from Tian et al. (2023). In addition, firm size as a moderator variable was included in the survey. This decision was informed by prior literature highlighting the significance of firm size as a moderator in various contexts (Farooq et al., 2021; Wang et al., 2020). Furthermore, firm age and size were included as control variables to control for potential confounding effects (Jiao et al., 2020; Zhou et al., 2023).

Analysis

As our data were obtained from a single source, we initially assessed the risk of common method bias (CMB) using the Harman single-factor test (Harman, 1976). The results showed that one factor extracted 37.96% of the total variance, which is below the recommended threshold of 50% (Tehseen et al., 2017). Consequently, we concluded that CMB was not present in this study.

Next, we implemented a three-step approach to test the proposed hypotheses. First, we used Confirmatory Factor Analysis (CFA) to verify the underlying factor structure of our measurement. Second, Ordinary Least Squares (OLS) regression was employed to examine the effects of various factors potentially influencing the adoption of CE practices (multicollinearity was assessed for the OLS models; all VIF values were below 10, indicating no serious multicollinearity concerns). To control for potential confounding effects, variables such as firm age and size were included as control variables (Jiao et al., 2020; Zhou et al., 2018). Finally, we assess the moderating role of firm size using interaction terms. As a robustness check, the Weighted Least Squares (WLS) indicator was used as a supplement to the OLS.

RESULTS

Preliminary analysis

Table 2 presents the descriptive statistics and results of the confirmatory factor analysis of the variables used in our study. Among the stakeholders' pressures, customers "customers" exert the greatest influence on firms ($\mu = 3.6$), while "reuse of packaging materials" is the most widely adopted circular economy practice, having the highest mean ($\mu = 3.1$). Regarding economic performance, company's "image" appears to be the most improved aspect ($\mu = 3.50$), whereas "created new jobs" seems to be the least likely among the aspects of sustainability performance ($\mu = 3.298$).

Table 2. Measurement items, descriptive statistics, and factor analysis

Measurement items	Mean	SD	Factor loadings
Internal Pressure			
Shareholders	2.758	1.327	0.558
Employees	2.855	1.234	0.613
External Pressure			
Customers	3.613	1.187	0.832
Suppliers	3.089	1.275	0.833
Competitors	2.984	1.182	0.638
Circular Economy Practices			
Use of renewable raw materials in products.	2.629	1.417	0.651
Reuse of post-consumer products and/or parts in production.	2.484	1.394	0.411
Reuse of leftover material to manufacture new products	3.065	1.430	0.590
Reuse of product packaging materials	3.113	1.461	0.455
During the production stage, use the least amount of energy and/or resources	2.960	1.334	0.547
During the product design stage, we consider recyclability.	2.629	1.428	0.841
Sustainability Performances			
More efficient use of resources and/or materials.	3.710	0.863	0.806
Reduced consumption of resources	3.589	0.988	0.646
Reduction of pollution and waste.	3.758	0.923	0.745
Reduced environmental impact in general.	3.694	0.876	0.756
Improved the quality of our products.	3.790	0.809	0.671
Improved the durability of our products.	3.565	0.913	0.605
Improved work safety.	3.750	0.833	0.648
Improved the work environment.	3.887	0.809	0.638
Created new jobs	3.298	1.119	0.449
Improved overall sustainability performance of the company.	3.710	0.881	0.769
Economic Performances			
Profitability	3.081	0.728	0.658
Sales	3.177	0.687	0.787
Market share	3.065	0.659	0.646
Customer satisfaction	3.492	0.656	0.763
Image	3.500	0.656	0.787
Overall success of the company	3.355	0.701	0.856

Note: Confirmatory factor analysis. SRMR (0.091), RMSEA (0.125), CFI (0.673), TLI (0.639), CD (0.999).

Table 2 also shows the factor loadings and goodness-of-fit statistics (the factor loadings are shown in the last column of Table 2). The goodness-of-fit statistics are shown at the bottom of Table). All items in the table have standardized factor loadings above the acceptable threshold of 0.4 (Field, 2005; Stevens, 1992; Tabachnick & Fidell, 2007). The SRMR (0.091) was slightly above the acceptable limit of 0.08, indicating a moderate fit in terms of residuals. However, RMSEA (0.125), CFI (0.673), and TLI (0.639) indicated that the model did not fit the data optimally. This may partly be attributed to the small sample size. Small sample sizes can affect the reliability of these fit indices (see, e.g., Marsh et al., 1988), making it difficult to accurately assess the model's true performance. While the fit statistics suggest caution in interpreting the exact magnitude of the effects, our study offers a meaningful contribution by exploring potential relationships between different theoretical aspects of a firm's behaviors, thus highlighting areas for further refinement with larger, more robust datasets in future research.

Table 3. Squared correlations (SC) matrix among latent variables

Variables	No. of items	CR	(1)	(2)	(3)	(4)	(5)
(1) CEP	6	0.760	0.359				
(2) IP	2	0.779	0.129	0.656			
(3) EP	3	0.815	0.230	0.351	0.598		
(4) ECP	6	0.887	0.152	0.018	0.061	0.567	
(5) SUP	10	0.894	0.350	0.049	0.080	0.192	0.463

Note: CEP = circular economy practices; IP = internal pressure; EP = external pressure; ECP = economic performance; SUP = sustainability performance. The Average Variance Extracted (AVE) (in italics) is shown on the diagonal. The off-diagonal values are the squared correlations between constructs. CR = Composite Reliability.

Table 3 presents the insights into the validity and reliability of the constructs. For discriminant validity, the analysis showed no issues across the latent variables. This is evident from the squared correlation (SC) matrix, where all off-diagonal values are lower than the AVE values for each latent variable. However, convergent validity was a concern for two variables: CEP (AVE = 0.359) and SUP (AVE = 0.463). These AVE values fall below the commonly accepted threshold of 0.5 (Hair et al., 2010; Malhotra & Dash, 2011), suggesting that these constructs may not explain enough of the variance in the indicators. The other three variables (IP, EP, and ECP) demonstrated satisfactory convergent validity, with AVE values above 0.5. In small sample sizes, a low AVE among certain variables might be expected due to sampling variability (Fornell & Larcker, 1981; Hair et al., 2010; Kline, 2023). When the sample size is small, the likelihood of variability in the estimates increases owing to random sampling errors. This can lead to inconsistent or unstable parameter estimates, including lower AVE values for certain constructs. As the sample size increased, the effects of sampling variability tended to diminish, leading to more stable and reliable estimates of AVE and other model parameters. Composite reliability (CR) scores with a threshold of 0.7 (Fornell & Larcker, 1981; Perry Hinton et al., 2004). As demonstrated in Table 3, all constructs were above the minimum requirement. Thus, our constructs were statistically reliable.

Hypothesis testing

We tested our proposed hypotheses using the results shown in Tables 4-7. Hypothesis H1 posits that internal stakeholder pressure has a positive impact on circular economy practices in SMEs, a proposition confirmed by our results. As indicated in Table 4, the association between CEP and IP is significant and positive (β=0.113, $p<0.01$). As shown in Table 5, EP also demonstrated a significant impact on CEP (β=0.174, $p<0.01$), thereby supporting hypothesis H2. When we control for more variables and confounding factors (i.e., SIZE, AGE, SUP, and ECP), the relationship remains strong. The significance of these relationships implies that IP and EP are key predictors of CEP in the model.

Table 4. The relationship between IP and CEP

	Dependent variable: CEP					
	(1)	(2)	(3)	(4)	(5)	(6)
IP	0.201***	0.144**	0.143**	0.140*	0.132*	0.113***
	(0.0762)	(0.0700)	(0.0721)	(0.0728)	(0.0730)	(0.0143)
SUP		0.637***	0.635***	0.634***	0.574***	0.530***
		(0.122)	(0.124)	(0.124)	(0.134)	(0.0265)
SIZE			0.0126	0.0199	0.0133	-0.0246
			(0.127)	(0.129)	(0.129)	(0.0327)
AGE				0.0771	0.0592	0.0918***
				(0.214)	(0.214)	(0.0295)
ECP					0.189	0.215***
					(0.157)	(0.0214)
constant	2.248***	0.0680	0.0517	-0.0382	-0.380	-0.218**
	(0.230)	(0.467)	(0.497)	(0.557)	(0.625)	(0.0897)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; IP = internal pressure; SUP = sustainability performance; SIZE = firm size; AGE = firm age; ECP = economic performance.

Table 5. The relationship between EP and CEP

	Dependent variable: CEP					
	(1)	(2)	(3)	(4)	(5)	(6)
EP	0.291***	0.204***	0.202***	0.199**	0.188**	0.174***
	(0.0803)	(0.0759)	(0.0763)	(0.0771)	(0.0777)	(0.0119)
SUP		0.598***	0.591***	0.590***	0.541***	0.591***
		(0.123)	(0.124)	(0.125)	(0.133)	(0.0474)
SIZE			0.0460	0.0514	0.0442	0.0413
			(0.123)	(0.124)	(0.125)	(0.0324)
AGE				0.0661	0.0514	0.115
				(0.211)	(0.211)	(0.0720)
ECP					0.164	0.151***
					(0.156)	(0.0496)
constant	1.872***	-0.0413	-0.107	-0.183	-0.473	-0.626***
	(0.272)	(0.466)	(0.499)	(0.557)	(0.621)	(0.170)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; EP = external pressure; SUP = sustainability performance; SIZE = firm size; AGE = firm age; ECP = economic performance.

Hypothesis H3 states that circular economic practices have a positive effect on firm-level economic performance. As shown in Table 6, the relationship between the two variables is positive and significant (β=0.136, p<0.01). Similarly, as shown in Table 7, circular economy practices positively affect firm-level sustainability performance (β=0.273, p<0.01), providing empirical support for hypothesis H4.

Table 6. The relationship between CEP and ECP

	Dependent variable: ECP					
	(1)	(2)	(3)	(4)	(5)	(6)
CEP	0.159***	0.157***	0.151***	0.142***	0.127**	0.136***
	(0.0487)	(0.0489)	(0.0493)	(0.0504)	(0.0518)	(0.00927)
AGE		0.0928	0.110	0.0983	0.0880	0.0461**
		(0.128)	(0.129)	(0.130)	(0.130)	(0.0217)
SIZE			0.0778	0.0620	0.0624	0.0496***
			(0.0756)	(0.0779)	(0.0777)	(0.0159)
IP				0.0386	0.0161	0.0102
				(0.0449)	(0.0483)	(0.00908)
EP					0.0652	0.0711***
					(0.0520)	(0.00776)
constant	2.830***	2.727***	2.562***	2.526***	2.434***	2.477***
	(0.145)	(0.202)	(0.258)	(0.262)	(0.271)	(0.0431)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. ECP = economic performance; CEP = circular economy practices; SIZE = firm size; AGE = firm age; IP = internal pressure; EP = external pressure.

Table 7. The relationship between CEP and SUP

	Dependent variable: SUP					
	(1)	(2)	(3)	(4)	(5)	(6)
CEP	0.297***	0.296***	0.288***	0.284***	0.269***	0.273***
	(0.0536)	(0.0539)	(0.0542)	(0.0556)	(0.0572)	(0.00577)
AGE		0.0112	0.0362	0.0308	0.0208	0.0172**
		(0.141)	(0.142)	(0.143)	(0.143)	(0.00795)
SIZE			0.110	0.103	0.104	0.0954***
			(0.0832)	(0.0859)	(0.0858)	(0.00479)
IP				0.0172	-0.00471	-0.00443
				(0.0495)	(0.0533)	(0.00473)
EP					0.0632	0.0661***
					(0.0574)	(0.00232)
constant	2.841***	2.828***	2.594***	2.578***	2.489***	2.491***
	(0.159)	(0.223)	(0.284)	(0.289)	(0.300)	(0.00355)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. SUP = sustainability performance; CEP = circular economy practices; SIZE = firm size; AGE = firm age; IP = internal pressure; EP = external pressure.

Finally, we test the moderating effects of firm size (see Tables 8 and 9). Again, we examined internal and external pressures separately. In the case of internal pressure (H5), we did not observe any significant effect, as shown in Table 8. However, regarding external pressures (H6), the effect was positive and significant (β=0.283, p<0.01), as shown in Table 9.

Table 8. The moderating role of firm size on the relationship between IP and CEP

	Dependent variable: CEP					
	(1)	(2)	(3)	(4)	(5)	(6)
IP	0.226	0.255	0.161	0.126	0.0963	-0.00601
	(0.300)	(0.305)	(0.278)	(0.279)	(0.277)	(0.106)
SIZE	0.146	0.207	0.0502	0.00474	0.0484	-0.174
	(0.432)	(0.448)	(0.408)	(0.409)	(0.406)	(0.171)
IP*SIZE	-0.0181	-0.0351	-0.0104	0.00293	-0.0106	0.0541
	(0.141)	(0.145)	(0.132)	(0.133)	(0.131)	(0.0524)
AGE		0.130	0.0809	0.0582	0.0397	0.00961
		(0.242)	(0.220)	(0.220)	(0.218)	(0.0249)
SUP			0.633***	0.574***	0.539***	0.552***
			(0.125)	(0.134)	(0.134)	(0.0362)
ECP				0.189	0.157	0.136***
				(0.159)	(0.158)	(0.0286)
EP					0.157*	0.138***
					(0.0849)	(0.00772)
constant	1.986**	1.727*	-0.101	-0.363	-0.543	-0.0639
	(0.876)	(1.001)	(0.979)	(1.002)	(0.996)	(0.340)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; SIZE = firm size; AGE = firm age; SUP = sustainability performance; ECP = economic performance; IP = internal pressure; EP = external pressure.

Table 9. The moderating role of firm size on the relationship between EP and CEP

	Dependent variable: CEP					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
EP	-0.279	-0.282	-0.316	-0.357	-0.375	-0.414***
	(0.282)	(0.283)	(0.261)	(0.262)	(0.263)	(0.0477)
SIZE	-0.857*	-0.849*	-0.849*	-0.907**	-0.913**	-0.963***
	(0.490)	(0.492)	(0.453)	(0.454)	(0.455)	(0.0695)
EP*SIZE	0.284**	0.284**	0.261**	0.275**	0.270**	0.283***
	(0.136)	(0.137)	(0.126)	(0.126)	(0.127)	(0.0221)
AGE		0.0919	0.0660	0.0485	0.0347	0.0414
		(0.226)	(0.208)	(0.208)	(0.209)	(0.0368)
SUP			0.581***	0.521***	0.520***	0.503***
			(0.123)	(0.132)	(0.132)	(0.0216)
ECP				0.195	0.189	0.189***
				(0.155)	(0.155)	(0.0185)
IP					0.0670	0.0887***
					(0.0774)	(0.0131)
constant	3.570***	3.460***	1.620	1.377	1.335	1.469***
	(0.997)	(1.037)	(1.032)	(1.047)	(1.050)	(0.192)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; EP = external pressure; IP = internal pressure; AGE = firm age; SIZE = firm size; SUP = sustainability performance; ECP = economic performance.

To explore whether larger or smaller SMEs exert a stronger influence, Figure 2 plots our interaction terms with external pressure on the x-axis and circular economy practices on the y-axis, while firm size serves as the moderating variable distinguishing the lines (1=micro; 2=small; 3=medium). Observing the plot, the simple slope of external pressure at "micro-size" firms is almost flat but becomes positive for "small" and "medium" firms. We observe the strongest association between external pressure and circular economy practices at the highest level of firm size (medium). Overall, our results suggest that firm size moderates the positive relationship between external stakeholder pressure and circular economy practices, with a more pronounced influence on larger SMEs than on smaller ones.

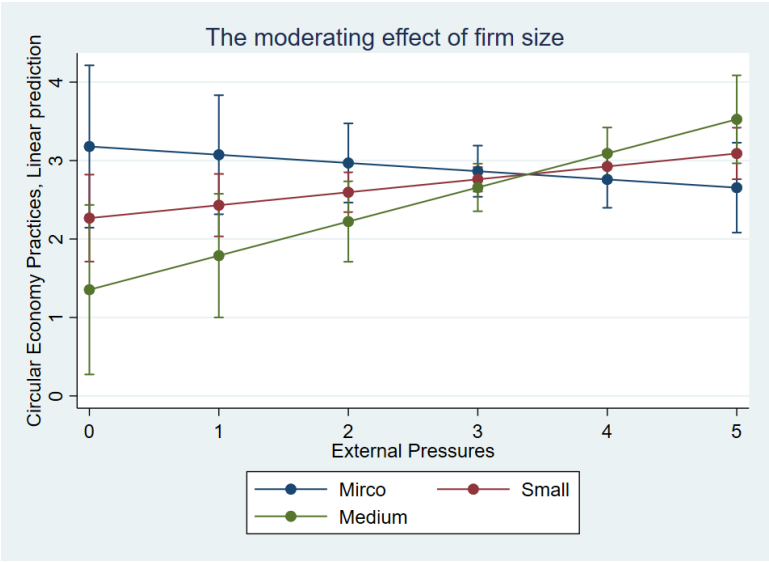

Figure 2. Interaction between firm size and external pressure on Circular economy practices

Note: The above shown plot is based on OLS regression.

DISCUSSION

The findings of this study provide an analysis that not only aligns with the existing literature but also extends our understanding of the dynamics influencing the adoption of CE practices among SMEs. Prior studies have consistently emphasized the critical role of stakeholder pressure in driving CE initiatives. For instance, Ahmadov, Gerstlberger, and Rahman, (2024), Baah et al. (2023), and Jakhar et al. (2019) all studies highlight how stakeholder pressure shapes the adoption of CE practices. This study corroborates these findings by showing that internal and external stakeholder pressures significantly influence CE practices, thereby supporting hypotheses H1 and H2. This is consistent with the arguments of Genovese et al. (2017) and Govindan and Hasanagic (2018), who emphasized the vital role of external stakeholder pressure in encouraging CE practices. These results can be effectively interpreted through the lens of stakeholder theory, which underscores the importance of both internal and external stakeholders in shaping organizational practices and outcomes.

Furthermore, the current study extends the literature by demonstrating the positive impact of CE practices on firm-level economic and sustainability performance, supporting hypotheses H3 and H4. This aligns with previous research indicating that CE practices can lead to improved financial outcomes owing to cost savings from resource efficiency and the creation of competitive advantages (Feng & Goli, 2023; Mazzucchelli et al., 2022). Additionally, the findings are consistent with those ofKhan et al. (2023) and Zhou et al. (2023), who highlighted that CE practices, mediated by sustainable supply chain practices and green logistics management, positively affect sustainability performance.

A critical contribution of this study is the detailed examination of firm size as a moderating factor. While prior research has indicated that firm size influences the integration of CE practices in response to stakeholder pressures (Ali & Johl, 2023; Farooq et al., 2021; Latip et al., 2022), this study provides empirical evidence that firm size significantly moderates the impact of external stakeholder pressure on CE practices but not internal pressure. This nuanced finding extends the work of Courrent and Omri (2022) and Vidal et al. (2023), who noted the varying levels of stakeholder pressure faced by SMEs of different sizes. The results reveal that larger SMEs experience a stronger positive impact of external pressure on CE adoption, whereas the influence on smaller firms is less pronounced.

The study's findings on the moderating effects of firm size also align (González-Rodríguez et al., 2019), highlighting the importance of distinguishing between internal and external stakeholder pressures. The interaction plot illustrating that the influence of external pressure is more significant in small and medium-sized firms compared to micro-sized firms offers a refined understanding of how firm size affects the adoption of CE practices.

The practical implications of these findings are substantial for SMEs and policymakers aiming to enhance the adoption of CE practices. Given the significant influence of internal and external stakeholder pressures, SMEs should strategically engage with stakeholders to foster a supportive environment for CE initiatives. Internally, this involves actively involving employees, owners, and shareholders in achieving sustainability goals and practices. Externally, SMEs should prioritize building strong relationships with customers, suppliers, and regulatory bodies to align their CE efforts with broader environmental expectations and regulations. Additionally, the moderating effect of firm size suggests that tailored strategies are necessary. Larger SMEs should leverage their greater resources and capabilities to respond more effectively to external pressures, while smaller SMEs might need targeted support and resources to overcome barriers to CE adoption. Policymakers can facilitate this by providing incentives and support mechanisms that account for firm size and fostering collaborative platforms where SMEs can share best practices and innovations in CE. This approach not only enhances the sustainability and competitiveness of SMEs but also contributes to broader environmental and economic goals.

CONCLUSION

The current study extends our understanding of the dynamics influencing the adoption of CE practices among SMEs, reinforcing and expanding the existing literature. Previous studies have consistently highlighted the critical role of stakeholder pressure in driving CE initiatives. This study goes further by distinguishing between internal and external stakeholder pressures and assessing their individual impacts on CE practices. Our findings demonstrate that both internal and external pressures significantly influence the adoption of CE practices, providing a more nuanced understanding of stakeholder dynamics while also resonating with the framework of stakeholder theory.

Moreover, this study adds depth to the current body of knowledge by examining the moderating role of firm size in the relationship between stakeholder pressures and the adoption of CE practices. The findings indicate that, while firm size does not significantly affect the impact of internal pressures, it moderates the relationship between external pressures

and CE practices. This study's contribution lies in shedding light on the contextual aspect of firm size within SMEs, challenging the common view that SMEs are a homogeneous group. From the perspective of the RBV, larger SMEs that are well equipped with resources are better positioned to leverage external stakeholder pressures to enhance their CE practices, emphasizing that size matters and highlighting the need for differentiated strategies based on firm size.

While this study offers insights into the adoption of CE practices among different categories of SMEs, it is not without its limitations. First, the sample may not be fully representative of the broader population of SMEs in Baltic countries, which limits the generalizability of the findings. Second, the study's cross-sectional design does not allow for the establishment of causal relationships between stakeholder pressure, firm size, and CE practices, limiting the ability to determine the directionality or temporal sequence of these interactions. Additionally, this research focused primarily on the influence of stakeholder pressures and firm size, neglecting other potentially relevant factors such as organizational culture and industry-specific dynamics. This study also employed a quantitative approach, which may limit the depth of understanding of the underlying mechanisms driving CE adoption.

Future research could address these limitations by employing qualitative methods to explore the nuances of stakeholder influence and firm-level dynamics in more detail. For instance, interviews and case studies can provide a deeper understanding of how internal and external stakeholder pressures uniquely impact firms of different sizes. In addition, future research should consider more diverse samples across various regions and industries to validate these findings. Longitudinal studies can provide insights into the long-term effects of CE practices on firm performance and sustainability outcomes. Additionally, investigating the role of other contextual factors such as industry characteristics and regulatory environments could enhance our understanding of the complex interplay between stakeholders and CE adoption in SMEs. By addressing these aspects, future research could provide a more comprehensive view of the determinants and effects of CE practices across different categories of SMEs.

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Biographical notes

Tarlan Ahmadov is a PhD candidate at Tallinn University of Technology, Department of Business Administration and a visiting researcher at RISE, Research Institute of Sweden. His research revolves around small and medium-sized enterprises transitioning to circular economy models. His work seeks to contribute to an eco-friendlier business landscape, understanding various stakeholders' interests and helping SMEs to navigate the transition process.

Susanne Durst is a Professor of Management at Reykjavik University, Iceland. Her research focuses on risks related to knowledge, responsible knowledge management, business development, and digital transformation in smaller entrepreneurial organizations. She aims to advance sustainable and ethical business practices in the digital age.

Wolfgang Gerstlberger is a professor at Tallinn University of Technology, and his interests and projects revolve around sustainable innovation, Industry 4.0, and the development of emerging technology clusters. His work aims to uncover insights that can inform strategies for fostering sustainable development and leveraging emerging technologies for industrial advancement.

Quang M. Nguyen is a PhD candidate in the Department of Economic Analysis at the University of Valencia. His research concentrates on enterprise surveys and the impact of various policies on firm performance. Currently, he is evaluating the effects of privatization on firm performance using a staggered difference-in-differences approach.

Authorship contribution statement

Tarlan Ahmadov: Introduction, Literature Review, Research Concept, Data Gathering. **Susanne Durst:** Conceptualising, Supervising, Review and Editing. **Wolfgang Gerstlberger:** Review and Editing, Data Gathering, Validation. **Quang M. Nguyen:** Data Analysing, Writing – Review & Editing.

Conflicts of interest

The authors declare no competing interests.

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