# Impact of Gender Diversity in Corporate Governance on Customer Satisfaction, Product, and Logistics Service Quality.

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# 1. Introduction

The economic literature on gender has developed significantly in recent years, supported by diverse considerations, a few theoretical models, novel data sources, and experimental studies of gender diversity in preferences and other traits. An impact of female representation in corporate governance has been studied specifically often and in context of many economic indicators, regulatory frameworks, or industry sectors. The scientific proofs for this associations are empirically uncertain, as board diversity can become "a double-edged sword" (Kaczmarek and Nyuur 2021) and it shows an intricated relationship for scientific studies, which requires deeper and further research.

While women's share on board of directors or in top management circles has slightly improved over decades, according to the recent study by World Economic Forum's (WEF) in 2024 there is no clear-cut trend (after the COVID-19 pandemics) and female participation in board or executive management positions can considerably vary by a world region. French and Maconachie (2004) note that equity management policies predict increased numbers of women in management, whereas the use of social structural policies does not. Young female human capital has long overperformed young men in many countries in enrolment and exam passes at schools and universities (Goldin 2024), but gender democratization in the top echelons of corporate power proceeds slowly and in waves due to political reforms, candidates' academic levels, and corporate talent retention policies (Heemskerk and Fennema 2014). Bergholt, Fosso, and Furlanetto (2024) document an important role for skill-biased trends in females' labor supply in USA, where a supply-driven expansion of female labor in high-skill jobs is accompanied by a contraction in the supply of female labor in low-skill jobs at the same time. Further evidence and publication of papers about favorable impact of women in corporate governance could possibly support a structural change in business management and cause encouraging trickle-down phenomena for the economy and entrepreneurial organizations.

A plethora of business and gender case studies reveals positive effects of women appointed to corporate governance. While three main theories consider a good impact of more balanced gender equilibriums in corporate governance bodies (e.g. agency theory, resource dependency framework, and behavioral theory), social choice theory points to the possibly negative aspects of gender heterogeneity in management (Gong and Girma 2021). Organizations may add female directors only as a defensive reaction to outside pressure and scarce female top performers could proactively prefer stronger and better-positioned

companies, since the likelihood of electing a woman to a corporate board declines with the number of females women appointed in the past (Farrell and Hersch 2005). The probability of appointing female directors grows with firm performance but diminishes with corporate ownership and firm risk (Martin-Ugedo and Minguez-Vera 2014). Turban, Wu, and Zhang (2019) exclude this reverse causality, confirming the positive effect of gender diversity (measured using Blau's index) on firms' market valuation (e.g., Tobin's Q or turnover ratio), but only in national contexts where gender diversity is normatively accepted and not in economies where it is regulated (e.g., Western Europe vs. Japan). Martinez and Rambaud (2019) apply a two-stage instrumental variables regression to address endogeneity and reverse causality issues and show that increasing number of women on board of directors drives company financial performance. Isidro and Sobral (2015) confirm that a higher ratio of female directors affects corporate compliance and rises the probability to have a separate committee for ethics or social responsibility issues in a company. Grosch and Rau (2017) find women significantly more honest than men and Swamy et al. (2001) determine that women are less involved in bribery and less likely to condone bribe-taking, while societies where clientelist attitudes prevail may also be more tolerant of corruption, which could exclude a causal connection between these two phenomena, especially in case of societal "modernization" towards more corrupt behavioral patterns. A bi-directional causality is however observed between gender diversity on boards and corporate social irresponsibility (CSI) (Godfrey et al. 2024). Positive assessments of female governance bear caveats and have opponents as several researchers also mention the negative possible effects (e.g.: Ramadhania et al. 2021, Arora 2021) or do not address the reverse causality issues effectively. For example after applying reasonable procedures to tackle the omitted variable and reverse causality bias Adams and Ferreira (2009) find that on average, firms perform worse the greater the gender diversity of the board, however after implementing some control variables and mechanisms in their research they confirm that diversity has beneficial effects only in companies with weak shareholder rights, where it is plausible that additional board monitoring can enhance value. Sila, Gonzalez, and Hagendorf (2016) find no evidence that female boardroom representation influences equity risk when controlling for reverse causality phenomenon. Luis-Carnicer et al. (2008, p. 588) reveal, in this context, that "*demographic dissimilarity and these outcomes may vary among negative, neutral and even positive, depending on the extent to which employees' social identities are built among their demographic characteristics*" (Chattopadhyay, Tluchowska, and George 2004). Fulton (2021) concludes that while social bridging theories argue in favor of diverse organizations, the social bonding theories argue against of them.

The topic of gender equality and participation has mainly been studied in developed countries, as systematic research on 140 studies published from 2015 to 2021 indicates (Koutoupis et al. 2022). Scholars concentrate on the effect of board diversity on firms' financial or sustainability performance, but too little to which extent diversity impacts operations. Nguyen, Ntim, and Malagila (2020) finds that many existing studies are descriptive and/or draw on single rather than multi-theoretical perspectives, and they focus on firm-level rather than country-level effects. Zattoni et al. (2024) perform a comprehensive review of the extant literature on board diversity's antecedents and its consequences, and Yao (2022) organizes board gender-diversity antecedents into three categories: social-system-, situation-centred, and person-centred antecedents.

This cumulative thesis contains three examples of how a higher female representation on board of directors and in the upper management may impact quality (of products and services as well as goods in specific types of industries) as measured by different performance indicators. Each chapter is an individual study based on separate models and assumptions to address a specific aspect of the respective quality attribute. My examinations follow a similar logic of reviewing the current research status quo and enhancing the context by adding a measurable aspect of quality. The first published study analyses how an increased female representation on a board of directors of business firms affects customer satisfaction (CS), described as an "*overall evaluation based on the total purchase and consumption experience with a good or service over time*" (Anderson et al., 1994, p.54). The second piece of research calculates the effects of women directors' ratio on product quality (PQ), considered to be a key consumer decision criterion and a "strategic weapon" in management practice (Garvin, 2001). Third paper assesses the effects of increased female share in director and executive management boards on logistics service quality (LSQ) of transportation companies, defined as "*company's ability to deliver the right amount of the right product to the right place at the right time in the right condition at the right price with the right information*" (Kennedy 2011, p. 110).

In my dissertation the second chapter includes a single author effort, which investigates the impact of females in corporate governance on the logistics service quality (index), which is derived from an American annual logistics industry survey "Quest for Quality" and published yearly by the "Logistics Management" (LM) magazine in the USA. My study confirms that streamlining certain financial and organizational aspects (e.g. organization size, revenue growth, total assets, capital expenditures, and high corporate ESG standards) and indicators in transportation companies is favourable for their logistics service quality (LSQ)

scores and that gender diversity in corporate governance does not yield unanimous positive results, which may rather depend on the business context where female management roles are deployed. As a central finding, using different multiple model variants and robustness specifications, I present mixed evidence for the impact of women on corporate governance in logistics companies. The female representation on a board of directors has not demonstrated any consistent association with the LSQ of transportation companies beyond a slightly negative tendence in women's count in the board of directors, therefore I expand the testing of female impact in corporate governance to the effect of a gender-balanced executive officers' suite (CxO suite). In this regression model I do not obtain a significant association for the share of women in executive management and LSQ, however I detect a significant positive relationship for the critical mass of 10% of female executives in a management board, where, according to the token theory, they should play a rather minimalistic role (Kanter 1993). My findings suggest that having maximum 10% of women in the executive management improves the LSQ score by approximately 19% (8.89 points), with other intervals remaining insignificant, also when controlled for time, company or industry fixed effects interchangeably. In the robustness analyses I use the M-, S-, and MM- estimation functions as well as stepwise regression approach, respectively. My research outcomes confirm the mixed results on gender impact, such as the negative effect of the number of female directors and the positive effect of the proportion of women in executive management on LSQ.

In the third chapter we analyze the impact of women on corporate boards of directors on product quality quantified in scores issued by the German product testing organization "Stiftung Warentest". We innovate firstly by integrating the broad but fragmented research on this topic, offering a first simultaneously testing of a larger set of variables identified to be significant in earlier studies. Second, we add alternative indicators of female representation in board of directors as a potential determinant of product quality. Our results confirm that optimizing certain indicators of organizational performance is relevant to increasing PQ benchmarks. Similarly to other researchers we largely find the same positive associations between selected key performance indicators (e.g. sales and administrative expenses, relative product price, product reliability, company brand, employee friendly workforce policy, higher capital investments, and firm size) and product quality, as well as some caveats for the influence of advertising expenses and Return on Investment (ROI). Finally, and as a central finding, using different multiple model variants and robustness specifications, we present evidence confirming that female directors can favourably affect PQ. Increasing the female director count by one woman (ca. 10%) improves the average PQ score

by 2.5%. While controlling for non-linearity we discover that a positive ratio of women directors of 21–30% results in a 3.6% improvement on the PQ score in our log-lev model, also when controlling for time fixed effects. As robustness tests, we leverage M-, S-, and MM-robust LS functions (to control for outliers' impact) and stepwise regression algorithms. To control for fixed effects, we also calculated selected models testing a similar set of variables along with the additional consideration of industry and time fixed effects to control for events that possibly affect all companies (e.g., financial crisis) but are not specific to any company. In this case, female directors on boards and the associated proportion also indicate a positive impact on PQ. We also test the models in Table 17 with company fixed effects, and the relationship between female share ratios and PQ remains positive. In this setting all other variables are insignificant, which points to some controversial aspect of estimation models with (too many) fixed effects (Bell & Jones, 2015; Hill et al., 2020). Robustness tests in the gender research selectively use a broad variety of analyses individually matched to a specific research question (e.g., 2SLS, GLS regressions, Heckman selection models, lagged structures, fixed effects, and other methods). In this study, we focus on methods, which correspond best with our sample and data set availability and still allow us to construct relevant approximation models in our research context. Future research efforts may apply additional methodologies. This paper has been published in the Journal of Management and Governance in 2023.

In the fourth part of my dissertation, we apply a regression model to test impact of different variables on the customer satisfaction score measured by an American Customer Satisfaction Index (ACSI) and receive a pool of most significant variables, which we then enhance by a gender related exogen variable of female bord share. Our research mainly confirms the findings of the previous scholars (e.g.: a significant positive influence of profitability, sales, general, and administrative expenditures, employee-friendly policy, investments in research and innovation, and effective inventory management) and additionally we find that the absolute number of women directors significantly affects CS in a positive way. The effect is economically small, but statistically significant, where one female board member gives 1% increase in the CS score of a company. Also doubling the average number of female directors on board would result in 4% growth of CS ratings. Furthermore, we analyse the idea of a nonlinear relationship between female participation and CS due to minimum critical masses found in other business outcomes (Kanter, 1993; Rosener, 1995; Konrad et al., 2008; Torchia et al., 2011; Elstad & Ladegard, 2012; Joecks et al., 2013; Schwartz-Ziv, 2017; Amorelli & Garcia-Sanchez, 2019; Saggese et al., 2020) and show that a positive ratio of women directors of 25–33% implies a 2.5 to 3,2% improvement on the CS score (ca. 2 rating points on average).

Likewise, the lack of a critical mass (below 1/5 of directors) can negatively affect CS performance by 2.1%. Similar results are achieved if controlled for the time fixed effects. Our outcomes are later validated in robustness tests and discussed in the light of possible limitations of my research. This paper has been also successfully published in the Journal of Knowledge Economy in April 2022.

I am aware of the limitations in my research (about the corporate management determinants of quality), which comprise a particular data sample, that is specific to the period chosen, a certain geography, and data availability. The regression analysis typically applied in such studies has shortcomings in examining the circumstantial aspects of corporate governance. Qualitative analyses, field studies or survey approaches could provide more observations of deeper traits of female directors' and managers' behaviours and working style. Campbell and Minguez-Vera (2008) argue that the proportion of women on boards is not an appropriate measure of diversity, as boards with a large female presence will exhibit a high degree of homogeneity. Likewise, a better knowledge of proprietary and consistently measured firm characteristics and personnel-related data (e.g., board members' biographical details, female directors' experience), which are often protected by privacy policies, could reveal more insights into the relationship between the board or executive management members' gender and goods or service quality, including customer satisfaction. Bigger data sets from different geographies could enhance my research in intercultural context. As diversity is highly important for companies operating in technologically disrupted service markets with rapidly changing trends, or markets with particularly creative and innovative products, I believe that my research can become a positive motivation for professionals, policymakers, and academics to continuously discuss, pragmatically influence, and possibly further regulate gender balance in the corporate governance of companies worldwide despite most recent roll back political trends in some countries.

# 2. Logistics service quality and women in the corporate governance of transportation companies

Dorota Korenkiewicz

**Abstract:** I analyse the impact of women in corporate governance of transportation companies (on corporate boards of directors and in the executive management) on the logistics service quality (LSQ) of such firms. First, I integrate the broad but fragmented research on the topic of logistics service quality by offering a first simultaneous testing of a larger set of variables identified to be significant in earlier studies. Second, I add alternative indicators of female representation in board of directors or in a management board as potential determinants of logistics service quality. Third, I use evaluation scores of LSQ determined by the American magazine "Logistics Management" as a quality indicator, thus adding to regionally diversified evidence. I find mixed effects for the impact of women in corporate governance of logistics companies. While small female representation in management boards could positively influence LSQ levels, more female directors might negatively affect LSQ scores.

**Keywords:** gender equality, female, women ratio, women on boards of directors, women in executive management, women on management board, logistics service quality, service reliability, consumer reports, customer satisfaction

**JEL Classification:** C30, J16, L15, L21, L25, L80, L87, L90, L91, L92, L93

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## 2.1 Introduction

The topic of gender equality has been in the public spotlight for decades, broadly discussed worldwide in different sectors and with regard to various issues. Political stakeholders, investors, and academic scholars recognize that the diversity of different groups is necessary to achieve fulfilled social development and has practical implications for businesses' competitive advantage (Mejia-Dorantes 2019).

In the World Economic Forum's (WEF) report 2024, LinkedIn data show that, globally, women's workforce representation remains below men's across nearly every industry and economy, with women accounting for 42% of the earth's workforce and 31.7% of senior leaders' group. Women have improved their participation rates in both cohorts only by approximately 1 percentage point since 2016, and top-level positions remain unproportionally accessible for women in global terms. A standardized measure from the World Economic Forum (WEF) of the gender parity in labor-force participation shows the global index level remaining relatively stable over decades, with a short decline during the COVID-19 pandemic (including a positive rebound after).

In the supply chain and transportation industry, women constitute 50% of global employment and manage approximately 35% of senior leadership roles in related professions (WEF 2024). From 2019 to 2023, the global female representation in supply chain increased at almost all levels of leadership and spiked among senior managers, directors, CSCOs, SVPs, EVPs, and CPOs positions. Organizations see progress with leadership inclusion, recruiting, and development for women employed in supply chain management (SCM) and transportation, but midcareer attrition remains a concern for them as seeking greater compensation and facing a lack of career opportunities bother female professionals the most (Gartner 2023).

In the USA, the Labor Force Participation Rate of Women hit a historic high—57% in 2024 according to the U.S. Bureau of Labor Statistics (BLS), with the female workforce gaining more employment in male-dominated fields. From February 2020 to March 2022, women saw a percentage increase of 7% in construction jobs and 15% in transportation and warehousing jobs (Hegewisch and Mefferd 2022). The corporate board diversity picture varies, however, by industry sector, with female directors occupying only 20% of boards in energy, resources, and industrial companies (Deloitte 2020). French and Strachan (2009) point to a US Catalyst census of women board directors and corporate officers in the Fortune 500, with the SIC Industry classification of "transportation and utilities" (101 organizations) indicating the

percentage of women directors ranging from 2.2% to 19% and that of women corporate officers ranged from 3% to 23% (Catalyst 2006a, 2006b).

Fraszczyk and Piip (2019) define a spectrum of issues causing the lower female employment in the transportation sector, beginning from the pre-work stage (e.g., qualification and recruitment) to actual employment (e.g., work life balance and wage issues). Major barriers include the reconciliation of work and family/social life (e.g., work organization), health and safety at the workplace, working culture, remuneration, career options, and training. Rust and Mundy (2020) indicate similar unattractive job reasons in the North American railroad operations. Rouhanizadeh and Kermanshachi (2021) discover comparable disadvantages in the US Departments of Transportation (DOT), where women are elevated to high-level positions less often than men, primarily because of their lower level of education, age, and fewer years in service. Ferla and Graham (2019) report the presence and some evidence of sexism, discrimination, prejudices, and stereotypes in the airline industry—especially against female pilots but not exclusively—which mostly came from passengers, rather than instructors, male colleagues, or management. In the Indian airline industry Singh, Saharan, and Bhat (2022) argue that feminine identity is still seen as detrimental to the job, despite similar educational levels to men. Several women are precluded important developmental and elaborative work allocations at the airports or in corporate office assignments, which would mark their career transition, owing to a powerful masculine customs and structure not grooming women for senior managerial roles. Moreover, the literature suggests that employees and employers focus on different priorities as employees first examine their career progression options, whereas employers focus on attraction and retention of the workforce (Turnbull, 2013, p. 41).

French and Strachan (2009) research firms' strategies and employment policies in the transport industry itself and discover that relatively few organizations in this sector implement proactive strategies in the areas of recruiting, promoting, and developing women to address any identified gender inequities. "Equal treatment" is the primary reason for the lack of any proactive strategies in recruitment, promotion and training for women in the transportation industry; hence, without specific programs that acknowledge women's historic systemic disadvantage in this industry, change is unlikely to occur. Sheridan (1998) suggests more proactive policies that include work and family balance issues to recognize the limitations that family roles had placed on women in the past. French and Maconachie (2004) note that equity management policies predict increased numbers of women in management, whereas the use of social structural policies does not. The old battle of "what is equity" is still being waged at an operational level in the transportation industry. Scholars consider a proactive

implementation of "role related" strategies (e.g., "organization of work," "conditions of service," or "pregnancy and breastfeeding policies") key to ensure that women are not disadvantaged professionally by their different and traditional role requirements in society, but the current corporate efforts may be not sufficient to promote further female access to management or non-traditional areas.

Young female human capital has overperformed young men in many countries in enrolment and exam passes at schools and universities (Goldin 2024), but women do not equally succeed in business governance for complex reasons (Walby 2011). They feel more frequently discouraged from aspiring to high-profile positions owing to modest self-image, discriminating stereotypes, or lack of networking opportunities among the higher establishment. In contrast, opportunities for female directors are higher in public and nonprofit firms. Greater economic and political empowerment accompanied by countries' shared cultural values, beliefs, and attitudes successively help women overcome the "glass ceiling" of corporate elites (Lewellyn & Muller-Kahle 2020). Gender democratization in the top echelons of corporate power proceeds slowly and in waves based on political reforms, board candidates' academic levels, and exceptional and company-grown female-talent retention policies (Heemskerk and Fennema 2014).

The impact of legislative measures is not effective and yields inconclusive results for enterprises. Female quotas positively affect companies' performance in France (Sabatier 2015), while Comi et al. (2020) find elicit mixed results with positive effects only on firms' labor productivity in Italy but negative effects in France, as well as an insignificant impact on profitability of Spanish companies. In Norway, the quotas applied in 2003 to publicly listed companies caused them to accumulate capital, which was financed by debt or a combination of debt and existing capital; therefore, the reform's short-term influence on company performance measured by a return on assets (ROA) was negligible (Dale-Olsen et al. 2013). Yang et al. (2019) discover that the Norwegian quota adversely affects treated firms' performance and reduces risk.

The political and academic debate about the business case of higher representation of women in corporate management positions continues, and researchers focus their analyses predominantly on economic (e.g., stock prices, liquidity, enterprise value, profits dividends, market returns, firms' profitability, and risk) or organizational effects (e.g., entrepreneurship, relationships with stakeholders, organizational and team performance, corporate innovativeness, or interdepartmental dynamics and transparency). The scientific

proofs for this associations are empirically uncertain as board diversity can become "a double-edged sword" (Kaczmarek and Nyuur 2021).

Firms with more gender balanced top management and board of directors may achieve better accounting performance (Simionescu et al. 2021, Perryman, Fernando, and Tripathy 2016; Dang and Nguyen 2016; Post and Byron 2015; Lückerath-Rovers 2013), larger returns (Kang et al. 2010; Johnstone-Louis 2017; Duppati et al. 2020), higher market valuation (Ntim 2015), higher share price and earnings per share (van Dunk et al. 2005), improved stock liquidity (Ammad and Searat 2017), increased patent activities (Griffin, Li, and Xu 2021), innovation capacity (Huang 2020), a larger price/book value, and a larger average growth (Rohner and Dougan 2012)—particularly firms with a higher market value, as expressed by superior Tobin's Q performance (Conyon and He 2017). Rossi, Cebula, and Barth (2018) determine that more women on boards of directors increase companies' indebtedness level, but invested capital is used more efficiently.

However, the positive effects can be moderated by external circumstances. For example, if female representation is moderated by high innovation intensity (Dezsö and Ross 2012) or high firm ownership concentration (Gyapong et al. 2019), or if companies can enhance pay-for-performance sensitivity (Sarhan, Ntim, and Al-Najjar 2019) or pursue a smaller strategic change (Hsu, Lai, and Yen 2019). The probability of women on a board increases with firm performance but diminishes with corporate ownership and firm risk (Martin-Ugedo and Minguez-Vera 2014). The likelihood of electing a woman to a corporate board declines with the number of women appointed in the past; this suggests that organizations may add female directors only as a defensive reaction to outside pressure, and scarce female top performers could proactively prefer stronger and better-positioned companies (Farrell and Hersch 2005). Turban, Wu, and Zhang (2019) exclude this reverse causality, confirming the positive effect of gender diversity (measured using Blau's index) on firms' market valuation (e.g., Tobin's Q or turnover ratio), but only in national contexts where gender diversity is normatively accepted and not in economies where it is regulated (e.g., Western Europe vs Japan).

Positive assessments of a greater influence of women on an economic performance are not without opposition. Other scholars do not find significant effects; for example, on returns (Francoeur, Labelle, and Sinclair-Desgagne 2008; Ramadhania et al. 2021), Tobin's Q (Rose 2007), IPO pricing (Mohan and Chen 2004), or dividend payouts (Pucheta-Martinez and Bel-Oms 2016; Arora 2022). Some even publish the negative effects of female directors; for example, on profitability (Shrader et al. 1997), firm performance (Dang and Nguyen 2016; Triana, Miller, and Trzebiatowski 2013), or companies' share price (Ryan and

Haslan 2005). Specifically in the logistics industry, Govindan et al. (2023) detect that while independent directors augment corporate financial performance, the female directors–chief executive officer (CEO) duality does not. In a study on 794 logistics companies (2011–2021), women improve sales revenues in large firms but do not drive firm performance in neither large nor small firms. Ferreira (2015) encourages to focus research on female directors' potential benefits to society rather than trying to prove the positive effects of female directors on firms' profitability.

Since no unanimity has emerged regarding the favorable effect of women on boards of directors and in top management, this study seeks to make four primary contributions to this disputable topic. First, it complements the existing spectrum of academic research demonstrating the positive but also mixed effects of diversity in corporate governance. I concentrate my research on the logistics service industry as not many gender-related studies have been conducted in this regard (Govindan et al. 2023). I analyze the effects of increased female representation on boards of directors and in the executive management on logistics service quality (LSQ), which I consider a critical measure of business reliability in the transportation sector and an important aspect of sustainable economic development. I examine whether companies with a higher proportion of female directors and executive officers deliver higher LSQ than competitors governed by fewer women. Second, I review the relevant literature and methodologies applied to examine the effects of increased female participation in corporate governance of transportation firms. Third, I systematically extend the literature on LSQ in light of our research. My study enhances the partially fragmented research on the determinants of LSQ (as described in the next section) by conducting the first simultaneous test of a larger set of variables identified as significant in earlier studies. Finally, I add to research in the economics and management literature regarding the potential effects of gender diversity in leading positions in these types of enterprises.

## 2.2 Background

Effective corporate social responsibility (CSR) is a tool for successful firm and product differentiation as internal and external CSR can enhance goods' quality (Calveras and Ganuza 2018) or even substitute it (Banerjee and Wathieu 2017). Yuen, Thai, and Wong (2018) find that shippers with strong CSR beliefs derive greater satisfaction and exhibit stronger behavioral intentions toward shipping firms' involvement in CSR. Then, implementing CRS in, for instance, marine shipping companies, can bear greater financial benefits (Yuen, Thai,

and Wong 2017). Likewise, top management support plays a mediating role in sustainability initiatives (Dai, Montabon, and Cantor 2014).

Since social role theory considers women to be more compassionate, inclusive, moral, diligent, and stakeholder-oriented, the gender ratio of women on boards of directors is positively proportional to their influence on CSR decisions (Elstad and Ladegard 2012). Higher educated female senior managers are more sensitive in terms of the quality and commitment to the environment, and they pay more attention to the community (Yang, Yang & Gao 2019). A larger proportion of women and female labor representatives at the board level are positively related to CSR and environmental performance (Govindan et al. 2021; Lopatta et al. 2020), which may subsequently favorably affect LSQ.

Logistics is an important organizational function that gets the right product to the right customer at the right time. The recent rise of e-commerce and last mile delivery giants (e.g., Amazon or Alibaba) show that it is key in the retail sector and can be used as a strategic weapon that enables firms to compete on speed, reliability, and cost (Tanga and Veelenturf 2019). Hopkins et al. (1993) indicate that the importance of service quality in the transportation business is undisputable; however, different understandings of LSQ exist between shippers and carriers. Service impressions play an important role in customers' evaluation of logistics quality as logistics service value "*is based on the customer's perceptions of the relationship between the service performed and service received*" (Novack, Rinehart, and Langley 1994, p.114). A high consistency between perceived and delivered logistics quality creates a positive service value for customers. Time and place utility have determined the traditional view of logistics value (Rutner and Langley 2000); however, additional opinions linking it to company cost, profitability, customer satisfaction, or market penetration exist. Despite the consensus regarding the great value of transport service quality for business, several interpretations of how a perfect distribution service shall be defined and which components it should consist of exist. Mentzer, Gomez, and Krapfel (1989) describe seven key characteristics of a LSQ, meaning the "*company's ability to deliver the right amount of the right product to the right place at the right time in the right condition at the right price with the right information*" (Kennedy 2011, p. 110), while other researchers expand this definition with more or different cues (Bienstock, Mentzer, and Bird 1997; Brensinger and Lambert 1990; Feng 2007; Mentzer, Flint, and Kent 1999; Millen and Maggard 1997; Millen, Sohal, and Moss 1999; Novack, Rinehart, and Langley 1994; Rahman 2006; Rafiq and Jaafar 2007; Read and Miller 1991; Thai 2013). Thai (2013) concludes that although several authors have studied this subject, their conclusions and proposals largely vary in terms of dimensions and attributes of LSQ. Eventually, Arabelen and

Kaya (2021) conduct a systematic literature review of 59 papers to investigate LSQ measurement dimensions obtained from previous studies and consolidate them.

Other scholars make a cross-industry examination of attributes of a well-done logistics service in different economic sectors (e.g., office systems/furniture, plastic resins, electronics) and show their diverse sensitivity for particular logistics service items (e.g., order accuracy, lead time) and performed quality dimensions (Jang, Kwon, and Kim 2014; Mentzer, Flint, and, Hult 2001; Stock and Lambert 1992). Thus, the researchers acknowledge that logistics performance perceptions vary among service-receiving industries and suggest, to logistics vendors customizing their service by a specific buyer type, to exploit their competitive advantage.

Instead focusing on positive constituents of a high-quality logistics service, Forslund (2007) proposes eliminating logistics quality deficits. Her approach presents an overview of "logistics quality deficiencies" and defines a few key process indicators available to measure failures in a fulfilment process (e.g., rush orders, stock out rate). She draws a framework for improving logistics quality performance by reducing common process flaws.

Industry experts regard LSQ as a key differentiator in a highly competitive global market for transportation services with increasing market liberalization in various service categories (e.g., postal, rail) and a growing demand among shippers for better service levels (Kennedy 2011). Transportation companies have been extensively driving on the outsourcing trend for a long time (Boyson et al. 1999; Lieb, Millen, and van Wassenhove 1993; Seth, Desmuth and Vrat 2006) and have built asset-less or asset-heavy business models to optimize their profitability and enhance revenues. Lai, Cheng, and Leung (2004) classified logistics service providers into four types: freight forwarders, transformers, full-service providers, and niches. Particularly, full-service players intend to become one stop shop specialists, assisting the customers not only with retail delivery or worldwide intermodal freight but also with further value-added warehousing activities reaching up to specific assembly operations (Ackerman 1989). Simultaneously, the globalization of supply chains caused and promoted the usage of some modes of carriage (e.g., airfreight or courier services) while disadvantaging others (e.g. rail) (Lieb and Miller 1988). Growing business opportunities for logisticians make them enter each other's market territories (Kennedy 2011), merge, and extend their capabilities in managing worldwide product supply chains. Therefore, common cargo carriers need to fully comprehend the value, which efficient logistics has for their clients, and ought to accommodate

their main service components in a cost-effective manner (Yazdanparast, Manuj, and Swartz 2010).

A strong interdepartmental coordination and realistic information exchange with buyers is necessary to convey LSQ to the end customers, while integrating buyers' feedback into the quality monitoring process can visibly improve logistics quality standards (Sharma, Greval, and Levy 1995). Quality-driven customer operations enable logistics enterprises to distinguish themselves in a market and have the greatest influence on customer satisfaction, which naturally leads to higher customer loyalty (Gaudenzi 2021; Huma et al. 2020; Jang, Marlow, and Mitroussi 2013; Lin et al. 2023; Saura et al. 2008). Finally, a combination of high client satisfaction and the client's repetitive purchasing behavior caused by a satisfactory logistics service positively affects the market share of a logistics vendor (Daugherty, Stank, and Ellinger 1998).

Carriers are usually determined to optimally serve their clients, but since various customer segments value service features differently, logisticians must often adjust service components offered to the service levels required by their customers to be effective and profitable. An open dialog with a contract awarding partner, regular quality ranking, or questionnaire solicited from customers can help third-party logistics providers continuously improve their service portfolio (Harding 1998). Clients regularly supervise the standard logistics service levels, and according to Lambert and Burduloglu (2000), in concrete business relationships, their value can be expressed in terms of customer satisfaction as, in general, "*quality can be viewed as a degree of customer satisfaction attained*" (Wicks and Roethlein 2009, p.90). Building on the concept that logistics service utility can be evaluated in the context of client satisfaction and positively drives it (Uvet 2020), which is the most important goal ever also in logistics (Read and Miller 1991), I test the main impact factors influencing LSQ from a customer satisfaction efficiency perspective. In this interdisciplinary marketing conceptualization, I follow the idea of Mittal et al. (2005), who used a company's selected corporate financial cost aggregates (e.g., advertising, sales general and administrative, costs of goods sold) to model the drivers of its customers' satisfaction (Mittal et al. 2005), and expand

my model with additional accounting and measurable external factors recently discussed in the context of sustainable and gender-balanced corporate governance.

## 2.3 Theoretical framework

Scholars, politicians, and business leaders prominently discuss the impact of gender diversity in top management; however, the empirical results on firms' performance are ambiguous. Inconclusive research contributions find their counterparts in different theoretical considerations. Three main theories consider the positive effects of a more balanced gender equilibrium in the corporate governance, while social choice theory points to the possibly negative aspects of gender heterogeneity in management (Gong and Girma 2021).

Agency theory implies that boards of directors are appointed by shareholders as intermediaries to monitor the behavior and performance of the top and second layer in the interest of company principals – the shareholders. Female directors may better cope with this task owing to their particularly valued ex-ante (visionary) strategic capabilities, diligent monitoring of the environment (e.g., benchmarking qualitative indices), and higher sensitivity to internal compliance policies or acts of discrimination. Grosch and Rau (2017) find women significantly more honest than men, while Swamy et al. (2001) confirm them to be less involved in bribery and less likely to condone bribe-taking.

A resource dependency framework conveys that appointing women to top management positions lends legitimacy to the organization as required by investors, and it helps maximally leverage the talent pool available (Lückerath-Rovers 2013). The increased presence of high-profile women in corporate governance could also enhance the level of service quality assurance as they may be more responsive to sustainable market trends and technologies. Female leaders can effectively contribute sophisticated managerial, engineering, and service development skills. They may also be more motivated and determined than their male counterparts in organizing and managing publicly transparent internal sustainability and quality reporting, and they may network across and beyond corporate hierarchies more proactively to anticipate, detect, and navigate service quality issues within the organization (e.g., service complains, warranty policy, and customer assistance). Isidro and Sobral (2015) confirm that a higher ratio of female directors affects corporate compliance and rises the probability to have a separate committee for ethics or social responsibility issues in a company.

Behavioral theory argues that heterogeneous management boards deliver a higher plurality of opinions; however finding consensus may take a longer time. The lower

pressure of conformity in the decision-making process spurs the innovation of gender-diversified teams, and the organization can benefit from links with stakeholders, particularly when determining business purpose and customer orientation. Addressing the political power dimension and public image is another positive effect to help generate more alternative business solutions (Adams & Ferreira 2004). Conversely, some researchers state that a higher heterogeneity in groups increases the cost of communication among it (Anderson et al. 2011). O'Reilly, Caldwell, and Barnett (1989) show that greater diversity may lead to intragroup conflict or even the isolation of minorities. Luis-Carnicer et al. (2008, p. 588) reveal, in this context, that "*demographic dissimilarity and these outcomes may vary among negative, neutral and even positive, depending on the extent to which employees' social identities are built among their demographic characteristics*" (Chattopadhyay, Tluchowska, and George 2004). A greater cohesion in homogenous groups results from easier communication and low relational conflict, while higher gender diversity leads to more absences and less organizational commitment for men and more organizational commitment for women (with no effect on absences) (Tsui, Egan, and O'Reilly 1992). These considerations demonstrate that women's impact in corporate governance may depend on the settings and general conditions in the relevant societies and firms. Board gender diversity may primarily affect firm performance positively in countries with high national governance quality (Nguyen et al. 2021), in national contexts where gender diversity is normatively accepted (Turban, Wu, and Zhang 2019) and in firms with a high rate of innovation (Dezsö and Ross 2012).

Furthermore, according to social identity theory, men and women differ in their management styles as well. Women and men in the same organizational roles might behave somewhat differently (Eagly and Johanessen-Schmidt 2001), and women may be more effective in performing certain tasks over others (Eagly, Karau, and Makhijani 1995). Martel, Lane, and Emrich (1996) discuss that even if gender differences in managerial positions are minimal, they can become impactful when applied in a long-term repetitive mode. These arguments suggest that gender differences in approach and management of LSQ on a strategic company level may result in different LSQ outcomes over time.

Despite varied theoretical explanations, scientific evidence for an association between a higher gender meritocracy and corporate performance remains mixed. Fulton (2021) asserts that while social bonding theories argue against diverse organizations, social bridging theories argue in favor of them. The author's study specifies these concepts as two distinct

mechanisms, indicating that both can positively impact organizations, but their respective benefits depend on the tasks being performed.

## 2.4 Literature review and hypothesis development

The topic of gender equality and participation has mainly been studied in developed countries, as systematic research on 140 studies published from 2015 to 2021 indicates (Koutoupis et al. 2022). Scholars mainly concentrate on the effect of board diversity on firms' (financial and sustainability) performance, but no unanimous results emerge regarding the extent to which diversity facilitates firms' operations. Another comprehensive systematic literature review of the existing research on women on corporate boards and financial and non-financial performance conducted by Nguyen, Ntim, and Malagila (2020) finds that many existing studies are descriptive and/or draw on single rather than multi-theoretical perspectives, and they focus on firm-level rather than country-level effects. The examination of 634 mixed, qualitative, quantitative, and theoretical studies conducted for more than 10 disciplines (e.g., accounting, finance, economics, and governance) in over 100 countries from 1981 to 2019 and published in 270 top-ranked journals reveals that the observable methodological limitations include a dearth of qualitative, mixed-methods, and cross-cultural/country perspectives, while outlining opportunities for future research regarding women on boards of directors. Zattoni et al. (2024) perform a comprehensive review of the extant literature on board-diversity antecedents and its consequences, and Yao (2022) organizes board gender-diversity antecedents into three categories: social system-, situation-, and person-centered.

According to the upper echelons theory, the quality of senior management and its traits are reflected in organizations and systematically cascade down the hierarchical ladder to achieve strategic importance (Finkelstein, Hambrick, and Cannella 2008; Hambrick and Mason 1984; Pfeffer 1983). The ratio of women in corporate governance represents a certain tendency of management and board team composition; hence, gender diversity can be a predictor of processes and effectiveness in these circles. Amin et al. (2021) indicate that women's presence on boards significantly reduces agency costs. Moreover, Gyapong et al. (2019) discover that gender-mixed boards may alleviate principal–agent conflicts around the dividend payout in hard times for a company. Corporate funds not spent on dividends could be theoretically invested in advancing a sustainable and high-quality service portfolio. Saona et al. (2019) argue that demographically balanced boards may tend to favor long-term policies

focused on high quality assurance as female corporate supervisors working in monitoring roles can mitigate business opportunism focused exclusively on profits. Zalata et al. (2021) confirm that female directors with financial backgrounds improve earnings' quality more than their female counterparts without relevant financial expertise.

I argue that women in top management positions are more effective as logistics agents for companies, staying more vigilant to customer feedback and corporate risks. Oliver (1996) suggests that women do not hesitate to use either customer service ratings or diverse satisfaction scores to measure performance, while men prefer to aim for an optimum in financial terms. Women in enterprise governance are highly concerned with product risk, supply chain, and reputational issues (Groysberg et al. 2016), mitigate such issues more decisively, and may have less tolerance for ethical failures (Eagly et al. 2004; Franke, Crown, and Spake 1997; Lunsford 2000; McCarthy 2017), which can prevent ambiguous LSQ and sustainability hazards. Female executives may more diligently control internal quality standards and more eagerly promote targeted internal quality guidelines and sustainable corporate policies (e.g., lean six sigma programs and ecologically friendly supply chains). Female managers have more strength to avoid lawsuits, partially by avoiding risky but value-increasing firm policies, such as more aggressive R&D, intensive advertising, and policies inimical to other parties (Adhikari, Agrawal, and Malm 2019). Furthermore, female directors could generally limit the volatility of equity returns, and hence, firms' risk performance (Yang et al. 2019; Zalata et al. 2019). For opposing findings, see Iqbal, Sewon, and Baek (2006) and Bruna et al. (2019). Ali et al. (2024) uncover the substantial mitigating effects of crises, participative, and transformational supply chain leadership styles on the negative influence of geopolitical disruptions on logistics innovation performance.

Access to external resources is a matter of organizational survival (Pfeffer and Salancik 1978), and an increased female representation in corporate management can significantly extend the number of relationships and resources available to a corporation. Women in governance may be expected to bring a high level of competence to the table (Freeman and Varey 1998; Pesonen, Tienari, and Vanhala 2009). For example, new female directors contribute more additional expertise in boardrooms than their newly selected male counterparts on average (Kim and Starks 2016), frequently enhancing their capacities for professional achievements (Pace 2009). Nielsen and Huse (2010, p.16-17) suggest that "*that it is not the gender per se, but the different values and professional experiences that women may possess that enable them to make a difference to actual board work and influence board decision-making*." They conclude that board decision-making can be enhanced by a female

board member equivalent with similar (board relevant) professional experiences and different values.

Contemporary research results contrast with the statistical reality of gender equity in top management positions, while female characteristics may complement or ameliorate the input of male decision makers in many business functions. Solakoglu and Demir (2016) suggest that an increased portion of female directors alters boards' supervisory behavior. Female managers are less likely to practice "management-by-exception" than male managers (Burke and Collins 2002). Women may rather engage as transformational and servant leaders (Duff 2013; Eagly and Carli 2003). A servant leadership style emphasizes behavioral dimensions such as interpersonal acceptance, humility, altruism, authenticity, trust building, responsibility, empowerment, and development, and competence in this approach can add considerable value to high-quality organizations (Amah 2018; Erdurmazli 2019; Su et al. 2020). Less tolerance for inconsistent LSQ management and high commitment to interdisciplinary teamwork across the organizations could cause more diverse corporate governance to compromise less on the quality of goods and services produced against other factors. Board gender diversity and the level of independent directors are positively linked to labor investment efficiency (Al-Hiyari et al. 2024). Less tolerance for inconsistent LSQ management and high commitment to interdisciplinary teamwork across the companies could cause more diverse management teams to compromise less on the quality of transportation services produced against other factors.

Kochan et al. (2003) and Burgess and Tharenou (2002) consider female managers as consensus seekers who value team building, democratic values, and long-term relationships the most. According to Johansen (2007), they tend to prioritize the process by which an outcome is achieved and are thus more likely to act as business defenders. Female supervisors prefer a more personal approach toward employees and customers (Allen and Truman 1993); thus, a gender-balanced board may lead to a more transparent information environment (Upadhyay and Zeng 2014), a greater level of corporate sustainability reporting (Al-Shaer and Zaman 2016), and higher adoption of sustainability reporting and external assurance (Girón et al. 2021). More reserved opinions point out that the influence of female directors on the promotion of CSR disclosure practices could be caused by reputational

motivations as some studies find mixed results in this regard (Amorelli and Garcia-Sanchez 2019).

Chen et al. (2016) disclose that, compared with female managers, their male counterparts are more willing to justify business-related unethical behaviors such as bribery and tax evasion. In their research, gender difference in ethics becomes more pronounced under the cultural dimensions of collectivism, humane orientation, performance orientation, and gender egalitarianism. Trang and Mai (2020) discover that female Chief Financial Officers (CFOs) undertake more ethical but not more risk-averse decisions than their male counterparts. Women open more interest in utilitarian and altruistic endeavors (Mukhtar 2002; Simmons and Emanuele 2007) as well as in corporate philanthropy (Selma, Yan, and Hafsi 2020). Adams and Funk (2012) find female directors to be not only more benevolent and caring for universalism and stimulation but also more risk-affine. The researchers find that women in the boardroom are less concerned about tradition, conformity, security, and power, which can be beneficial when any problematic status quo in LSQ is being questioned. Dobson and White (1995) suggest that "feminine firms," in which trust and soft-skilled persuasion become contractual enforcement mechanisms, foster cooperative business ecosystems supporting communal objectives. If a firm has an ethics and compliance committee and a woman in the corporate board or as an executive officer, its value and performance can increase (Cunha, De Moura, and Cruz 2022).

In light of the above arguments, I argue that companies with a higher proportion of women in corporate governance may be able to pursue a corporate strategy and manage operations to achieve a higher LSQ output than their competition with fewer women represented in the highest echelons of enterprise management.

## 2.5 Research design

Since different sets of determinants of LSQ have been tested independently of one another, I propose an integrated approach to consolidate a comprehensive analysis of the determinants of LSQ to investigate the effect of women in corporate governance—specifically on boards of directors and at the executive management level. In the first range, I examine the bespoke determinants, and in the second step, I add gender-related variables. I apply a three-stage methodology. First, I replicate earlier studies on LSQ; second, I estimate models including all the variables identified as significant in earlier studies; third, I add gender-specific variables to test my hypotheses of the favorable impact of women directors and female executive officers

on LSQ. I find a positive relationship between a higher female top management ratio and companies' LSQ scores, which I discuss along with other results.

I use a measure of company-level LSQ score as a dependent variable and leverage the results from an American annual logistics industry survey, Quest for Quality, published between 2016 and 2022 by the *Logistics Management* (LM) magazine. For four decades, the yearly Logistics Management's Quest for Quality Awards have been recognized prizes for companies operating in the US transportation business. The quality ratings acknowledge the best freight carriers in terms of LSQ and customer satisfaction and are generated from an evaluation of LM readers' feedback. The survey is conducted by LM and a specialized consultancy, Peerles Research Group (PRS), who interview the buyers of different logistics services. Every year, the LM research group receives several thousands of responses, and freight companies need to receive at least 5% of the category vote to win.

**TABLE 1** LSQ survey samples from Peerles Research Group (PRS)

| Year | LM award winners | Survey responses |
|---|---|---|
| 2022 | 131 | 3800 |
| 2021 | 142 | 4100 |
| 2020 | 144 | 4500 |
| 2019 | 117 | 4500 |
| 2018 | 138 | 4500 |
| 2017 | 127 | 5437 |
| 2016 | 129 | 4725 |

Source: Annual LSQ report publications and award winners announcements from 2016-2022 (https://www.logisticsmgmt.com/)

The surveyors of LSQ address all modes and service disciplines, choosing the top performers in categories including motor carriers, railroad and intermodal services, ocean carriers, airlines, freight forwarders, third party/contract logistics services, and ports. They rate them on five criteria: On-time Performance, Value, Information Technology, Customer Service, and Equipment & Operations. Owing to the nature of services offered by third-party players, a different set of criteria is used to judge this category. Third-party logistics providers are rated on the following attributes: Carrier Selection & Negotiation, Order Fulfilment, Transportation & Distribution, Inventory Management, and Logistics Information Systems (Brier 2010). Each year, readers are first asked to rank the attributes in each category on a 5-point scale, with 5 representing the highest value and 1 representing the lowest value. A rough overview of the logistics service priorities indicated in the survey suggests that transportation buyers attach the

most importance to the timeliness of delivery and its value. After readers have ranked these key attributes in order of importance, they then grade each provider that they currently use on each of the five core Quest for Quality attributes on a scale of 1 to 3 (1 = poor, 2 = average, 3 = outstanding). The final company evaluation itself is a weighted metric, which is determined by multiplying the average raw scores by the average importance of each attribute (Brier 2010).

Some global logistics players provide many kinds of logistics services and compete in diverse market segments (e.g., FedEx, UPS, DHL); hence, they receive several weighted end-scores in different type of services per annum. For the operability of my analysis, I calculate an average final rating per enterprise per year considering its versatile offerings provided (e.g., trucking and courier/express in parallel). From the initial pool of all surveyed and awarded logistics companies, I focus on publicly listed firms with at least two awards in two consecutive years of study, which also provide financial and organizational details in an annual reporting process. For these firms, I match their average LSQ observations per annum with their respective yearly company financials retrieved from the annual reports as well as with other industry specific statistics provided by various market monitoring organizations. Data consistency is a challenging aspect of multi-year quality studies as the respective firm financials may vary owing to market factors such as mergers and acquisitions, altered reporting structure of business units and accounts, subsidiary business branching, and other changes. The tabulated sample selection process is presented in Tab. 2.

**TABLE 2** Tabulated selection process of the research sample

| | Sample size by year | | | | | | |
|---|---|---|---|---|---|---|---|
| **Selection step** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** |
| Total # of companies awarded by PRS & LM | 131 | 142 | 144 | 117 | 138 | 127 | 129 |
| # of observations with consecutive scores for publicly listed companies and their multiple business units (with consistent financial data) | 71 | 72 | 70 | 64 | 68 | 55 | 52 |
| # of observations with an avg. score per single company | 35 | 31 | 33 | 28 | 32 | 34 | 29 |
| Total observed panel sample for seven consecutive years of study | 222 | | | | | | |

Source: Author's calculations based on the data from annual reports and PRS quality evaluations in Logistics Management's magazines (2016-2022)

For my final research sample, I consider an ultimate number of 222 LSQ evaluations awarded to 48 distinct publicly listed companies from 2016 to 2022. The included firms report a cumulative revenue of 1.042 billion US$ in 2022, jointly employing over 3.3 million people worldwide. On average, I collect approximately five LSQ evaluations per company between 2016 and 2022. I calculate *LSQ (t)* as an endogenous variable, based on the service quality ratings achieved per company for various types of services (e.g., trucking, courier service) in the respective year, leading to the total panel size of N = 222. The

composition of the data sample in terms of firms' industry segment and geographic origin (including calculated average LSQ values) is presented in Table 3.

Numerous papers study the impact of word of mouth on demand, and multiple studies demonstrate that numerical estimates are influenced by starting points (anchors), even when these are obviously irrelevant (Simonsohn, 2011). Bauer and Greyser (1967) argue that heavily advertised brands receive higher scores in consumer reports. Morris and Bronson (1969) highlight that the method of scoring employed by the American Customer Union's engineers and the limited number of market samples tested make leveraging the consumer reports' data in research difficult. Hjorth-Andersen (1984) also criticizes the reliability of consumer reports and claims that the mathematical averaging process and some arbitrary product cue weights used for creating quality indices could be misleading.

**TABLE 3** Sample composition of the dependent variable and average logistics service quality scores

| **Data sample** | **Observations** | **Companies** | **avg. LSQ rating** |
|---|---|---|---|
| **Total** | **222** | **48** | **47.23** |
| *by Region* | | | |
| North America | 140 | 29 | 47.21 |
| Asia | 48 | 11 | 47.37 |
| Europe | 34 | 8 | 47.11 |
| *by Year* | | | |
| 2022 | 29 | 29 | 47.83 |
| 2021 | 34 | 34 | 46.07 |
| 2020 | 32 | 32 | 45.83 |
| 2019 | 28 | 28 | 48.70 |
| 2018 | 33 | 33 | 46.87 |
| 2017 | 31 | 31 | 47.36 |
| 2016 | 35 | 35 | 48.11 |
| *by Industry segment* | | | |
| Trucking | 59 | 12 | 46.68 |
| Logistics | 46 | 9 | 47.65 |
| Marine shipping | 46 | 9 | 46.95 |
| Airlines | 40 | 11 | 47.68 |
| Rail | 18 | 5 | 46.72 |
| Courier Express Parcel | 13 | 2 | 48.34 |

Source: Author's calculations based on the data from annual reports and PRS quality evaluations in Logistics Management's magazines (2016–2022)

Curry and Faulds (1986), who empirically study consumer reports, come to conflicting conclusions regarding the efficacy of published quality indices. Tellis and Johnson (2007) find product evaluations in the Wall Street Journal to be a reliable source of information that impacts capital markets and increases abnormal returns of product manufacturers' stock prices for five days from the date of the quality test disclosure. In the US hospital service sector, Popovich et al. (2020) determine that consumer reports confidently confirm that hospital scores reflect what they claim to measure.

**TABLE 4** Descriptive statistics

| Variables | Mean | Median | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| **Dependent** | | | | | |
| Logistics service quality score (LSQ) [avg. rating per company] | 47.22 | 47.07 | 2.56 | 42.12 | 57.49 |
| **Independent** | | | | | |
| Days Inventory Outstanding (DIO) [in days] | 6.88 | 3.65 | 11.99 | 0 | 112.48 |
| Sales, General, and Administrative expenses (SG&A) [in % of sales] | 0.07 | 0.05 | 0.07 | 0.001 | 0.40 |
| Sales efficiency | 0.000003 | 0.000002 | 0.000002 | 0.0000001 | 0.000010 |
| Cost of Goods Sold (COGS) [in %] | 0.78 | 0.80 | 0.16 | 0.36 | 1.32 |
| Organization size [# persons] | 70.099 | 23.567 | 128.500 | 1.153 | 600.278 |
| Total Assets [Mio US$] | 22.115 | 12.151 | 24.489 | 621 | 93.680 |
| Firm tenure [years] | 64 | 58 | 36 | 11 | 200 |
| Return on Assets (ROA) [in %] | 0.09 | 0.08 | 0.11 | -0.31 | 0.47 |
| Capital expenditures (CAPEX) [in % of sales] | 0.10 | 0.08 | 0.08 | 0.001 | 0.42 |
| Revenues' growth (YoY) [in %] | 0.11 | 0.07 | 0.29 | -0.70 | 1.36 |
| Employees' headcount growth (YoY) [in %] | 0.04 | 0.03 | 0.14 | -0.60 | 1.12 |
| Personnel costs [in % of sales] | 0.23 | 0.22 | 0.15 | 0.01 | 0.75 |
| Female directors count | 2.59 | 2 | 1.90 | 0,01 | 10 |
| Female executive officers count | 0.93 | 1 | 1.01 | 0 | 5 |
| Women share on board of directors [in %] | 0.22 | 0.25 | 0.12 | 0 | 0.55 |
| Women share in executive management [in %] | 0.12 | 0.13 | 0.12 | 0 | 0.56 |
| Blau index (female directors) | 0.32 | 0.38 | 0.14 | 0 | 0.50 |
| Blau index (female executive officers) | 0.17 | 0.22 | 0.17 | 0 | 0.49 |
| Environmental Social & Governance (ESG) rating [in points] | 48.59 | 55.91 | 24.47 | 0 | 85.51 |
| Advertising expenses [in % of sales] | 0.01 | 0.01 | 0.02 | 0 | 0.08 |
| Female CEO* | 0.07 | 0 | 0.26 | 0 | 1 |
| Zero women on board of directors* | 0.09 | 0 | 0.29 | 0 | 1 |
| Women share on board_1-10 PC* | 0.05 | 0 | 0.22 | 0 | 1 |
| Women share on board_11-20 PC* | 0.28 | 0 | 0.45 | 0 | 1 |
| Women share on board_21-30 PC* | 0.35 | 0 | 0.48 | 0 | 1 |
| Women share on board_31-40 PC* | 0.18 | 0 | 0.39 | 0 | 1 |
| Women share on board_41-55 PC* | 0.05 | 0 | 0.21 | 0 | 1 |
| Women share on board_1-20 PC* | 0.33 | 0 | 0.47 | 0 | 1 |
| Women share on board_21-55 PC* | 0.58 | 1 | 0.50 | 0 | 1 |
| Women share on board_11-25 PC* | 0.44 | 0 | 0.50 | 0 | 1 |
| Women share on board_26-33 PC* | 0.29 | 0 | 0.46 | 0 | 1 |
| Women share on board_34-55 PC* | 0.12 | 0 | 0.33 | 0 | 1 |
| Women share on board_1-25 PC* | 0.49 | 0 | 0.50 | 0 | 1 |
| Women share on board_26-55 PC* | 0.41 | 0 | 0.49 | 0 | 1 |
| Women share on board_1-33 PC* | 0.78 | 1 | 0.41 | 0 | 1 |
| Women share on board_34-55 PC* | 0.12 | 0 | 0.33 | 0 | 1 |
| Zero women in executive management* | 0.44 | 0 | 0.50 | 0 | 1 |
| Women share in executive management_1-20 PC* | 0.37 | 0 | 0.48 | 0 | 1 |
| Women share in executive management 21-56 PC* | 0.19 | 0 | 0.39 | 0 | 1 |
| Women share in executive management_1-25 PC* | 0.44 | 0 | 0.50 | 0 | 1 |
| Women share in executive management_26-56 PC* | 0.12 | 0 | 0.33 | 0 | 1 |
| Women share in executive management_1-10 PC* | 0.04 | 0 | 0.20 | 0 | 1 |
| Women share in executive management_10-20 PC* | 0.33 | 0 | 0.47 | 0 | 1 |
| Women share in executive management_21-30 PC* | 0.11 | 0 | 0.32 | 0 | 1 |
| Women share in executive management_31-56 PC* | 0.09 | 0 | 0.28 | 0 | 1 |
| Women share in executive management_11-25 PC* | 0.40 | 0 | 0.49 | 0 | 1 |
| Women share in executive management_26-33 PC* | 0.07 | 0 | 0.25 | 0 | 1 |
| Women share in executive management_34-56 PC* | 0.05 | 0 | 0.23 | 0 | 1 |
| Women share in executive management_26-56 PC* | 0.12 | 0 | 0.33 | 0 | 1 |
| Women share in executive management_11-33 PC* | 0.46 | 0 | 0.50 | 0 | 1 |
| Region North America* | 0.63 | 1 | 0.48 | 0 | 1 |
| Region Asia* | 0.22 | 0 | 0.41 | 0 | 1 |
| Region Europe* | 0.15 | 0 | 0.36 | 0 | 1 |
| Trucking industry* | 0.27 | 0 | 0.44 | 0 | 1 |
| Rail industry* | 0.08 | 0 | 0.27 | 0 | 1 |
| Airlines industry* | 0.18 | 0 | 0.39 | 0 | 1 |
| Courier Express Parcel industry* | 0.06 | 0 | 0.24 | 0 | 1 |
| Marine shipping industry* | 0.21 | 0 | 0.41 | 0 | 1 |
| Logistics industry* | 0.21 | 0 | 0.41 | 0 | 1 |
| **Control** | | | | | |
| Board of directors size | 11 | 10 | 4 | 5 | 29 |
| Management board size | 8 | 8 | 3 | 3 | 26 |

Note: *Dummy variable; Data from 2016 to 2022, N=222;

Author's calculations based on the data from annual reports and PRS quality evaluations in Logistics Management's magazines (2016-2022)

I also draw on the theoretical considerations of previous studies from the related research, including independent determinants that different studies find to have an impact on LSQ, which are presented in Tab. 4.

Lee and Billington (1992) suggest that an effective inventory turnaround improves the service offered to customers. Stock and Lambert (1992) undertake a cross-industry examination of logistics function activities in different economic sectors (e.g., office systems/furniture, plastic resins, imaging products) and assess 13 attributes of a well-done logistics service. Their analyzed sectors show a different sensitivity for particular logistics service items (e.g., order accuracy, lead-time, complaint management, shipping advance notice, damage rate, and delivery promises) and performed quality. Thus, they realize that a real opportunity for logistics vendors is to exploit a competitive advantage via a more tailored offering to clients' needs. This customization is frequently done by optimizing and adjusting the lead-time and timing of service delivery to the client. Hence, I re-estimate this factor using the *days of inventory outstanding* (DIO), which measures the number of days it will take a company to sell its entire inventory. Lower values are better from the cost perspective; however, in the end, minimized stock levels may conflict with steady sales' delivery capacity and consumer satisfaction. I calculate DIO as an annual ratio of total inventory value on the balance sheet divided through total sales per year based on annual company reports.

Mittal et al. (2005) discover a significant positive relationship linking different corporate key performance indicators to customer satisfaction and attest a negative relationship for sales efficiency. They identify the number of employees and selected financial cost aggregates of a company such as advertising expenses, sales efficiency, sales, general, and administrative expenses (SG&A), and cost of goods sold (COGS) as valid input variables to their regression analysis. They do not claim "to have identified the 'correct' set of satisfaction inputs, nor have (they) included the 'exhaustive' set of satisfaction inputs" (p. 548), since their selection is based on data availability and some preliminary theoretical justifications. Transposing that concept to the transportation service environment I aim to test, *sales, general, and administrative expenses* in % of sales, *cost of goods sold* in % of sales, and *organizational size* in headcount can also explain the notion of LSQ as endogenous variable from the input factor perspective. In my research, I exclude testing for sales efficiency parameter as it is multicollinear with the organizational size, and companies report insufficient data on the advertising expenditures. All mentioned financial performance indicators are sourced from the firms' annual reports.

Simon and DeVaro (2006) detect that employee-friendly organizations are positively associated with customer satisfaction, which could also apply to a better perception of LSQ in the transportation service environment. They deploy "Best Company" status—a binary variable—as a positive driver of customer contentedness, which I approximate with *firm tenure* in years by assuming that a company with a long-standing tradition would have an established and renowned market brand and could enjoy clients' loyalty. They also control for financial and organizational factors, such as ROA, logarithm of employees' count, logarithm of total assets, unemployment rate, and industry fixed effects or multiple brands, finding a positive and significant impact of corporate profitability on satisfaction but an opposite relation for total assets. Consequently, I also control for *return on assets* in % and a logarithm of *total assets in Mio. US$*. Annual corporate profitability is measured by ROA and computed as a ratio of earnings before interest and taxes (EBIT) to total assets per company. The total assets financials are retrieved from annual reporting documents, and organizational size is not tested owing to its multicollinearity with the assets' numbers. I also follow Simon and De Varo (2006) by controlling for a company's industry affiliation (e.g., trucking, rail, etc.), and I do not include the unemployment rate in the model owing to its insignificance in the findings of Simon and De Varo (2006).

Hopkins et al. (1993) state that expectation discrepancies between shippers and freight service providers often lay in a gap between what logistics clients say (e.g., "We want an on-time delivery") and what logisticians hear and interpret (e.g., "We do not want late deliveries") (Hopkins et al. 1993, p.146), which implies that good service contracts with precise agreement clauses—including defined delivery time windows—have to be made. They determine 19 expected and delivered logistics service attributes, where modern equipment also plays also an important role. To approximate for the effect of transportation equipment on LSQ, I test the influence of *capital expenditures* (CAPEX) in % of sales and control with ROA and *revenues' growth year on year (YoY)* of the transportation enterprises.

Finally, Kennedy (2011) postulates that an effective human resource management (e.g., employee selection and training) could positively affect LSQ, especially in the current talent and labor shortage situation in many logistics related professions and market segments. Therefore, I include employees' *headcount growth (YoY)*, corporate *personnel costs* in % of sales, as well as the company's *environmental, social, and governance rating* (ESG) in scoring points as my model variables potentially related to the LSQ. Headcount-related information and staff expenditures are sourced from annual reports, while the ESG details come from the LSEG database.

To test my hypothesis regarding the positive impact of female share in corporate governance on LSQ, I introduce the *number of women on the board of directors* as well the *women share on the board* in % and the *size of the board* per firm. Likewise, I test for the *number of women in executive management*, *women share in the management board* in %, and the *size of the management board* itself. I also include dummy variables for the companies (and years) with different female share critical masses. The average female directors' share in my sample increased from 16% in 2016 to 26% in 2022 on average, along with the average female count. The share of female executives doubled from 9% to 16% at the same time. In 2016, eight director boards had exclusively male representation, compared to two boards in 2022, with a 9% increase of the board size. In 2016, 18 management boards had zero female representation compared to eight boards in 2022, with a stable board size over time.

I begin by quasi-replicating the previously mentioned studies, study by study. In the next step, I simultaneously test all variables using ordinary least squares (OLS) regression.

**Equation 1: Regression model for the impact of women directors on LSQ:**

$$(1) \qquad L_{c,\,i,\,t} = g(X_{1\text{-}\tau,c,\,i,\,t}) + h(WBOARD_{c,\,i\,,\,t}) + i(c) + j(i) + k(t) + \varepsilon it$$

where L is the average LSQ score of cth firm in year t. All model variables are indexed by firm c, industry i, and year t. $X_{1-\tau}$ is the set of firm-level control variables described above, and the term WBOARD represents the variables related to female gender ratio on the board of directors.

**Equation 2: Regression model for the impact of women in executive management on LSQ:**

$$(2) \qquad L_{c,\,i,\,t} = l(Y_{1\text{-}\tau,c,\,i,\,t}) + m(WMGMT_{c,\,i\,,\,t}) + n(c) + o(i) + p(t) + \varepsilon it$$

where L is the average LSQ score of cth firm in year t. All model variables are indexed by firm c, industry i, and year t. $Y_{1-\tau}$ is the set of firm-level control variables described above, and the term WMGMT represents the variables related to female gender ratio in the executive management board.

For robustness testing, I analyse the same data pool using a robust LS regression function by applying the M-, S-, and MM-estimation methods to mitigate the impact of outliers. I also run stepwise regressions; being aware of the criticisms of the last method (Whittingham et al. 2006, p. 1), I use a "hands-off" approach to test our data selection.

## 2.6 Empirical findings

Table 5 presents the re-estimation results of the effects of variables on LSQ as individually considered by different researchers. First, I test the variable from Stock and Lambert (1992) in column (1), which appears insignificant in my model.

Second, in column (2), I use the factors considered by Mittal et al. (2005) and find a negative and lightly significant association between the Cost of Goods Sold (COGS) and LSQ. Scholars argue that, in general, COGS should be positively related to goods' quality, hence also to customer satisfaction. However, my results show that their impact on service quality might be more ambiguous as higher costs would also mean higher transportation service prices, which the shippers and clients of freight companies could perceive in an opposite way.

In column (3), I check the determinants of quality considered by Simon and DeVaro (2006) and, similarly to them, find a significant positive influence of ROA on LSQ. Owing to multicollinearity between organizational size and total assets as well as between total assets and sales efficiency, I only take the total assets values into account in this model, which appears positively significant in my model in contrast to their research. Assets are important production factors in the transportation industry; therefore, their influence on quality might be higher.

Further, in column (4), I evaluate the impact of capital expenditures and growing company revenues on LSQ and detect a significant positive relationship between the increasing revenue streams and perceived delivery performance. Companies expanding their service portfolio and scope can more easily satisfy their logistics customers and more precisely respond to shippers' needs.

Additionally, in column (5), I test whether corporate investments in personnel, consistent headcount growth, and a more sustainable environmental, social, and governmental (ESG) policy positively affect LSQ and find that freight management firms scoring high in the ESG dimension have a significant positive effect on their logistics service.

Finally, model (6) in Table 5 presents the results of my estimation, including all previously used exogenous variables. The goodness of fit of this integrated approach is comparatively better. I find that total assets and year on year revenues' growth significantly impact LSQ. This outcome is also confirmed in model (7), which includes only significant variables. Table 6 shows the computational results for the same models while also accounting

for industry fixed effects. In model (4), I additionally confirm the significant and positive impact of capital expenditures on LSQ, and in model (5), the ESG score loses its significance.

**TABLE 5** Determinants of logistics service quality (OLS): quasi-replication of earlier studies (incl. time fixed effects)

| **Columns**<br>**Model** | **1**<br>**Stock & Lambert (1992)** | **2**<br>**Mittal et al. (2005)** | **3**<br>**Simnon & DeVaro (2006)** | **4**<br>**Hopkins et al. (1993)** | **5**<br>**Kennedy (2011)** | **6**<br>**Integrative approach (All variables)** | **7**<br>**Integrative approach (All significant variables)** |
|---|---|---|---|---|---|---|---|
| Constant | 47.281 *** | 47.522 *** | 43.265 *** | 46.562 *** | 46.200 *** | 42.242 *** | 43.161 *** |
| | *0.187* | *5.808* | *1.241* | *0.310* | *0.447* | *2.074* | *1.885* |
| DIO | -0.009 | | | | | -0.002 | |
| | *0.014* | | | | | *0.016* | |
| SG&A | | -0.363 | | | | 1.622 | |
| | | *2.362* | | | | *2.516* | |
| COGS | | -1.799 * | | | | 0.613 | 0.547 |
| | | *1.069* | | | | *1.392* | *1.331* |
| Organizational size (L) | | -0.064 | | | | | |
| | | *1.120* | | | | | |
| Organizational size^2 (L) | | 0.017 | | | | | |
| | | *0.055* | | | | | |
| Total assets (L) | | | 0.356 *** | | | 0.292 ** | 0.255 * |
| | | | *0.125* | | | *0.147* | *0.140* |
| Firm tenure | | | 0.006 | | | 0.006 | |
| | | | *0.004* | | | *0.005* | |
| ROA | | | 3.101 * | 2.131 | | 2.830 | 2.749 |
| | | | *1.578* | *1.641* | | *2.130* | *1.890* |
| CAPEX | | | | 3.378 | | 3.672 | 3.480 |
| | | | | *2.152* | | *2.325* | *2.290* |
| Revenue growth (YoY) | | | | 1.291 * | 1.488 ** | 1.428 * | 1.369 * |
| | | | | *0.698* | *0.711* | *0.752* | *0.708* |
| Headcount growth (YoY) | | | | | 0.165 | 0.326 | |
| | | | | | *1.210* | *1.220* | |
| Personnel costs | | | | | 0.306 | 0.244 | |
| | | | | | *1.063* | *1.072* | |
| ESG Rating | | | | | 0,016 ** | 0.010 | 0.011 |
| | | | | | *0,007* | *0.007* | *0.007* |
| Industry fixed effects (FE) | No | No | No | No | No | No | No |
| Time fixed effects (FE) | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | **0.120** | **0.144** | **0.158** | **0.144** | **0.149** | **0.159** | **0.170** |
| AIC | **4.626** | **4.612** | **4.590** | **4.607** | **4.605** | **4.622** | **4.588** |

*Note:* (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

**TABLE 6** Determinants of logistics service quality (OLS): quasi-replication of earlier studies (incl. time and industry fixed effects)

| **Columns**<br>**Model** | **1**<br>**Stock & Lambert (1992)** | **2**<br>**Mittal et al. (2005)** | **3**<br>**Simnon & DeVaro (2006)** | **4**<br>**Hopkins et al. (1993)** | **5**<br>**Kennedy (2011)** | **6**<br>**Integrative approach (All variables)** | **7**<br>**Integrative approach (All significant variables)** |
|---|---|---|---|---|---|---|---|
| Constant | 47.763 ***<br>*2.524* | 48.441 ***<br>*7.192* | 43.009 ***<br>*2.437* | 46.514 ***<br>*2.500* | 47.155 ***<br>*2.584* | 44.202 ***<br>*3.926* | 45.591 ***<br>*3.595* |
| DIO | -0.010<br>*0.014* | | | | | -0.0004<br>*0.016* | |
| SG&A | | -1.037<br>*2.436* | | | | 0.082<br>*2.616* | |
| COGS | | -3.204 **<br>*1.237* | | | | -0.982<br>*1.717* | -1.016<br>*1.638* |
| Organizational size (L) | | 0.292<br>*1.325* | | | | | |
| Organizational size^2 (L) | | -0.009<br>*0.066* | | | | | |
| Total assets (L) | | | 0.292<br>*0.216* | | | 0.292<br>*0.225* | 0.190<br>*0.214* |
| Firm tenure | | | 0.006<br>*0.005* | | | 0.007<br>*0.005* | |
| ROA | | | 3.443 **<br>*1.652* | 3.035 *<br>*1.705* | | 1.970<br>*2.286* | 2.124<br>*2.047* |
| CAPEX | | | | 3.787 *<br>*2.229* | | 3.489<br>*2.357* | 3.385<br>*2.317* |
| Revenue growth (YoY) | | | | 1.259 *<br>*0.696* | 1.511 **<br>*0.714* | 1.140<br>*0.785* | 1.099<br>*0.749* |
| Headcount growth (YoY) | | | | | 0.180<br>*1.241* | 0.050<br>*1.260* | |
| Personnel costs | | | | | -0.837<br>*1.409* | -1.053<br>*1.432* | |
| ESG Rating | | | | | 0.008<br>*0.008* | 0.004<br>*0.008* | 0.005<br>*0.008* |
| Industry fixed effects (FE) | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time fixed effects (FE) | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | **0.140** | **0.156** | **0.165** | **0.174** | **0.153** | **0.161** | **0.169** |
| AIC | **4.628** | **4.623** | **4.603** | **4.596** | **4.625** | **4.645** | **4.614** |

*Note:* (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

In Table 7, column (1), I simultaneously test all variables positively associated with LSQ in Tables 5 and 6 and control for the board of directors' size. Since this variable is multicollinear with total assets, I deploy it only in the first two models. The adjusted $R^2$ increases. Variables such as capital expenditures, revenues' growth (YoY), and ESG score remain significant. When I test for industry effects in column (2), I find that all determinants turn insignificant. The coefficients of CAPEX and ESG increase in value, while other significant factors decrease. In columns (3) and (5), I add the focus variables featuring the count and proportion of women on boards of directors as well as the Blau Index in column (7), which is a statistical measurement used to quantify the level of diversity within a group, also tested as the Index of Heterogeneity by other scholars. The Blau index could be used to measure gender diversity as it is more sensitive to smaller values and may be more appropriate to capture critical mass effects (Humbert and Gunther 2017). The board of directors' size shows multicollinearity with the number of female directors; hence, I keep the latter factor in subsequent models and

exchange with female share later. While I find an insignificant impact of board size on LSQ, the absolute number of women directors has a negative and lightly significant effect. Increasing the female director count by one woman (approximately 39%) deteriorates the average LSQ score by approximately 8% (3.61 scoring points). Columns (4) and (6) test the quadratic polynomial values of gender-specific variables and remain insignificant. I also confirm that LSQ is positively impacted by total assets, ROA, capex, revenue growth, and ESG score. Moreover, the Blau Index variable does not significantly affect the studied LSQ.

When the model in column (3) is additionally controlled for industry fixed effects, the coefficient for female directors increases slightly to -0.209, and its significance also increases to $p = 0.04$ (**); however, all other variables appear insignificant. When the model is tested for firm fixed effects, only two factors remain negatively significant: female directors count (with coefficient -0.457 and $p > 0.05$) and cost of goods sold (with coefficient -6.930 and $p < 0.05$), and all other factors lose their significance (Tab. A1-1).

**TABLE 7** Effects of women on boards of directors on logistics service quality (OLS)

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
|---|---|---|---|---|---|---|---|---|
| **Model** | **Board of directors size$^{FE}$** | **Board of directors size$^{FE}$** | **Number of female directors$^{FE}$** | **Number of female directors^2$^{FE}$** | **Female board share [in %]$^{FE}$** | **Female board share^2 [in %]$^{FE}$** | **Female directors' Blau Index$^{FE}$** | **Female directors Blau Index^2$^{FE}$** |
| Constant | 45.829 *** | 47.574 *** | 37.162 *** | 41.688 *** | 43.292 *** | 43.268 *** | 43.285 *** | 43.387 *** |
| | *1.290* | *3.072* | *3.754* | *1.986* | *1.893* | *1.899* | *1.896* | *1.927* |
| COGS | 0.220 | -0.481 | 1.184 | 1.153 | 0.642 | 0.577 | 0.669 | 0.658 |
| | *1.326* | *1.657* | *1.361* | *1.361* | *1.337* | *1.358* | *1.344* | *1.347* |
| Total assets (L) | | | 0.353 ** | 0.370 ** | 0.253 * | 0.254 * | 0.252 * | 0.249 * |
| | | | *0.148* | *0.149* | *0.140* | *0.141* | *0.140* | *0.141* |
| ROA | 2.020 | 2.529 | 3.341 * | 3.279 * | 2.922 | 2.809 | 2.967 | 3.011 |
| | *1.860* | *2.048* | *1.901* | *1.902* | *1.903* | *1.946* | *1.917* | *1.927* |
| CAPEX | 3.964 * | 3.805 | 3.832 * | 3.639 | 3.547 | 3.461 | 3.592 | 3.676 |
| | *2.319* | *2.316* | *2.281* | *2.288* | *2.293* | *2.316* | *2.298* | *2.318* |
| Revenue growth (YoY) | 1.311 * | 1.113 | 1.285 * | 1.315 * | 1.301 * | 1.289 * | 1.320 * | 1.331 * |
| | *0.713* | *0.745* | *0.705* | *0.705* | *0.714* | *0.716* | *0.712* | *0.715* |
| ESG | 0.018 *** | 0.008 | 0.014 * | 0.012 * | 0.013 * | 0.012 | 0.012 | 0.013 * |
| | *0.007* | *0.008* | *0.007* | *0.007* | *0.008* | *0.008* | *0.008* | *0.008* |
| Size of Board of Directors (c) | -0.034 | -0.070 | | | | | | |
| | *0.040* | *0.042* | | | | | | |
| Female directors count | | | -0.196 * | 0.038 | | | | |
| | | | *0.099* | *0.246* | | | | |
| Female directors count^2 | | | | -0.029 | | | | |
| | | | | *0.028* | | | | |
| Women on board share | | | | | -1.266 | -0.063 | | |
| | | | | | *1.543* | *4.377* | | |
| Women on board share^2 | | | | | | -2.793 | | |
| | | | | | | *9.505* | | |
| Blau Index (Female directors) | | | | | | | -0.923 | -2.169 |
| | | | | | | | *1.304* | *4.193* |
| Blau Index (Female directors)^2 | | | | | | | | 2.487 |
| | | | | | | | | *7.955* |
| Industry fixed effects | No | Yes | No | No | No | No | No | No |
| Time fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Adj. $R^2$** | **0.160** | **0.177** | **0.182** | **0.182** | **0.169** | **0.165** | **0.168** | **0.165** |
| **AIC** | **4.601** | **4.605** | **4.579** | **4.583** | **4.594** | **4.603** | **4.595** | **4.604** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

The models in Table 8 adopt the idea of a nonlinear relationship between female participation and LSQ due to minimum critical mass (Amin et al. 2021; Amorelli and Garcia-Sanchez 2019; Elstad and Ladegard 2012; Gyapong et al. 2019; Joecks, Pull, and Vetter 2013; Kanter 1993; Konrad, Kramer, and Erkut 2008; Nguyen et al. 2021; Rosener 1995; Saggese,

Sarto, and Vigano 2020; Schwartz-Ziv 2017; Torchia, Calabro, and Huse 2011). Columns (1) and (2) of Table 8 indicate that a complete lack of women on a board of directors does not significantly affect the LPS status quo, and no critical female-gender mass influences the dependent variable, as shown in columns (3)–(6). This lack of significant impact of a critical mass of female directors is also confirmed when controlled for industry or firm fixed effects (results available upon request). Moreover, I confirm the positive significant impact of total assets, capital expenditures, revenue growth, and the ESG score.

**TABLE 8** Effects of women on boards of directors on logistics service quality (OLS), nonlinear

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Model** | **Zero female directors$^{FE}$** | **Zero female directors$^{FE}$** | **Female board share intervals I [in %]$^{FE}$** | **Female board share intervals II [in %]** | **Female board share intervals III [in %]** | **Female board share intervals IV [in %]** |
| Constant | 45.520 *** | 42.943 *** | 43.595 *** | 43.528 *** | 43.563 *** | 43.611 *** |
| | *1.328* | *1.896* | *1.935* | *1.930* | *1.926* | *1.948* |
| COGS | 0.264 | 0.620 | 0.594 | 0.691 | 0.585 | 0.607 |
| | *1.327* | *1.332* | *1.345* | *1.345* | *1.335* | *1.352* |
| Total assets (L) | | 0.248 * | 0.247 * | 0.247 * | 0.256 * | 0.246 * |
| | | *0.140* | *0.141* | *0.140* | *0.141* | *0.142* |
| ROA | 2.306 | 3.023 | 3.006 | 3.076 | 3.037 | 3.043 |
| | *1.883* | *1.907* | *1.915* | *1.915* | *1.910* | *1.938* |
| CAPEX | 4.140 * | 3.731 | 3.725 | 3.692 | 3.519 | 3.703 |
| | *2.326* | *2.301* | *2.307* | *2.307* | *2.322* | *2.328* |
| Revenue growth (YoY) | 1.269 * | 1.319 * | 1.325 * | 1.289 * | 1.274 * | 1.308 * |
| | *0.714* | *0.710* | *0.712* | *0.714* | *0.713* | *0.718* |
| ESG | 0.020 *** | 0.013 ** | 0.013 * | 0.014 * | 0.014 * | 0.013 * |
| | *0.007* | *0.008* | *0.008* | *0.008* | *0.008* | *0.008* |
| Size of board of directors (c) | -0.026 | | | | | |
| | *0.041* | | | | | |
| Zero women on directors' board (D) | 0.601 | 0.627 | | | | |
| | *0.611* | *0.595* | | | | |
| Women share on board_1-20 PC (D) | | | -0.654 | | | |
| | | | *0.619* | | | |
| Women share on board_21-55 PC (D) | | | -0.596 | | | |
| | | | *0.628* | | | |
| Women share on board_1-25 PC (D) | | | | -0.581 | | |
| | | | | *0.606* | | |
| Women share on board_26-55 PC (D) | | | | -0.737 | | |
| | | | | *0.646* | | |
| Women share on board 1-33 PC (D) | | | | | -0.619 | |
| | | | | | *0.596* | |
| Women share on board_34-55 PC (D) | | | | | *-1.001* | |
| | | | | | *0.788* | |
| Women share on board_1-10 PC (D) | | | | | | -0.433 |
| | | | | | | *0.899* |
| Women share on board_11-20 PC (D) | | | | | | -0.708 |
| | | | | | | *0.638* |
| Women share on board_21-30 PC (D) | | | | | | -0.537 |
| | | | | | | *0.648* |
| Women share on board_31-55 PC (D) | | | | | | -0.740 |
| | | | | | | *0.699* |
| Industry fixed effects | No | No | No | No | No | No |
| Time fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | **0.160** | **0.171** | **0.167** | **0.167** | **0.169** | **0.160** |
| AIC | **4.605** | **4.592** | **4.601** | **4.600** | **4.599** | **4.617** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

Since female representation on a board of directors has not demonstrated any consistent relationship with the LSQ of transportation companies beyond a slightly negative

tendence in women's count in the board of directors, I expand the testing of female impact in corporate governance to the effect of a gender-balanced executive officers' suite (CxO suite). Executive managers have a more practical and operative day-to-day influence on highly dynamic business of global logistics companies and can theoretically closer follow market dynamics and react to client needs in a more proactive and agile manner.

In Table 9, column (1), I analyze whether women's participation in management boards as executive management officers has any impact on LSQ, and I do not find such a significant relationship. Furthermore, I do not obtain any significant association for the share of women in executive management tested in column (3) as well as for the Blau Index variable checked in column (5). Moreover, the quadratic polynomial values of all these factors do not show any significant link with LSQ. Likewise, neither do the models controlled for industry and company fixed effects (results available upon request). Beyond the gender-related variables, I confirm that organizational size and revenue growth have a significant impact on the LSQ of freight companies.

**TABLE 9** Effects of female executive officers on logistics service quality (OLS)

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Model** | **Number of female executive officers$^{FE}$** | **Number of female executive officers^2$^{FE}$** | **Female executive officers share [in %]$^{FE}$** | **Female executive officers share^2 [in %]$^{FE}$** | **Female executive officers_Blau Index$^{FE}$** | **Female executive officers_Blau Index^2$^{FE}$** |
| Constant | 43.459 *** | 43.475 *** | 43.454 *** | 43.491 *** | 43.440 *** | 43.602 *** |
| | *1.789* | *1.807* | *1.763* | *1.804* | *1.772* | *1.819* |
| COGS | 0.088 | 0.089 | 0.074 | 0.073 | 0.078 | 0.054 |
| | *1.309* | *1.312* | *1.309* | *1.313* | *1.309* | *1.313* |
| Organizational size (L) | 0.246 * | 0.244 * | 0.252 ** | *0.249* * | 0.253 ** | 0.243 * |
| | *0.126* | *0.131* | *0.126* | *0.130* | *0.128* | *0.130* |
| ROA | 2.276 | 2.272 | 2.253 | 2.238 | 2.268 | 2.169 |
| | *1.866* | *1.871* | *1.865* | *1.875* | *1.862* | *1.881* |
| CAPEX | 3.767 | 3.768 | 3.761 | 3.760 | 3.762 | 3.700 |
| | *2.341* | *2.347* | *2.341* | *2.346* | *2.341* | *2.350* |
| Revenue growth (YoY) | 1.440 ** | 1.442 ** | 1.430 ** | 1.431 ** | 1.431 ** | 1.425 ** |
| | *0.713* | *0.715* | *0.713* | *0.715* | *0.714* | *0.715* |
| ESG | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 | 0.010 |
| | *0.007* | *0.007* | *0.007* | *0.007* | *0.007* | *0.007* |
| Size of Management Board (c) | -0.001 | -0.001 | -0.003 | -0.004 | -0.002 | -0.009 |
| | *0.055* | *0.055* | *0.051* | *0.053* | *0.051* | *0.054* |
| Female executive officers count | -0.027 | -0.001 | | | | |
| | *0.180* | *0.420* | | | | |
| Female executive officers count^2 | | -0.009 | | | | |
| | | *0.131* | | | | |
| Women in management board share | | | -0.433 | -0.099 | | |
| | | | *1.419* | *3.615* | | |
| Women in management board share^2 | | | | -0.990 | | |
| | | | | *9.837* | | |
| Blau Index (Female executives') | | | | | -0.290 | 1.068 |
| | | | | | *1.047* | *3.478* |
| Blau Index (Female executives')^2 | | | | | | -3.451 |
| | | | | | | *8.426* |
| Industry fixed effects | No | No | No | No | No | No |
| Time fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| **Adj. $R^2$** | **0.166** | **0.162** | **0.167** | **0.163** | **0.167** | **0.163** |
| **AIC** | **4.601** | **4.611** | **4.601** | **4.610** | **4.601** | **4.609** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

If any effects of a critical female mass in executive management may significantly affect the LSQ, I create additional models in Table 10. In column (1), I detect that

zero women in any CxO position do not significantly impact LSQ. In columns (2) and (3), I test the notion that having at least one-fourth or one-fifth of women in the executive circle could be favorable for the LSQ of such a transportation company; however, my results do not confirm any significant association in this regard. However, in columns (4)–(6), I detect a significant positive relationship for the critical mass of 10% of female executives in a management board, where, according to the token theory, they should play a rather minimalistic role (Kanter 1993). My findings suggest that having maximum 10% of women in the executive management (hence increasing their participation by the first 10% of CxO board) improves the LSQ score by approximately 19% (8,74 points), with other intervals remaining insignificant. Simultaneously, I find that organizational size and revenue growth have a significant positive impact on LSQ. Models in columns (5) and (6) keep the gender variables of maximum 10% positively significant also when controlled for company or industry fixed effects (Tab. A1-1); additionally, in equation (4), the gender factor remains significant also when industry fixed effects are included (results available upon request).

**TABLE 10** Effects of female executive officers on logistics service quality (OLS), nonlinear

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Model** | **Zero female officers$^{FE}$** | **Female officers' share intervals I [in %]$^{FE}$** | **Female officers' share intervals II [in %]** | **Female officers' share intervals III [in %]** | **Female officers' share intervals IV [in %]** | **Female officers' share intervals V [in %]** |
| Constant | 43.616 *** | 43.571 *** | 43.761 *** | 43.801 *** | 43.825 *** | 44,115 *** |
| | *1.911* | *1.803* | *1.824* | *1.817* | *1.784* | *1,807* |
| COGS | 0.101 | 0.065 | 0.051 | -0.038 | -0.118 | -0.333 |
| | *1.308* | *1.314* | *1.311* | *1.300* | *1.301* | *1.318* |
| Organizational size (L) | 0.232 * | 0.231 * | 0.229 * | 0.260 ** | 0.244 * | 0.236 * |
| | *0.129* | *1.310* | *0.130* | *0.128* | *0.128* | *0.129* |
| ROA | 2.302 | 2.362 | 2.183 | 2.283 | 2.407 | 2.204 |
| | *1.859* | *1.870* | *1.870* | *1.866* | *1.848* | *1.859* |
| CAPEX | 3.750 | 3.700 | 3.683 | 2.822 | 2.698 | 2.293 |
| | *2.343* | *2.352* | *2.348* | *2.361* | *2.360* | *2.394* |
| Revenue growth (YoY) | 1.447 ** | 1.449 ** | 1.406 * | 1.165 | 1.215 * | 1.249 * |
| | *0.713* | *0.714* | *0.716* | *0.716* | *0.712* | 0.713 |
| ESG | 0.011 | 0.011 | 0.010 | 0.008 | 0.010 | 0.010 |
| | *0.007* | *0.007* | *0.007* | *0.007* | *0.007* | *0.007* |
| Size of Management Board (c) | -0.006 | -0.002 | -0.013 | -0.019 | -0.013 | -0.014 |
| | *0.053* | *0.053* | *0.054* | *0.054* | *0.053* | *0.053* |
| Zero women in management board (D) | -0.049 | | | | | |
| | *0.359* | | | | | |
| Women share in executive management _1-25 PC (D) | | 0.008 | | | | |
| | | *0.378* | | | | |
| Women share in executive management_26-56 PC (D) | | 0.204 | | | | |
| | | *0.561* | | | | |
| Women share in executive management_1-20 PC (D) | | | 0.166 | | | |
| | | | *0.399* | | | |
| Women share in executive management_21-56 PC (D) | | | -0.158 | | | |
| | | | *0.473* | | | |
| Women share in executive management_1-10 PC (D) | | | | 1.850 ** | | |
| | | | | *0.852* | | |
| Women share in executive management_11-20 PC (D) | | | | -0.092 | | |
| | | | | *0.396* | | |
| Women share in executive management_21-30 PC (D) | | | | -0.429 | | |
| | | | | *0.552* | | |
| Women share in executive management_31-56 PC (D) | | | | -0.291 | | |
| | | | | *0.618* | | |
| Women share in executive management_1-10 PC (D) | | | | | 1.882 ** | 1.907 ** |
| | | | | | *0.852* | *0.852* |
| Women share in executive management_11-25 PC (D) | | | | | -0.173 | -0.161 |
| | | | | | *0.381* | *0.381* |
| Women share in executive management_25-56 PC (D) | | | | | 0.190 | |
| | | | | | *0.554* | |
| Women share in executive management_26-33 PC (D) | | | | | | 0.619 |
| | | | | | | *0.699* |
| Women share in executive management_34-56 PC (D) | | | | | | -0.322 |
| | | | | | | *0.753* |
| Industry fixed effects | No | No | No | No | No | No |
| Time fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | **0.166** | **0.163** | **0.164** | **0.180** | **0.183** | **0.183** |
| AIC | **4.602** | **4.610** | **4.608** | **4.598** | **4.590** | **4.594** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

## 2.7 Conclusion

I research for the determinants of LSQ, beginning by a quasi-replication of earlier quantitative studies, simultaneously testing all variables identified to be significant in the past and then adding gender-specific variables. As robustness tests, I leverage M-, S-, and MM- robust LS functions (to control for outliers' impact) and stepwise regression algorithms.

My study confirms that streamlining certain financial and organizational factors in transportation companies is favorable for their LSQ scores and that gender diversity in corporate governance does not yield unanimous positive results, which may rather depend on the business context where female management roles are deployed. In a highly male dominated

sector such as the transportation industry, "tokenism" in executive management may provide a chance to constructively diversify higher echelons of corporate power and successfully leverage female management style in logistics business operations. In contrast, gender diversity in boards of directors can slightly negatively influence the LSQ of shipping companies, when strategic control and innovation functions might be diluted. I contest the findings of Simon and DeVaro (2006), by which the organizational size of transportation firms may have a positive impact on LSQ and logistics profitability supports positive quality experience of B2B clients. My tests do not find any significant link between inventory management performance and delivered service quality as suggested by Stock and Lambert (1992), possibly because logistics firms only selectively offer inventory management related solutions. Contrary to Mittal et al. (2005), my results indicate a negative relationship of cost of goods sold with logistics quality scores, owing to particularly high price sensitivity in the freight industry, its intense global competition, and rather moderate profit margins in often locally fragmented markets. I confirm the positive association between revenue growth and perceived quality as demonstrated by Hopkins et al. (1993) and Kennedy (2011), since the expansion of service portfolio and advancing market mergers create global logistics service providers with comprehensive and sophisticated industry vertical offerings. Occasionally, I discover that capital expenditures can also positively affect LSQ as modern equipment and investments in process automation and digitalization ultimately improve logistics customer service and help synchronize multiple clients' operations. Likewise, funds spent on ESG policies in transportation enterprises pay back with higher LSQ scores and likely better employees' and customer satisfaction.

Finally, and as a central finding, using different multiple model variants and robustness specifications, I present mixed evidence for the impact of women on corporate governance in logistics companies. While female representation in management boards could positively influence LSQ levels, more female directors might negatively affect LSQ scores. The number of women directors may not be a sufficient argument for quality improvements as female directors' actual knowledge base and competency levels may play a bigger role in this case. Testing in more detail for further nonlinearities, I find that one-tenth of female executives are enough to positively influence LSQ scores in such a male dominated transportation sector. High-quality services require a considerable degree of operational resilience and sustainability as well as a respective communication style and policy regarding which female managers may have an effective role as LSQ agents. Advanced logistics services tend to become digital, automated, and climate-friendly and reduce waste and environmental pollution. Many transportation services companies now operate with energy-savvy mechanisms, equipment, and

facilities, trying to lower their carbon footprint and proactively reacting to shippers' needs. Business ethics and sustainability are among the top issues considered by contemporary investors and gender diversity in corporate governance to promote the implementation of high ethical codes (Koutoupis et al. 2022), which presumably also includes LSQ-oriented management guidance. Best practices for ambitious governance and strict monitoring procedures in corporations are company prerequisites for delivering reliable and environmentally friendly services. Female diversified management boards may eventually better facilitate quality-friendly policies and business ecosystems. Gender-balanced corporate governance bodies are more likely to implement quality-assurance services (Liao, Lin, and Zhang 2018). If more enterprises are motivated through appropriate regulations or research outcomes—such as those found in this study—to raise the number of female management appointments, a positive effect on LSQ and the sustainability of global transportation could be achieved in the long run. Nongovernmental stakeholders could positively affect the current regulatory status quo of gender participation in corporate governance (Lindberg, Lindgren, and Packendorff 2014) and proactively advance management sensitivity to the business implications of high-quality services. Diversified management boards have also a better multicultural understanding and can more effectively structure and run global internal communication campaigns and talent management programs to train the human resources employed at the company to effectively operate across different cultures.

I understand the limitations of my analysis, being aware that selection bias is not eliminated by the researchers' intervention (Massaro, Dumay, and Guthrie 2016). My results, as in any scientific study, comprise a particular data sample that is specific to the period chosen, a certain geography, and data availability. The regression analysis typically used in such studies has shortcomings in examining the circumstantial aspects of corporate governance. Nonparametric analyses or survey approaches and more qualitative assessments could provide adjacent observations in my context. Additionally, the deeper traits of female directors' behavior and management style cannot be fully captured by only measuring the proportion of female board members, which only allows for the binary modelling of diversity (Koutoupis et al. 2022). Campbell and Minguez-Vera (2008) argue that the proportion of women on boards is not an appropriate measure of diversity as boards with a large female presence will exhibit a high degree of homogeneity. Furthermore, a better knowledge of proprietary and consistently measured firm characteristics and personnel-related data (e.g., board members' biographical details, female directors' experience), which are often protected by privacy policies, could reveal more insights into the relationship between board members' gender and LSQ. Bigger

datasets from other geographies could help assess even more factors and conduct a similar study for a sample of companies from developing countries. However, with broader resource inequality data that include diverse data on demographic, leadership, and formal personnel and organizational factors, an analysis of gender causality could become overly complex (Cruz-Castro and Sanz-Menendez 2019; Mazur and Spierings 2016). Rossignoli, Lionzo, and Buchetti (2021) suggest that other aspects of diversity, such as professional expertise, educational background, and other personal information (e.g., marital status, sexual orientation, and measures that are difficult to model owing to a lack of relative disclosures) do not seem to matter for company performance. Considering such caveats, my paper could inspire further studies, such as in B2C or public domains. Simultaneously, in sophisticated and transparent markets, where the public is pushing for inclusion, brand value and customer loyalty may especially and increasingly depend on a greater representation of women in corporate management. A prospective examination of the impact of women's representation in the executive ranks of companies operating in technologically disrupted service markets with rapidly changing trends, or markets with particularly creative and innovative products, may be of particular interest. I believe that my research can become a positive motivation for logistics professionals, policymakers, and academics to continuously discuss, pragmatically influence, and possibly further regulate gender balance in the corporate governance of transportation enterprises.

# 3. Impact of women on corporate boards of directors on product quality

Wolfgang Maennig, Dorota Korenkiewicz

**Abstract:** We analyze the impact of women on corporate boards of directors on product quality. We innovate firstly by integrating the broad but fragmented research on the topic, offering a first simultaneously testing of a larger set of variables identified to be significant in earlier studies. Second, we add alternative indicators of female representation in board of directors as a potential determinant of product quality. Third, we use evaluation scores of goods by the nonprofit foundation "Stiftung Warentest" as a quality indicator, thus adding to a regionally diversified evidence. We find a significant positive effect of female board directors on product quality.

**Keywords:** gender equality, female, women ratio, women on boards of directors, product quality, product reliability, consumer reports

**JEL Classification:** C30, J16, L15, L21, L25

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## 3.1 Introduction

Around the world, policymakers, legislators, large institutional investors, and certain stock exchanges have called to diversify boards of directors to increase board independence. Having women on boards sends a positive signal to both internal and external constituents, regarding whether man and women in a firm have similar educational backgrounds and the overall labor market in a particular economy is balanced (Dunn 2012; Terjesen et al. 2016).

Impact of women in corporate boards of directors on product quality

On average, women constituted 30% of corporate boards of directors in Europe's largest publicly listed companies in 2020 (Gender Statistics Database), with the highest representation in France (45.1%), Iceland (44.4%), and Norway (40.4%), but other European countries lagged in this regard (e.g., Estonia, 8.8%). Although the female share of boards within European companies has almost tripled since 2010, it remains distant from the European Commission's recommendation of 40%. The global picture is similar, with females holding only 26.2% of corporate directorships among the Morgan Stanley Capital International World Index companies in 2020, and a declining growth rate in female board positions (Emelianova 2020). Rohner and Dougan (2012) report that more than 15% of publicly listed companies in the US and Europe still did not have even one female board member appointed, with the gender gap particularly visible in IT, industrial goods, materials, and telecom sectors. The authors find an underrepresentation of women in consumer-related sectors in the European markets and for large-cap stocks. Adams & Kirchmaier (2016) confirm that women are underrepresented in science and engineering professions as well as all academic levels in academia. According to Hillman, Shropshire, and Cannella (2007), only large firms are more inclined to employ a more gender-balanced directors' cadre to strive for more legitimacy in the corporate hierarchy, as structural barriers still exist for female board candidates, and the actual circumstances are determined by individual firm and industry specific characteristics (Brieger et al. 2019). Young female human capital has overtaken young men in many countries in enrolment and exam passes at schools and universities, but women do not appear to succeed in corporate governance for complex reasons (Walby 2011). Higher academic achievements are often required for female nominees to be considered for a board nomination. Women also feel that they are more frequently discouraged from aspiring to high-profile positions due to modest self-image, discriminating stereotypes, or lack of networking opportunities among the higher echelons of corporate power. Furthermore, firm size and masculine corporate culture may impede women's election to governance bodies. In contrast, opportunities for female directors are higher in public and nonprofit enterprises. Greater economic and political empowerment accompanied by countries' shared cultural values, beliefs, and attitudes has successively helped women overcome the "glass ceiling" of corporate elites (Lewellyn & Muller-Kahle 2020). However, corporate boardrooms' gender democratization proceeds slowly, with the first wave of feminization based on political background, the second facilitated by female board candidates' academic achievements, and the third attributed to exceptional and company-grown female talent (Heemskerk & Fennema 2014).

Sabatier (2015) confirms that existing quotas have prompted French companies to engage more female directors, which positively impacted companies' performance, while Comi et al. (2020) elicit mixed results, finding positive effects only on firm labor productivity in Italy, negative effects in France, and an insignificant impact on the profitability of Spanish companies. The Norwegian board of directors' quota reform of 2003 only applied to publicly listed companies in Norway, which to a larger extent accumulated capital that was financed by debt or a combination of debt and existing capital. The short-run impact of the reform on company performance measured by a return on assets was negligible (Dale-Olsen et al. 2013). Yang et al. (2019) determine that the Norwegian quota adversely affects treated firms' performance and reduces risk.

Researchers continue to investigate the business case for a higher proportion of female directors on boards, predominantly focusing on financial (e.g., firms' profitability, market returns, stock prices, liquidity, enterprise value, profits dividends, and risk) or organizational effects (e.g., corporate innovativeness, entrepreneurship, relationships with stakeholders, organizational and team performance, or interdepartmental dynamics and transparency). The scientific evidence for these associations is mixed, as board diversity can become "a double-edged sword," including a "value-in-diversity" proposition and counterarguments; for instance, regarding social categorization processes that lead to in-group favoritism and out-group discrimination and subsequent team fragmentation and negative behavioral dynamics or group outcomes (Kaczmarek and Nyuur 2021). Numerous scholars have provided empirical evidence that differences in boards or firms with enhanced female participation may lead to differences in key company figures. Companies with more diversified boards may achieve increased patent activities (Griffin, Li, & Xu 2021), improved stock liquidity (Ammad & Searat 2017), better accounting performance (Post & Byron 2015; Dang & Nguyen 2016; Lückerath-Rovers 2013), higher market valuation (Ntim 2015), larger returns (Kang et al. 2010; Johnstone-Louis 2017; Duppati et al. 2020), higher share price and earnings per share (van Dunk et al. 2005), a larger price/book value, and a larger average growth (Rohner & Dougan 2012), particularly firms with a higher market value, as expressed by superior Tobin's Q performance (Conyon & He 2017). Rossi, Cebula, and Barth (2018) determine that more women on boards of directors increase companies' indebtedness level, but invested capital is used more efficiently.

However, the positive impact of female directors could also depend on external circumstances. Dezsö and Ross (2012) suggest that women in executive management improve company performance only if female representation is moderated by high innovation intensity,

measured as the ratio of research and development (R&D) expenses to assets from the prior year. Sarhan, et al. (2019) determine that the positive impact of diversity on firms' financial performance is stronger in companies that are better governed and can enhance the pay-for-performance sensitivity. Hsu, Lai, and Yen (2019) used a composite diversity index, including board members' gender, age, tenure, and professional background, demonstrating that boardroom diversity positively affects operating performance, however firms with larger strategic change tend to present a negative correlation between boardroom diversity and operating performance. The probability of women on a board increases with firm performance, defined as return on assets and family ownership, but diminishes with corporate ownership and firm risk (Martin-Ugedo & Minguez-Vera 2014). Farrell and Hersch (2005) find that the likelihood of electing a woman to a corporate board negatively depends on the number of females appointed in the past, suggesting that firms may add female directors only as a defensive reaction to outside pressure and scarce female top performers could proactively prefer stronger and better-positioned companies. Turban et al. (2019) rule out this reverse causality, confirming the positive effect of gender diversity (measured using Blau's index) on firms' market valuation (e.g., Tobin's Q or turnover ratio), but only in national contexts where gender diversity is normatively accepted and not in economies where it is regulated (e.g., Western Europe vs. Japan).

Positive evaluations of the greater participation of women on business performance are not without opposition. Other scholars do not find significant effects; for example, on returns (Francoeur et al. 2008; Ramadhania et al. 2021), Tobin's Q (Rose 2007), IPO pricing (Mohan & Chen 2004), or dividend payouts (Pucheta-Martinez & Bel-Oms 2016; Arora 2021). Some even reveal negative effects of female directors; for example, on companies' share price (Ryan & Haslan 2005), profitability (Shrader 1997), or firm performance (Dang & Nguyen 2016; Triana, Miller & Trzebiatowski 2013). The impact of female directors may even be unfavorable to a company's share price (Ryan & Haslan 2005), profitability (Shrader 1997), and firm performance (Dang & Nguyen 2016; Triana, Miller & Trzebiatowski 2013). Ferreira (2015) criticizes research that seeks to prove the positive effects of female directors on firms' profitability, encouraging focus on female directors' potential benefits to society.

Since no consensus has emerged regarding the favorable effect of females on boards of directors, this study seeks to make four primary contributions to this controversial topic. First, our study complements the existing spectrum of academic research demonstrating the positive effects of boardroom diversity. We analyze the effect of increased female

representation on boards of directors on product quality (PQ),[1] which we consider to be a socially responsible measure of corporate success and an aspect of sustainable economic development, which is contemporarily deserving of more attention. We examine whether companies with a higher proportion of female directors produce higher quality goods than competitors that are governed by fewer women in boardrooms. Second, we review the relevant literature and methodologies applied to examine the effects of increased female participation in corporate governance. Third, we systematically extend the literature on Product Quality (PQ) in the light of our research. Our study enhances the partially fragmented research on the determinants of PQ (as described in the next section) by conducting the first simultaneous test of a larger set of variables identified to be significant in earlier studies. Finally, we add to research in the economics and management literature regarding the potential effects of gender diversity in leading positions in business enterprises.

## 3.2 Background

High PQ is an instrumental component of sustainable corporate policies, as increased quality standards indicate corporations' high social responsibility, which is a crucial management strategy (Kytle & Ruggie 2005). Moreover, contemporary firms are expected to manage non-economic business results and fulfill social and ecological responsibilities to stakeholders and clients. Effective corporate social responsibility (CSR) is a tool for successful firm and product differentiation, since internal and external CSR can enhance products' quality (Calveras & Ganuza 2016). Social role theory considers women to be more moral, diligent, compassionate, inclusive, and stakeholder oriented. The proportion of females on boards of directors is positively proportional to their influence on CSR decisions (Elstad & Ladegard 2012). The more highly educated a female senior manager, the more sensitive she is in terms of the quality and commitment of the environment, and the more attention she pays to the community (Yang, Yang & Gao 2019). A larger proportion of women and female labor representatives at the board level are positively related to CSR and environmental performance (Lopatta et al. 2020), which may subsequently favorably affect PQ.

PQ is also a key consumer decision criterion and has long been a "strategic weapon" in management practice (Garvin 2001) that can impact several company performance

[1] For summaries of the evolution of the definition of PQ, see (Reeves & Bednar, 1994) & Golder, Mitra, & Moorman (2012).

indicators, such as outgoing defect rates and on-time delivery rates (Nagar & Rajan 2001). Phillips et al. (1983) demonstrate that PQ also has a significant positive influence on return on investment (ROI), particularly for enterprises operating consumer goods non-durables, capital goods, and components businesses. Jacobson & Aacker (1987) observe a highly significant association between quality and product price (for four of six defined business segments), suggesting that buyers are inclined to reward premium goods with higher prices in these markets. Lakhal & Pasin (2008) summarize the literature finding a positive impact of PQ on financial performance, although they do not find a direct significant association linking PQ and financials for a sample of 133 Tunisian companies. Nevertheless, they detect a favorable correlation between PQ and customer satisfaction and internal processes. Tab. 11 presents the major determinants of PQ studied empirically. For a summary on the evolution of the definition of PQ, see Reeves & Bednar (1994), Golder, Mitra, & Moorman (2012), and Suchanek, Richter & Kralova (2014).

**Table 11** Literature review of the determinants of product quality

| | | | | | | Independent variables tested | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No** | **Authors (Year)** | **Research period** | **Research method** | **Industry sample** | **Dependent variable** | **Advertising spend** | **Sales, General and Admin (SG&A)** | **% of sales of new products** | **Return on Investment** | **Relative price** | **Relative quality (t-1)** | **Cost of Goods Sold (COGS)** | **Market share** | **Company brand** | **Co-management** | **Firm size** | **Downsizing** | **Capital expenditures** | **Unions** | **Market size** | **Fixed cost industry** |
| 1 | Phillips et al. (1983) | 1974-1975; 1980-1981 | OLS | Consumer durables | Relative product quality (t) | (+) ** | (+) ** | (+) ** | | | | | | | | | | | | | |
| | | | | Consumer non-durables | | (-) | (-) | (-) | | | | | | | | | | | | | |
| 2 | Jacobson & Acker (1987) | 1970- 1983 | Vector autoregression models | Consumer durables | Relative product quality (t) | | | | (+) | (+) | (+) *** | (+) | (-) | | | | | | | | |
| | | | | Consumer non-durables | | | | | (-) ** | (+) | (+) *** | (-) | (-) | | | | | | | | |
| 3 | Erden & Swait (1998) | pre 1998 | Generalized Least Squares | Consumer non-durables | Perceived quality | | | | | | | | | (+) ** | | | | | | | |
| 4 | Cooke, W.N. (2010) | 1981-1987 | Ordered probit estimates | Industrial goods | Perceived extent of change in product quality | | | | | | | | | | (+) ** | (-) ** | (-) ** | (+) | (+) | | |
| 5 | Berry & Waldvogel (2010) | 2009 | OLS, Tobits | Newspapers restaurants | Product quality | | | | | | | | | | | | | | | (+) ** | (+) ** |

*Note:* ***p<0.01; **p<0.05; *p<0.1

## 3.3 Theoretical framework

Despite substantial empirical literature devoted to the matter, the impact of boardroom diversity on firm performance is not an unanimously held business case. Note that diverging empirical results find their counterparts in diverging theoretical considerations. Three key theories support the positive aspects of greater gender meritocracy on corporate boards, including agency, resource dependence, and stakeholder theories (Ntim 2015), whereas social identity theory emphasizes a more critical approach (Luis-Carnicer et al. 2008).

Agency theory implies that female directors can more effectively resolve agency problems between shareholders and company managers. Female directors are particularly valued for ex-ante (visionary) strategic company control related to long-term strategy and monitoring of the environment (e.g., benchmarking qualitative indices). They may apply a higher sensitivity to internal compliance policies or acts of discrimination and are considered as more independent board members.

The resource-based perspective argues that firms can develop a competitive advantage by employing a complementary pool of female talent, skills, capabilities, and networks. Corporate boards maintain essential links between companies and their environment. A firm's effective linkage to its ecosystem, provides an organization with useful information, maintains a channel for communication purposes, is an important step in obtaining commitments of support from important elements of the environment, and helps legitimize organizations (Lückerath-Rovers 2013). The increased presence of high-profile women in corporate governance could enhance the level of quality assurance, as they may be more responsive to sustainable market trends and technologies. Female leaders can passionately contribute cutting-edge managerial, engineering, and product development skills. They may also be more motivated and determined than their male counterparts to organize and manage publicly transparent internal sustainability and quality reporting, and more proactively network across and beyond corporate hierarchies to anticipate, detect, and navigate quality issues within organization (e.g., product recalls, warranty policy, and customer service).

Stakeholder theory indicates that heterogeneous boards may be more creative, although it may take longer to negotiate and achieve consensus. By recruiting female directors, firms can benefit from links with stakeholders, particularly when determining business purpose and customer orientation, which can become major aspects of the superior PQ of delivered goods. Adams & Ferreira (2004, p.14) suggest that gender diversity on boards may also have a

political dimension, as "companies may care more about diversity when they are concerned about their public image."

In contrast, Luis-Carnicer et al. (2008, p. 588) examine social identity theory in context, revealing "demographic dissimilarity and these outcomes may vary among negative, neutral and even positive, depending on the extent to which employees' social identities are built among their demographic characteristics" (Chattopadhyay et al. 2004). Tsui et al. (1992) demonstrate that greater cohesion in homogenous groups results from easier communication and low relational conflict, while higher gender diversity leads to more absences and less organizational commitment for men and more organizational commitment for women (with no effect on absences). These considerations imply that the impact of female directors may depend on the settings and general conditions in the relevant societies and firms. Board gender diversity may primarily affect firm performance positively in countries with high national governance quality (Nguyen et al. 2021), in national contexts where gender diversity is normatively accepted (Turban et al. 2019), and in firms with a high rate of innovation (Dezsö & Ross 2012). According to social identity theory, male and female management styles differ as well. Women and men in the same organizational roles may behave somewhat differently (Eagly, Johanessen-Schmidt 2001) and women may be more effective in performing certain tasks over others (Eagly, et al. 1995). Although social scientists and organizational scholars argue that gender differences in managerial positions are minimal, they can become impactful when applied in a long-term repetitive mode (Martel, Lane & Emrich 1996). These arguments suggest that gender differences in approach and management of PQ on a strategic company level may result in different PQ outcomes over time.

While diversity fosters change and evolution, the aggregate results of contemporary research in this topic remain inconclusive regarding whether it hinders or improves organizational performance. Fulton (2021) asserts that while social bridging theories argue in favor of diverse organizations, social bonding theories argue against it. The author's study specifies these concepts as two distinct mechanisms, indicating that both can positively impact organizations, but their respective benefits depend on the task being performed. The study demonstrates that social diversity facilitates performance related to accessing external resources and social interaction facilitates performance related to internal coordination.

## 3.4 Literature review and hypothesis development

Koutoupis et al. (2022) systematically scrutinize 140 board diversity studies published from 2015 to 2021, determining that this topic has primarily been empirically investigated in developed countries. The research analyzed predominantly concentrates on the effect of board diversity on firms' (financial and sustainability) performance; however, no conclusive results have emerged regarding the extent to which diversity facilitates firms' operations. Nguyen et al. (2020) conducted a comprehensive systematic literature review of the existing research on women on corporate boards and financial and non-financial performance, reviewing 634 mixed, qualitative, quantitative, and theoretical studies conducted in over 100 countries from more than 10 disciplines (e.g., accounting, finance, economics, and governance) from 1981 to 2019 and published in 270 top-ranked journals. The authors find that many existing studies are descriptive and/or draw on single rather than multi-theoretical perspectives and focus on firm-level rather than country-level effects. The observable methodological limitations include a dearth of qualitative, mixed-methods, and cross-cultural/country studies. The study concludes by outlining opportunities for future research regarding women on boards of directors.

The upper echelons theory stipulates that senior management's quality and traits are reflected in organizations and systematically cascade down the hierarchical ladder to achieve strategic importance (Finkelstein et al. 2008; Hambrick & Mason, 1984; Pfeffer, 1983). The ratio of female directors represents a certain tendency of team (board) composition; hence, gender diversity can be a predictor of board level processes and effectiveness. Amin et al. (2021) indicate that female board presence significantly reduces agency costs (defined as the sum of monitoring expenditures by the principal, bonding expenditures by the agent, and residual losses), hence reduces the principal–agent conflict, particularly when a critical mass of women is achieved. Demographically balanced boards may tend to pursue long-term policies focused on high quality assurance, as female directors holding monitoring roles can mitigate managerial opportunism focused on earnings (Saona, et al. 2019). Gyapong et al. (2019) reveal that gender mixed boards may alleviate principal–agent conflicts around the dividend payout in hard times for a company (e.g., during an economic crisis), although they generally favorably affect dividend payouts, particularly when female directors have a critical mass; however, when ownership concentration is high, board gender diversity reduces dividend payments. Corporate funds not spent on dividends could be theoretically invested in advancing a sustainable product portfolio of superior quality. Female directors with financial backgrounds improve earning's

quality more than their female counterparts without relevant financial expertise (Zalata et al. 2021).

We assume that female directors are more effective as PQ agents for companies, staying more vigilant to customer feedback and corporate risks. Oliver (1996) notes that while men tend to measure performance quantitatively in financial terms, women do not hesitate to use either customer service ratings or diverse satisfaction scores. Female directors report higher concerns regarding product risk, supply chain, and reputational issues (Groysberg et al. 2016), mitigate such issues more decisively, and may have less tolerance for ethical lapses (Eagly et al. 2004; McCarthy 2017; Lunsford 2000; Franke et al., 1997), which can prevent ambiguous PQ and sustainability hazards. Female directors may monitor internal quality control mechanisms more diligently. They may be more inclined to promote targeted internal quality guidelines and sustainable corporate policies (e.g., product recycling, six sigma programs, and ecologically friendly supply chains). Furthermore, female directors could generally limit firms' risk performance,[2] measured by the volatility of equity returns (Zalata et al. 2019 and Yang et al. 2019). Shahab et al. (2020) confirm that CEO's power to increase the likelihood of stock price crash risk is significantly mitigated when a company's proportion of female directors is high. Adhikari, Agrawal, & Malm (2019) determine that female executives have more power to avoid lawsuits, partially by avoiding risky but value-increasing firm policies, such as more aggressive R&D, intensive advertising, and policies inimical to other parties.

Since organizations depend on external resources to survive (Pfeffer & Salancik 1978), increased female board representation can significantly extend the number of relationships and resources available to a corporation. Because of this, and beyond any soft skills, female directors may be expected to bring a high level of competence to the table (Pesonen, Tienari, & Vanhala 2009, Freeman & Varey 1998), and new female directors contribute more additional expertise in boardrooms than newly selected male counterparts, on average (Kim & Starks 2016), frequently advancing capacities for professional achievement (Pace 2009). Nielsen & Huse (2010, p.16-17) propose "that it is not the gender per se, but the different values and professional experiences that women may possess that enable them to make a difference to actual board work and influence board decision-making." The authors conclude that a female board member equivalent with similar (board relevant) professional experiences and different values can enhance board decision-making. The apparent higher quality of female corporate governors may positively affect quality strategy and management of the corporation,

[2] For opposing findings, see Iqbal, Sewon, & Baek (2006) and Bruna et al. (2019).

as female directors could be more educated, vigilant, and committed to quality management issues.

Board members' statistics by gender contrast with contemporary research results, confirming that females' characteristics may complement or ameliorate the input of male directors in multiple business management aspects. Solakoglu & Demir (2016) argue that an increased portion of female directors alters boards' supervisory behavior. Female managers are less likely to practice "management-by-exception" than males (Burke & Collins 2002). Women may prefer to engage as transformational and servant leaders (Duff 2013, Eagly & Carli 2003). Servant leadership style involves behavioral dimensions, such as empowerment and development, building trust, humility, altruism, authenticity, responsibility, and interpersonal acceptance, and competence in this approach can add significant value to high quality organizations (Su et. al 2020, Amah 2018, Erdurmazli 2019). Less tolerance for inconsistent PQ management and high commitment to interdisciplinary teamwork across the organizations could cause more diverse boards to compromise less on the quality of goods and services produced against other factors.

Kochan et al. (2003) and Burgess & Tharenou (2002) describe female managers as consensus seekers who focus on team building, democratic values, and long-term relationships, and Johansen (2007) suggests that female managers tend to prioritize the process by which an outcome is achieved, and are more likely to act as business defenders. Women tend to prefer an inclusive, "power sharing" management style more so than their male counterparts (Burgess & Tharenou 2002), assuming a more personal approach toward employees and customers (Allen & Truman, 1993). A gender-sensitive board setting may lead to a more transparent information environment (Upadhyay & Zeng 2014), a higher quality of corporate sustainability reporting (Al-Shaer & Zaman 2016), and improved adoption of sustainability reporting and external assurance (Girón et al. 2021). However, critical voices suggest that the influence of female directors on the promotion of CSR disclosure practices could be attributable to reputational motivations, and some studies have found mixed results in this regard (Amorelli & Garcia-Sanchez 2019). Women show more interest in corporate philanthropy (Selma, Yan & Hafsi 2020) as well as utilitarian and altruistic endeavors (Simmons & Emanuele 2007, Mukhtar 2002). A qualitative management survey by Adams & Funk (2012) finds female directors to be not only more risk-loving but also more benevolent and caring for universalism and stimulation. The authors find that women in the boardroom are less concerned about power, security, conformity, and tradition, which can be beneficial when any problematic status quo in PQ is being questioned. Dobson & White (1995) argue that

"feminine firms," in which soft-skilled persuasion and trust become contractual enforcement mechanisms, establish cooperative environments supporting communal objectives.

Based on the above arguments it can be argued that enterprises with a higher proportion of female directors on the board may be able to pursue a corporate strategy and respectively manage operations to achieve a higher quality output than their competition with fewer women represented in corporate governance.

## 3.5 Research design

Since different sets of determinants of PQ have been tested independently of one another, we propose an integrated approach to elicit a comprehensive analysis of the determinants of PQ for investigating the effect of women on boards. We aim to introduce a) an integrated analysis of the bespoke determinants and b) a novel approach, adding gender related variables. We apply a three-stage methodology. First, we replicate earlier studies on PQ; second, we estimate models including all the variables identified as significant in earlier studies; third, we add gender-specific variables to test our hypothesis of the favorable impact of women directors on PQ. We find a positive relationship between a higher female board ratio and companies' PQ scores, which we discuss along with other results.

We use firm-attested PQ as a dependent variable, obtained from the goods' evaluation scores published regularly by the German nonprofit foundation, Stiftung Warentest (SW). This institution, which tests consumer goods and services from various industry sectors, publishes a monthly journal with a series of tests. All products inspected by the organization are described in the magazine (including price, producer, sample, and other factors), which are evaluated using a reverse point scale per item, from 1 (very good) to 5.5 (very bad).

We also draw on the theoretical considerations of previous studies from the past four decades of related research, including independent determinants that different studies find to have an impact on PQ, which are presented in Tab. 12.

**Table 12:** Descriptive statistics

| Variables | Mean | Median | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| **Dependent** | | | | | |
| Median product quality score (PQ) [1-5.5] | 2.74 | 2.60 | 0.67 | 1.65 | 5.50 |
| **Independent** | | | | | |
| Advertising expenses [in % of sales] | 0.06 | 0.03 | 0.08 | 0.00 | 0.32 |
| SG&A [in % of sales] | 0.23 | 0.21 | 0.12 | 0.01 | 0.68 |
| Innovative company* | 0.20 | 0.00 | 0.40 | 0.00 | 1.00 |
| R&D [in % of sales] | 0.04 | 0.03 | 0.03 | 0.00 | 0.14 |
| Return on investment (ROI) [%] | 7.25 | 6.31 | 8.11 | -24.63 | 32.79 |
| Relative product price | 1.03 | 1.03 | 0.35 | 0.34 | 2.94 |
| COGS [in %] | 0.65 | 0.68 | 0.16 | 0.22 | 0.93 |
| Best brand* | 0.23 | 0.00 | 0.42 | 0.00 | 1.00 |
| Firm size [1000 persons] | 74.21 | 34.00 | 89.03 | 0.09 | 385 |
| Best company* | 0.20 | 0.00 | 0.4 | 0.00 | 1.00 |
| Downsizing [YoY in %] | 0.03 | 0.01 | 0.24 | -0.64 | 2.50 |
| Capital expenditures (CAPEX) [in % of sales] | 0.04 | 0.03 | 0.03 | 0.00 | 0.19 |
| Market size [in €B] | 17.20 | 11.30 | 26.70 | 0.24 | 158 |
| Female directors count | 1.32 | 1.00 | 1.55 | 0 | 8.00 |
| Women on board share [%] | 0.11 | 0.09 | 0.11 | 0.00 | 0.50 |
| Zero women on board* | 0.37 | 0.00 | 0.49 | 0.00 | 1.00 |
| Women share on board_1-10 PC* | 0.18 | 0.00 | 0.38 | 0.00 | 1.00 |
| Women share on board_11-20 PC* | 0.26 | 0.00 | 0.44 | 0.00 | 1.00 |
| Women share on board_21-30 PC* | 0.15 | 0.00 | 0.36 | 0.00 | 1.00 |
| Women share on board_31-50 PC* | 0.04 | 0.00 | 0.20 | 0.00 | 1.00 |
| **Control** | | | | | |
| Board size | 11 | 11 | 5 | 3 | 22 |
| Fixed cost industry* | 0.94 | 1.00 | 0.23 | 0.00 | 1.00 |
| Consumer durables* | 0.75 | 1.00 | 0.44 | 0.00 | 1.00 |

*Note:* *Dummy variable; Data from 2009 to 2010, N=142;
Own calculations based on the data from annual reports and product quality evaluations in consumer reports.

Phillips et al. (1983) analyze factor correlations of *advertising expenditure*, sales, general and administrative costs, and R&D expenditure with PQ, finding a positive relationship between all three categories and PQ, particularly in the consumer durables industry sector.[3] We re-estimate these factors using the variables *sales*, *general and administrative costs* in percentage of sales (SG&A), *research and development expenses* in percentage of sales (R&D), and a dummy variable for an *innovative firm* (INNOV) if a company is listed by the

[3] For an older rank correlation study on promotional expenses and the quality of diverse consumer goods, see Rotfeld and Rotzoll (1976); for a test on the reverse causality of PQ on advertising expenditure, see Tellis and Fornell (1988); and for an analysis of perceived PQ, see Moorthy and Zhao (2000).

*Business Week* journal as one of the top 50 most innovative companies in the world in respective years. All financial data are sourced from companies' public annual reports.

Jacobson & Acker (1987) use a vector autoregressive model for relative PQ (t) as a dependent variable. The authors' model equation considers one year lagged ROI, market share, relative product price, relative costs, and relative PQ as independent variables, revealing the positive impact of an established PQ and product price and mixed effects of ROI and costs in consumer durables and non-durables sectors. We use a *return on investment* ratio as a percentage per anno (ROI), a *relative product price* level[4] of a firm (REL_PRC) to control for companies' pricing position (expensive or low-cost products), and *cost of goods sold* as a percentage of sales (COGS) as independent factors possibly impacting PQ. Due to the lack of publicly and readily available information on market share, we are unable to test the exogenous variables of Jacobson & Acker (1987), which are based on a proprietary dataset. Note that market share is not found to be significant in the results for the industry sectors in our study. We alternatively assign two separate dummy parameters; one for corporations active in the *consumer durables* (IND_CD) sector, and the second for firms in the *consumer nondurable* (IND_NON_CD) sector, examining them separately in our regressions.

Erdem & Swait (1998) use proprietary questionnaires and ordinary least squares (OLS) regressions to find that brand investments may positively affect a (perceived) quality of goods. We replicate their study by using a BEST BRAND dummy, if a company was ranked among the Global Best Brands in 2010 and in 2009 (Interbrand 2010).

Cooke (1992) uses ordered probit estimates to investigate the effectiveness of an employee participation program on PQ improvement, determining that investments and a well-established workforce friendly employee participation program positively affect PQ improvement, while downsizing measures significantly deteriorate PQ. Firm size may impact quality endeavors slightly negatively, but the outcome value is rather minimal. Likewise, we test *capital investments* in percentage of sales (CAPEX) as a potential driver of PQ, the numbers for which are taken from the company annual reports (sourced from the corporate investor relations websites). We also deploy the standard test variable of *FIRM SIZE* based on absolute

[4] SW documents publish the prices for all reviewed goods and firms, allowing us to calculate the average price of a particular product within each single test sample (e.g., TV sets). We then analyze the price ratio (in percentage) that a particular test item per company (e.g., a TV set unit) has in comparison to the average reference price estimated for this type of product within each test sample. Finally, we determine an average value of the relative product price levels per company in all test samples scrutinized for a particular company.

employee headcount values, supplemented by parameters approximating corporate human resource policies, such as *organizational downsizing* (DOWNSIZE), if a year-on-year personnel reduction had exceeded 10%, as well as a BEST EMPLOYER dummy variable, if a company was awarded this title in 2010 and/or 2009 by The Great Place to Work Institute (http://www.greatplacetowork.net/ ).

Finally, we reference Berry & Waldfogel (2010), who use OLS regressions and Tobin's Q to find a positive impact of market size on PQ in newspaper and restaurant sectors in the US. The authors also demonstrate that markets competing primarily through variable costs (like restaurants) allow for more rapid development of broader market variety, including high-end products, than markets ruled by fixed costs (like newspapers). We use a binary variable indicating whether a company operates within a *fixed costs industry* (FIX_COST_IND) and consider MARKET SIZE values for Germany, which were taken in absolute numbers from the national value-added tax statistics published by the German Statistical Office (Destatis 2012).

To test our hypothesis regarding the positive impact of women on boards of directors on PQ, we use several control parameters, such as the number of women on the board of directors (FEMALE DIRECTORS), the size of the board (BOARD SIZE), and the share of female directors (in percentage) per firm (WBOARD). We also include dummy variables for the companies (and years) with a female share of 0%, 1%–10%, 11%–20%, 21%–30%, and 31%–50%. Only six of the observations in our data set (N = 142) have more than a 31% female share. The average female directors' share in our sample increased from 10% in 2009 to 11% in 2010, on average, along with the average female count. In 2010, 26 boards had exclusively male representation, compared to 27 boards in 2009, with a 1% increase of the board size.

SW initially evaluated products from 173 companies in 2009 and 175 firms in 2010, including financial services corporations. We exclude banking and insurance corporations from our analysis due to the effect of the financial crisis on this sector in the respective years; hence, we review 759 product tests for 151 enterprises profiled in 2010 and 682 product tests for 154 firms in 2009 from the SW foundation. We include companies evaluated in two consecutive years reducing our sample to 93 companies evaluated in both years. Finally, we establish our research sample with 71 publicly listed companies for which we are able to obtain consistent financials for our 16 independent variables simultaneously that are consistently reported each year. Therefore, our sample includes a balanced panel data set of 142 observations for which a corresponding set of comprehensive financial details and testing

samples is consistently available the two consecutive years of study. Data consistency is a challenging aspect of multi-year quality studies, as the SW foundation's tested product portfolio changes every year and respective firm financials may vary due to market factors such as mergers and acquisitions, altered reporting structure of business units and accounts, subsidiary business branching, and other changes. The tabulated sample selection process is presented in Tab. 13.

**Table 13** Tabulated selection process of the research sample

| | Sample size | |
|---|---|---|
| **Selection step** | **2009** | **2010** |
| Total companies evaluated p.a. | 175 | 173 |
| whereof financial service firms | 21 | 22 |
| Total companies reviewed | 154 | 151 |
| Total companies with consecutive scores p.a. | 93 | 93 |
| Total companies with consistent financial data p.a. | 71 | 71 |
| Total observed panel sample for two consecutive years of study | 142 | |

Own calculations based on the data from annual reports and product quality evaluations in consumer reports.

For the final research sample, we consider a final number of 555 product evaluations in 2010 and 558 in 2009. The included firms reported a cumulative revenue of 2.150 billion US$ in 2010, jointly employing over 5.4 million people worldwide. On average, we collect approximately eight product evaluations per company per year. We calculate *PQ (t)* approximated by a (log) median product evaluation score per company (MED_PQS) in 2010 and in 2009 as an endogenous variable, based on the product reliability marks achieved per company in the respective year, leading to N = 142. The composition of the data sample in terms of firms' industry affiliation and geographic origin (including calculated average PQ values) is presented in Table 14.

The reliability of consumer reports is criticized by Hjorth-Andersen (1984), who claims that the mathematical averaging process and some arbitrary product cue weights used for a creation of quality indices could be misleading. However, in an empirical study of consumer reports, Curry & Faulds (1986) come to conflicting conclusions regarding the efficacy of published quality indices. Tellis & Johnson (2007) find product evaluations in the Wall Street Journal to be a reliable source of information that impacts capital markets and

increases abnormal returns of product manufacturers' stock prices for five days from the date of the quality test disclosure.

**Table 14** Sample composition of the dependent variable and median/average quality scores

| Company sample | No. of companies | No. of product quality tests 2010 | Median product quality score 2010 | Average product quality score 2010 |
|---|---|---|---|---|
| Total (consumer durables and nondurables) | 71 | 555 | 2.5 | 2.7 |
| Consumer durables | 53 | 461 | 2.6 | 2.8 |
| Automotive | 8 | 19 | 2.7 | 3.2 |
| Consumer electronics | 41 | 425 | 2.5 | 2.7 |
| Consumer goods | 4 | 17 | 2.3 | 2.6 |
| Non-Durables | 18 | 94 | 2.3 | 2.5 |
| Cosmetics & Chemicals | 9 | 64 | 2.1 | 2.3 |
| Food & Beverage | 2 | 13 | 2.0 | 2.4 |
| Retail | 4 | 10 | 3.3 | 3.3 |
| Telecommunication | 3 | 7 | 2.5 | 2.3 |
| By headquarter region | | | | |
| Europe | 31 | 189 | 2.5 | 2.8 |
| Asia | 24 | 268 | 2.8 | 2.7 |
| America | 16 | 98 | 2.4 | 2.6 |

*Source:* Own calculations.

We begin by quasi-replicating the previously mentioned PQ studies, study by study. In the next step, we simultaneously test all variables using an OLS regression, referencing Jacobson & Acker (1987).

**Equation 1:** Regression model for impact of women directors on PQ:

$$(1)\quad V_{c,r,t} = g(X_{1\text{-}p,c,t}) + h(WBOARD_{c,t}) + i(c) + k(t) + \varepsilon_{it}$$

where $V$ is the logarithm of $c$th firm's median PQ score in year $t$. All model variables are indexed by firm $c$ and time period $t$. $X_{1\text{-}p}$ is the set of firm-level control variables described above and the term WBOARD represents the variables related to gender.

For robustness testing, we analyze the same data pool using a robust LS regression function by applying the M-, S-, and MM-estimation methods to mitigate the impact of outliers. We also run stepwise regressions; being aware of the criticisms of the last method (Whittingham et al. 2006, p. 1), we use a "hands-off" approach to test our data selection.

## 3.6 Empirical findings

Table 15 presents the re-estimation results of the effects of variables on PQ as individually considered by various studies. We first re-estimate the model of Phillips et al. (1983) in column (1). For consumer durables, we confirm a positive impact of sales force expenditure and company innovative power on PQ. In contrast, we do not find a positive relationship between advertising spending and PQ when using the variable specifications of Phillips et al. (1983).

Column (2) confirms the findings of Jacobson & Aaker (1987), indicating a significant impact of higher relative product prices. Although Jacobson & Aaker (1987) find a significant negative impact of ROI on PQ within nondurable businesses, they generally doubt any larger association between these two parameters. Our results do not find a significant relationship between ROI and PQ. Jacobson & Aaker (1987) find no significant effect of COGS on PQ, which is confirmed in our replication. As the COGS variable is multilinear with industry dummy variables, we only test for COGS.

Column (3) confirms the results of Erdem & Swait (1998) of a positive impact of brand names on the quality of goods, indicating that membership in the global group of "best brand" can favorably impact attested PQ.

Cooke (1992) finds that firms' size negatively, but marginally, impacts quality, while unionized and nonunionized companies, if empowered with an employee participation program, can improve product reliability. Model (4) shows a significant positive relationship between firm size and PQ but does not reveal any significant positive effects from an employee friendly human resource policy or effective employee participation. In addition, the results do not indicate any significantly negative effect of downsizing measures or capital expenditures on PQ. The author also finds a positive impact of capital investments on PQ, whereas the impacts of these variables are not significantly different from zero in our estimations.

Model (5) quasi-replicates the finding of Berry & Waldfogel (2010) that fixed costs industries may have a significantly positive PQ advantage, but in contrast, we do not find a significant association between market size and PQ.

**Table 15** Determinants of product quality (OLS): Quasi-replication of prior studies

| **Columns**<br>**Model** | **1**<br>**Phillips et al. (1983)** | **2**<br>**Jacobson & Acker (1987)** | **3**<br>**Erdem & Swait (1998)** | **4**<br>**Cooke (1992)** | **5**<br>**Berry & Waldvogel (2010)** | **6**<br>**Integrative approach** |
|---|---|---|---|---|---|---|
| Constant | 0.836 *** | 1.039 *** | 1.009 *** | 1.356 *** | 1.354 *** | 1.173 *** |
| | *0.067* | *0.072* | *0.020* | *0.159* | *0.324* | *0.373* |
| Advertising expenses | 0.330 | | | | | 0.689 ** |
| | *0.277* | | | | | *0,306* |
| SG&A** | -0.112 | | | | | -0.081 ** |
| | *0.035* | | | | | *0.037* |
| Innovative company* | -0.082 * | | | | | 0.021 |
| | *0.046* | | | | | *0.054* |
| R&D | -0.630 | | | | | 0.144 |
| | *0.547* | | | | | *0.564* |
| Return on investment | | 0.001 | | | | -0.001 |
| | | *0.002* | | | | *0.002* |
| Relative product price** | | -0.141 ** | | | | -0.096 * |
| | | *0.056* | | | | *0.056* |
| COGS** | | 0.110 | | | | |
| | | *0.086* | | | | |
| Best brand* | | | -0.110 ** | | | -0.073 |
| | | | *0.042* | | | *0.052* |
| Firm size** | | | | -0.039 *** | | -0.028 ** |
| | | | | *0.011* | | *0.013* |
| Best company* | | | | -0.044 | | 0.034 |
| | | | | *0.046* | | *0.049* |
| Downsizing | | | | 0.083 | | 0.065 |
| | | | | *0.072* | | *0.072* |
| CAPEX** | | | | -0,010 | | 0.010 |
| | | | | *0.021* | | *0.023* |
| Market size** | | | | | -0.009 | 0.005 |
| | | | | | *0.014* | *0.017* |
| Fixed cost industry*© | | | | | -0.163 ** | -0.183 * |
| | | | | | *0.078* | *0.098* |
| Industry fixed effects | Yes | Yes | | | | Yes |
| Time fixed effects | | | | | | Yes |
| Adj. $R^2$ | **0.069** | **0.045** | **0.039** | **0.112** | **0.022** | **0.170** |
| AIC | **-0.272** | **-0.253** | **-0.268** | **-0.326** | **-0.244** | **-0.328** |

*Note:* © Control variable * Dummy variable. **Logarithm. FE=Fixed Effects. n=142. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

Finally, Model (6) in Table 15 presents the results of our estimation model including all previously used exogenous determinants. Note that the goodness of fit of our integrated approach is comparatively better. We find that sales, general and administrative expenses, relative product price, firm size, being part of a fixed cost industry, and advertising expenditures significantly impact PQ.

In Table 16, column (1) we simultaneously test all variables significantly associated with PQ in estimation (6) of Table 15. Note that adjusted $R^2$ increases. Variables such as advertising expenses, sales, general and administrative expenditures, product price, firm size, and fixed cost industry remain significant, while company innovativeness and best brand status lose significance. The coefficients of relative price and fixed cost industry increase in value, while other significant factors decrease. In column (2) we add our focus variables featuring the number and the proportion of females on boards of directors and the control

parameter of board size. While we find an insignificant impact of board size on PQ, the absolute number of women directors significantly positively affects PQ. Increasing the female director count by one woman (ca. 10%) improves the average PQ score by 2.5%. Accordingly, in column (5) we find a significant positive association of the proportion of females on boards of directors on PQ. Columns (4) and (7) test the quadratic polynomial values of gender-specific variables and remain insignificant. We also confirm that PQ is positively impacted by sales, general and administrative expenses, the relative product price, best brand status, and by being in a fixed cost industry. Conversely, there is an inverse relationship between higher advertising expenses and goods' quality.

**Table 16** Effects of women on boards of directors on product quality (OLS)

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|---|
| **Model** | **All significant$^{FE}$** | **Number of female directors$^{FE}$** | **Number of female directors$^{FE}$** | **Number of female directors^2$^{FE}$** | **Female board share [in %]$^{FE}$** | **Female board share [in %]$^{FE}$** | **Female board share^2 [in %]$^{FE}$** |
| Constant | 1.218 *** | 1.214 *** | 1.210 *** | 1.213 *** | 1.211 *** | 1.209 *** | 1.207 *** |
| | *0.143* | *0.142* | *0.143* | *0.144* | *0.141* | *0.142* | *0.143* |
| Advertising expenses | 0.693 ** | 0.781 *** | 0.830 *** | 0.821 *** | 0.799 *** | 0.828 *** | 0.830 *** |
| | *0.283* | *0.253* | *0.290* | *0.294* | *0.248* | *0.287* | *0.289* |
| SG&A** | -0.076 ** | -0.083 *** | -0.079 ** | -0.080 ** | -0.084 *** | -0.082 ** | -0.081 ** |
| | *0.033* | *0.030* | *0.033* | *0.033* | *0.030* | *0.033* | *0.033* |
| Innovative company* | 0.021 | 0.008 | 0.013 | 0.013 | 0.009 | 0.012 | 0.012 |
| | *0.051* | *0.050* | *0.052* | *0.052* | *0.050* | *0.052* | *0.052* |
| Relative product price** | -0.107 ** | -0.130 ** | -0.130 ** | -0.129 ** | -0.128 ** | -0.128 ** | -0.128 ** |
| | *0.047* | *0.054* | *0.054* | *0.055* | *0.053* | *0.054* | *0.054* |
| Best brand* | -0.078 | -0.080 * | -0.081 * | -0.079 * | -0.072 | -0.073 | -0.073 |
| | *0.047* | *0.047* | *0.047* | *0.048* | *0.047* | *0.047* | *0.047* |
| Firm size** | -0.025 ** | -0.017 | -0.017 | -0.017 | -0.015 | -0.015 | -0.015 |
| | *0.011* | *0.014* | *0.014* | *0.014* | *0.014* | *0.014* | *0.014* |
| Fixed cost industry*© | -0.190 ** | -0.183 ** | -0.197 ** | -0.196 ** | -0.181 ** | -0.190 ** | -0.189 ** |
| | *0.086* | *0.077* | *0.087* | *0.088* | *0.076* | *0.087* | *0.088* |
| Board size © | | -0.001 | -0.001 | -0.001 | -0.003 | -0.003 | -0.003 |
| | | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* |
| Female directors count | | -0.025 * | -0.024 * | -0.031 | | | |
| | | *0.013* | *0.014* | *0.030* | | | |
| Female directors count^2 | | | | 0.001 | | | |
| | | | | *0.005* | | | |
| Women on board share | | | | | -0.383 ** | -0.373 ** | -0.343 |
| | | | | | *0.167* | *0.175* | *0.390* |
| Women on board share^2 | | | | | | | -0.084 |
| | | | | | | | *0.992* |
| Industry fixed effects | Yes | No | Yes | Yes | No | Yes | Yes |
| Time fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | **0.209** | **0.224** | **0.219** | **0.214** | **0.233** | **0.227** | **0.221** |
| AIC | **-0.409** | **-0.422** | **-0.409** | **-0.395** | **-0.433** | **-0.419** | **-0.405** |

*Note:* © Control variable * Dummy variable. **Logarithm. FE=Fixed Effects. n=142. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

The models in Table 17 adopt the idea of a nonlinear relationship between female participation and PQ due to minimum critical mass (Kanter, 1993; Rosener, 1995; Konrad, Kramer, & Erkut 2008; Torchia, Calabro, & Huse 2011; Elstad & Ladegard 2012; Joecks et al. 2013; Schwartz-Ziv 2017; Amorelli & Garcia-Sanchez 2019; Gyapong et al. 2019, Saggese, Sarto, & Vigano 2020; Nguyen et al. 2021; Amin et al. 2021). Column (1) of Table 17 indicates that a complete lack of females on a board of directors does not significantly affect the PQ status quo. Column (2) shows that a positive ratio of women directors of 21%–30% results in a 3.6% improvement on the PQ score in our log-lev model, also when controlling for time fixed effects. In columns (3)–(6), we control our model for variable outliers, obtaining similar positive results. The strongest M-estimation model is obtained excluding industry effects. These

outcomes suggest that a minimum one-fifth female directors' ratio generates effective action on PQ.

**Table 17:** Effects of female directors on product quality: Nonlinear effects

| Columns | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Model | Zero women$^{FE}$ | Female board intervals [in %]$^{FE}$ | Female board intervals [in %]FE_M-estimation | Female board intervals [in %]_M-estimation | Female board intervals [in %]_S-estimation | Female board intervals [in %]_MM-estimation |
| Constant | 1.169 *** | 1.187 *** | 0.960 *** | 0.972 *** | 1.082 *** | 1.084 *** |
| | *0.146* | *0.143* | *0.124* | *0.124* | *0.070* | *0.101* |
| Advertising expenses | 0.708 ** | 0.945 *** | 1.056 *** | 1.011 *** | -0.985 *** | 0.300 |
| | *0.285* | *0.292* | *0.254* | *0.225* | *0.142* | *0.203* |
| SG&A** | -0.085 ** | -0.083 ** | -0.072 ** | -0.084 *** | 0.054 *** | 0.022 |
| | *0.033* | *0.033* | *0.029* | *0.026* | *0.017* | *0.024* |
| Innovative company* | 0.018 | -0.006 | -0.037 | -0.046 | | |
| | *0.053* | *0.053* | *0.046* | *0.045* | | |
| Relative product price** | -0.112 ** | -0.123 ** | -0.163 *** | -0.164 *** | -0.220 *** | -0.265 *** |
| | *0.054* | *0.054* | *0.047* | *0.047* | *0.029* | *0.042* |
| Best brand* | -0.078 | -0.067 | -0.065 | -0.060 | | |
| | *0.047* | *0.047* | *0.045* | *0.041* | | |
| Firm size** | -0.018 | -0.012 | 0.015 | 0.013 | 0.001 | -0.006 |
| | *0.014* | *0.014* | *0.012* | *0.012* | *0.007* | *0.010* |
| Fixed cost industry*© | -0.198 ** | -0.182 ** | -0.235 *** | -0.216 *** | | |
| | *0.088* | *0.088* | *0.076* | *0.070* | | |
| Board size © | -0.002 | -0.004 | -0.006 | -0.006 | -0.002 | -0.003 |
| | *0.005* | *0.005* | *0.004* | *0.004* | *0.002* | *0.004* |
| Zero women on board* | 0.053 | | | | | |
| | *0.040* | | | | | |
| Women share on board_1-10 PC* | | -0.029 | -0.012 | -0.017 | | |
| | | *0.051* | *0.044* | *0.044* | | |
| Women share on board_11-20 PC* | | -0.021 | -0.008 | -0.017 | -0.025 | 0.026 |
| | | *0.046* | *0.040* | *0.038* | *0.021* | *0.031* |
| Women share on board_21-30 PC* | | -0.179 *** | -0.199 *** | -0.210 *** | -0.068 ** | -0.105 ** |
| | | *0.061* | *0.053* | *0.050* | *0.030* | *0.043* |
| Women share on board_31-50 PC* | | -0.132 | -0.150 ** | -0.157 ** | | |
| | | *0.087* | *0.075* | *0.075* | | |
| Industry fixed effects | Yes | Yes | Yes | No | No | No |
| Time fixed effects | Yes | Yes | No | No | No | No |
| Adj. $R^2$ | **0.211** | **0.243** | **0.125** | **0.131** | **0.190** | **0.088** |
| AIC | **-0.399** | **-0.421** | **180** | **176** | **NA** | **217** |

*Note:* © Control variable* Dummy variable. **Logarithm. FE=Fixed Effects. n=142. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

## 3.7 Conclusion

We analyze the determinants of PQ, beginning by a quasi-replication of earlier quantitative studies, simultaneously testing all variables identified to be significant in the past and then adding gender-specific variables. As robustness tests, we leverage M-, S-, and MM-robust LS functions (to control for outliers' impact) and stepwise regression algorithms.

Our study confirms that optimizing certain determinants of organizational performance is relevant to increasing PQ benchmarks and that gender diversity in corporate governance could be an additional lever for improving the quality of offered goods. Our results also imply that stakeholders should discourage "tokenism" in appointing boards of directors. We confirm the finding of Phillips et al. (1983) that general sales and administrative expenses have a significant and positive effect on PQ. Our results mainly indicate a negative relationship of advertising expenses on PQ, showing a positive association only in one LS robustness test regression (S-Model). This relationship also remains unsettled in the literature. We confirm a positive association between relative product price and product reliability as demonstrated by Jacobson & Aaker's (1987) research. We also identify an insignificant impact of costs of goods

sold and ROI on PQ. Like Erdem & Swait (1998), we find company brand to be a significant determinant of quality performance. Our results suggest that an employee friendly workforce policy and higher capital investments could positively affect PQ, while downsizing measures may decrease it. We find a positive and significant correlation between firm size and PQ. Our models also confirm that being part of a fixed cost industry significantly favors PQ (Berry & Waldfogel 2010).

Finally, and as a central finding, using different multiple model variants and robustness specifications, we present evidence confirming that female directors can favorably affect PQ. Testing in more detail for further nonlinearities, we find that a critical mass of female board members—beyond a one-fifth proportion—is needed to positively influence PQ scores. Modern and high-quality products demand a considerable degree of sustainability (monitoring and governance) and a respective communication style and policy, regarding which female board members appear to have an effective role as PQ agents. Advanced goods tend to already consume less energy and produce less waste and pollution in manufacturing processes. During the product life cycle, such companies usually operate with energy savvy mechanisms, assess low warranty costs, seldom experience product recalls, and maintain a low carbon footprint. Notably, business ethics and sustainability are among the top issues considered by contemporary investors and an overall board gender diversity promotes the implementation of high ethical codes (Koutoupis et. al 2022), which presumably also includes related PQ and sustainability guidance. Ambitious governance best practices and strict monitoring procedures in corporations are company prerequisites for producing reliable and environmentally friendly goods. Diverse boards with more female directors may eventually better facilitate quality friendly policies and business ecosystems. Gender-balanced corporate governance bodies are more likely to implement quality assurance services (Liao et al. 2018). If more companies are motivated through appropriate regulations or research findings such as those found in this study to raise the number of female board appointments, a positive effect to PQ and the sustainability of national economic output could be achieved in the long run. Nongovernmental organizations could have a unique role in favorably affecting the current regulatory status quo of gender participation in corporate governance (Lindberg, Lindgren, & Packendorff 2014) and advance board sensitivity to the business implications of high-quality goods.

We acknowledge the limitations of our analysis, being aware that researchers' intervention does not eliminate selection bias (Massaro et al. 2016). As with any empirical study, our results are based on a particular data sample that is specific to the period chosen, geography, and data availability. The regression analysis primarily used in such studies has

limitations in assessing the circumstantial aspects of corporate governance. More qualitative and non-parametric analyses or survey approaches could provide adjacent observations in our context. In addition, measuring the proportion of female board members cannot fully capture the deeper traits of female directors' behavior and management attributes; hence, it only allows for binary modeling of board diversity (Koutoupis et. al 2022). Some authors argue that the proportion of women on the board is not an appropriate measure of diversity, as boards with a large female presence will exhibit a high degree of homogeneity in terms of the gender category (Campbell & Minguez-Vera 2008). Alternatively, rather than this measure (the proportion of females on boards of directors), the Blau or Shannon index could be used to measure gender diversity, since they are more sensitive to smaller values and may be more appropriate to capture critical mass effects (Humbert & Gunther 2017). We analyze effects of critical mass in Tab. 17 by setting precise female share intervals. Furthermore, improved access to proprietary and consistently measured of firm characteristics and personnel-related data (e.g., board members' biographical details, female directors' experience, or granular key performance indicators on manufacturing shop floors), which are often protected by privacy policies, could presumably uncover further insights into the relationship between board member gender and PQ or other firm performance indicators. Broader data sets from other jurisdictions could consider even more factors, and conducting a similar study for a sample of companies from emerging countries could reveal further results. Notably, with broader resource inequality data that include diverse data on demographic, leadership, and formal personnel and organizational factors, an analysis of gender causality could become overly complex (Cruz-Castro & Sanz-Menendez 2019; Mazur & Spierings 2016). Rossignoli et al. (2021) also argue that other aspects of diversity, such as educational background, professional expertise, and other personal information (e.g., marital status, sexual orientation, and other difficult measures that are to model due to a lack of relative disclosures) do not seem to matter for company performance. Considering such caveats, our framework could stimulate further studies, such as in B2B or public domains. Likewise, in sophisticated and transparent markets, where the public is pushing for inclusion, brand equity, and customer loyalty may especially and increasingly depend on a greater representation of female directors, executive officers, and CEOs. In addition, an examination of the impact of women's representation in the executive ranks of companies operating in markets with rapidly changing market trends, or markets with particularly creative and innovative products, may be of particular interest. We believe that our research could be a good inspiration for academics, practitioners, and policymakers to continuously discuss, pragmatically influence, and possibly further regulate the gender balance of boards of directors.

# 4. Women on a corporate board of directors and consumer satisfaction

Wolfgang Maennig, Dorota Korenkiewicz

**Abstract:** Consumer satisfaction is a widespread measure of company success, and it shows positive interdependence with several key performance indicators of an enterprise. Although many researchers emphasize that women directors have a positive influence on the economic success of a firm, little research has focused on the impact that females on a board of directors have on customer satisfaction. This paper resumes previous insights on determinants of customer satisfaction and shows that a more balanced gender representation in corporate governance bodies can positively affect customer satisfaction with a company.

**Keywords:** women directors, female, gender equality, customer satisfaction, employee Performance

**JEL Classification:** C13, C30, J16, L21, L25

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## 4.1 Introduction

Diversity is a prerequisite for change and evolution, governed by a continuous interplay of system's variety and selection mechanisms. Jacques Sapir claims that heterogeneity should not be treated as an accidental byproduct, but rather conceptualized as a norm and acknowledged as an alternative economic theory (Sandven 2008). The idea that gender diversity on the board of directors adds value to companies is based on a few theories, e.g.: agency theory,

resource dependence theory, and stakeholder theory. Agency theory assumes that female directors bring different perspective on complex issues therefore can help more efficiently solve complex corporate problems. Resource dependence theory suggests that women directors elected to boards effectively enable a better access to critical resources due to an enhanced repertoire of skills, cues, and attributes. Stakeholders' theory indicates that heterogeneous boards may become more creative, even though they may take longer to negotiate and achieve consensus (Dang & Nguyen, 2016).

Brieger et al. (2019) state that structural barriers for female board candidates still exist in the practice and several individual, firm, as well as industry specific characteristics determine the status quo. Women often require higher academic achievements than men to be considered for a board nomination. Females also more frequently than men feel discouraged to aspire to such high-profile positions due to their modest self-image, discriminating stereotypes, or lack of networking opportunities in high-end corporate circles. Furthermore, firm size and masculine corporate culture may impede women's election to the governance bodies. In contrast, public, or non-profit character of an enterprise increases the chances for female directors, due to a more favorable business context. Lewellyn and Muller-Kahle (2020) find that a greater economic and political empowerment accompanied by shared cultural values, beliefs, and attitudes of a country successively help women overcome the glass ceiling of corporate elites. Boardroom's gender democratization happens however slowly, with the first wave of feminization being based on political background, the second one facilitated by academic achievements of the female board candidates and the third one accomplished by exquisite and company grown female talent (Heemskerk & Fennema 2014). From human capital perspective young women have closed the gender gap and overtaken young men in many countries in enrolment and exam passes at school and university, but they fail to succeed in the corporate governance due to complex reasons (Walby, 2011).

Women are underrepresented in science and engineering professions as well as in academia on all academic levels (Adams & Kirchmaier 2016). The global aggregate percentage of women in board positions reached ca. 20% in 2019, hence increased by ca. 10 percentage points since 2009 (Emelianova & Milhomem, 2019). In Europe the female board ratios rose by 17 percentage points, up to 28% between 2009 and 2019 (EU Gender Statistics Database); which is still far away from either gender parity or the European Commission's proposal of 40% percent by 2020 (Jourová, 2016). Sabatier (2015) confirms that quotas have prompted French companies to engage more female directors, which positively impacted companies' performance, while Comi et al. (2020) post mixed results. They disclose only

positive effect on firm labor productivity in Italy, but a negative one in France, including an insignificant impact on profitability of Spanish companies in the scope of their study.

The contemporary board statistics contrast with research findings that females' characteristics may complement or ameliorate the input of male directors in multiple business management dimensions. Solakoglu and Demir (2016) argue that an increased portion of female directors alters board's supervisory behavior. Nielsen and Huse (2010) propose *"that it is not the gender per se, but the different values and professional experiences that women may possess that enable them to make a difference to actual board work and influence board decision-making"* (p.16-17). They conclude that a female board member equivalent with similar (board relevant) professional experiences and different values can enhance board decision-making.

Our study analyzes the effects that increased female representation on a board of directors of business firms has on customer satisfaction (CS), described as an *"overall evaluation based on the total purchase and consumption experience with a good or service over time"* (Anderson et al., 1994, p.54).[5] Our paper contributes to the literature on the determinants of CS. The literature on this topic is rich but partly fragmented. Many studies have contributed by analyzing different variables, but none of the previous publications have tried to simultaneously test a larger set of variables identified to be significant in earlier studies. Churchill and Surprenant (1982) suggest that CS encompasses: expectations, performance, disconfirmation, and satisfaction. Spreng, MacKenzie and Olshavsky (1996) specify that satisfaction arises when product fulfills both: consumers desires and expectations. Cotiu (2013) reviewed further determinants of CS. Tab.18 summarizes the major factors impacting customer satisfaction considered in our study.

[5] For other definitions, see Johnson et al. (2001), Johnson, Herrmann and Gustafsson (2002), Gupta and Zeithaml (2006), Griffiths (2006), Moliner et al. (2007), and Malik (2012).

**Table 18**
Literature review of the determinants of customer satisfaction in our study

| No | Authors (Year) | Research period | Research method | Dependent variable | Independent variables tested | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Market share | Quality | Price | Quality expectation | Sales efficiency | COGS | Advertising expenses | Sales, General and Admin (SG&A) | Best company status | Retrun on Assets (ROA) | Employees | Total assets | Multiple brands | Unemployment rate | Supply chain practices / | Competitive advantage / profitability | Design attributes of products |
| 1 | Anderson, E. W., Fornell, C., Lehmann, D. R. (1994) | 1989-90 | Pearson correlation | SCSB[a] | (-) ** | | | | | | | | | | | | | | | |
| | | | Three-stage LS | | | (+) ** | (+) ** | (+) ** | | | | | | | | | | | | |
| 2 | Mittal, V. et al. (2005) | 1994-2000 | Regression analysis | ACSI[b] | | | | | (-) *** | (+) *** | (+) *** | (+) *** | | | | | | | | |
| 3 | Simon, D. H., DeVaro, J. (2006) | 1994-2002 | Regression models | ACSI | | | | | | | | | (+) *** | (+) *** | (+/-) | (-) ** | (+) | (+) | | | |
| 4 | Singh R. et al. (2010) | 2007-2009 | Correlation analysis | Customer satisfaction | | | | | | | | | | | | | | | (+) | (+) | |
| 5 | Chan, K, Kwong, C.K., Wong, T.C. (2011) | 2007 | Genetic programming | CS dimensions[c] | | | | | | | | | | | | | | | | | (+)* |

Notes: a) Swedish Customer Satisfaction Board; b) American Customer Satisfaction Index, c) Two dimensions of customer satisfaction for digital cameras ("photo quality" and "take distant image"); ***p<0,01; **p<0,05; *p<0,1

We also add to important strands in the economics and management literature on the potential gains and benefits that firms can achieve with gender diversity in leading positions in business enterprises. Despite a substantial body of literature having studied the gender boardroom diversity issue, no scientific consensus has emerged yet. The lack of unanimous research outcomes is mainly caused by different institutional, regulatory, and legislative systems for sampled companies, critical mass phenomena, different research periods, or individual approaches of scholars. We consider CS a socially responsible measure of corporate success and therefore would like to add one additional perspective on this matter. Our research results acknowledge a possibility of a significant association of female directors' representation on CS, which we interpret in line with the studies that ascertain positive effects of women on boards in terms of better addressing consumer preferences and building better relationships with external institutions.

Boards of directors have been traditionally focused on controlling financial accountability, executives' nomination and evaluation, and strategic oversight of a company. But changing consumers' sentiment, the proliferation of corporate accounting and the rising complexity of the global economy have caused some boards to reassess their responsibilities and mission. In this process, female directors increasingly participate in the corporate governance process and have been witnessed to have specialized knowledge (Dunn 2012) and pay a specific attention to decision-making factors that might also influence CS. Women directors are said to "humanize" personal interactions on boards and may have a positive impact on attendance at board meetings (Adams & Ferreira, 2008; Singh & Vinnicombe, 2004). Women on a board of directors tend to be more critical with the content of board work, which may improve the boards' quality of advice (Freeman & Varey 1998, Kim & Starks 2016). Gender diversity leads to more transparency (Upadhyay & Zeng 2014), higher detail levels of corporate sustainability reporting (Al-Shaer & Zaman 2016), and a better adoption of sustainability reporting and external assurance (Girón et al. 2021). Female directors tend to be more diligent and may change not only the decision-making culture, but also the tone of board discussions (Huse & Solberg, 2006). Oliver (1996) notes that, while men tend to measure their financial performance quantitatively, females do not hesitate to use either customer service ratings or diverse satisfaction scores. In accordance with the upper echelon theory, an increased female ratio may influence strategic choices made by the board (Nielsen & Huse, 2010).

Women may endorse a "power sharing" management style (Bradshaw et al., 1992), which may contribute to a more egalitarian decision-making process within an organization (Burgess & Tharenou, 2002). Women may prefer to engage as transformational

and servant leaders (Duff 2013, Eagly and Carli 2003). Such a servant leadership style with behavioral dimensions such as empowerment and development, building trust, humility, altruism, authenticity, responsibility, and interpersonal acceptance and competence (Beck 2010, Van Diernedonck 2011) can add significant value to organizations (Amah 2018, Erdurmazli 2019).

Female advisors seem to be more sensitive to unethical judgments (Lunsford, 2000); simultaneously, women show more interest in corporate philanthropy (Selma, Yan and Hafsi 2020) as well as utilitarian and altruistic endeavors (Simmons & Emanuele, 2007). Because psychological need satisfaction mediates the relationship between perceived justice and organizational identification and employee commitment (Malhotra, Sahadev, & Sharom, 2020), female leaders may be more likely to foster workforce motivation and loyalty (Burgess & Tharenou, 2002), in part because women often prefer a collaborative leadership style and take a more personal approach to employees and customers (Allen & Truman, 1993),[6] thus contributing a group-oriented organizational culture emphasizing commitment which may drive success of projects (Patanakul and Aronson 2012). Women tend to pay more attention to the process of how an outcome is achieved and are therefore more likely to act as business defenders (Johansen, 2007). Female directors holding monitoring roles mitigate managerial opportunism focused on earnings. Saona, et al. (2019) report that *"equilibrated board tends to mitigate earnings management practices"* (p.1). Zalata et al. (2019) and Yang et al. (2019) suggest that women directors generally limit a firm's risk performance[7] measured by a volatility of equity returns. A qualitative management survey by Adams and Funk (2012) finds female directors more risk-loving, but also more benevolent and caring for universalism and stimulation. Women in the board room bother less about power, security, conformity, and tradition, which can help if any problematic status quo in customer relations is being questioned. Ringqvist (2014) found that women in Swedish businesses tend toward more conservative pricing. This is important because a moderate pricing strategy is an important level of customer satisfaction. The Swedish Women Resource Centers (WRC) have been classified as innovation systems that link actors from different spheres of society to develop new knowledge and transform it into innovations (Lindberg, Danilda and Torstensson, 2012).

[6] Besides diversity-driven effects, women directors may also increase average qualification levels as long as *"women need to be even more competent than men"* (Pesonen et al., 2009, p.335). Women regularly stretch themselves to either learn new capabilities or acquire critical knowledge to capture innovative topics and business trends (Pace, 2009).

[7] However, there are many contrary findings that discuss risk-taking behavior of female executives (Iqbal, Sewon & Baek (2006), Bruna et al. (2019)).

Turning from internal relationships and effects to external ones, females put more emphasis on communication that aims for a high level of customer loyalty and long-term satisfaction (Mukhtar, 2002). Gender diversity may make consumers feel that their preferences and profiles are better addressed (Burke, 1999; Bilimoria & Wheeler, 2000). Women directors are more concerned about supply chain and reputational issues (Groysberg et al., 2016), which benefits relationships with external institutions (Singh & Vinnicombe, 2004). Finally, companies with more diversified boards achieve a higher quantity and novel patents (Griffin, Li, and Xu 2021). The innovativeness of complex enterprises can jump when the proportion of female leaders exceeds 20% (Lorenzo et al., 2017), as a feminine and servant leadership style can promote service-innovative behavior and intrinsic motivation among employees, especially in the case of individual identification with the leader (Su et al. 2020). Empowering leadership significantly impacts quality of people and methods such as technology endorsement, job design or innovative culture, as well as creating employee engagement (Muafi et al. 2019). A larger female representation has a positive impact, both on financial aspects (Hsu, Lai and Yen 2019, Lückerath-Rovers 2013) and on stock prices[8] when a favorable effect on a firm's financial performance indicators (e.g., Tobin's Q and Return on Assets) is larger in high-performing firms (Conyon & He, 2017). Turban et al. (2019) explicitly control for the reverse causality argument and confirm the positive effect of gender diversity on firms' market valuation (e.g., Tobin's Q or turnover ratio), but only in national contexts where gender diversity was normatively accepted (e.g., Western Europe vs. Japan). Rossi, Cebula and Barth (2018) determine that more women on board of directors increase company's indebtedness level, but the invested capital is used more efficiently.

The positive impact of female directors, however, might be also contingent on external circumstances. The case studies conducted yield not unanimous results due to their individual data samples, geographic coverage, and different research periods. Dezsö and Ross (2012) find that women in executive management improve company performance exclusively if the female representation is moderated by a high innovation intensity (the ratio of the "research and development" (R&D) expenses to assets from the prior year). Farrell and Hersch (2005) find that the likelihood of electing a woman to a corporate board negatively depends on the number of females already appointed to it in the past. They suggest that firms may add female directors only as a defensive reaction to outside pressure and that scarce female top performers might proactively prefer the stronger- and better-positioned companies.

[8] Post and Byron (2015), Ntim (2015), cf. Rohner and Dougan (2012), Kang et al. (2010), Francoeur et al. (2008), Luis-Carnicer de et al. (2008), or company's return on assets (Dezsö & Ross, 2012).

There may even be negative impacts of female directors on a company's share price (Ryan & Haslan, 2005), profitability (Shrader, 1997), and firm performance (Dang & Nguyen, 2016; Triana, Miller, & Trzebiatowski, 2013). Other studies report neutral findings and zero effects on, for example, excess returns (Francoeur et al., 2008), Tobin's Q (Rose, 2007), IPO underpricing (Mohan & Chen, 2004), or a dividend payout (Pucheta-Martinez & Bel-Oms, 2016). Ferreira (2015) criticizes literature that seeks to prove the positive effects of female directors on firms' profitability and suggests rather to focus the research on female directors' potential benefits to society.

Since many sets of determinants of customer satisfaction have been tested independently from each other, we propose an integrated approach to accomplish a comprehensive analysis of parameters influencing CS overall and additionally investigate the effect of women on boards on CS. We apply a two-stage methodology. First, we run a regression model, including all the variables identified as significant in earlier studies. Second, we add gender-specific variables to test our hypothesis of an impact (favorable) by women directors on CS. We find a positive relationship between a higher female ratio on the board and customer satisfaction scores of companies, which we discuss along other results.

## 4.2 Data and empirical strategy

We use the American Customer Satisfaction Index (ACSI), developed by the Michigan Ross School of Business and the American Society for Quality, as well as the National Customer Satisfaction Index (NCSI) UK measured by the CFI Group in the UK, as dependent variables. The ACSI is reported annually on a scale of 1 (min) to 100 (max) (http://www.theacsi.org) and is calculated consistently across service and manufacturing sectors from a telephone survey of indexed brands. The statistical pool of the ACSI represents 10 economic sectors, 47 industries, and more than 230 firms. The NCSI index scores are expressed as a number out of 100 (max), and results are based on survey data from 5,000 customers, collected via an online panel.[9] The NCSI UK applies the technology of the CFI Group (https://cfigroup.com) and the methodology of the ACSI. The composition of the data sample regarding industry affiliation and geographic origin of the firms (including calculated average CS values) is presented in Table 19.

[9] Deviations between NCSI and ACSI scores per company.

| **Table 19**<br>Data sample: selected industries and average CS scores in 2009 | | | |
|---|---|---|---|
| Industry | Number of companies | Share of the sample | Avg. CS score in 2009 |
| **Total** | **103** | **100%** | **77** |
| Consumer goods | 37 | 36% | 79 |
| Utilities | 22 | 21% | 74 |
| Retail | 18 | 17% | 78 |
| Technology Media Telecom | 17 | 17% | 73 |
| Automotive | 5 | 5% | 85 |
| Financial services | 4 | 4% | 77 |
| | | | |
| Manufacturing business | 57 | 55% | 79 |
| Retail and service business | 46 | 45% | 75 |
| | | | |
| American headquarter* | 96 | 93% | 76 |
| European headquarter | 4 | 4% | 81 |
| Asian headquarter | 3 | 3% | 86 |
| Data source: Own calculations; Note: * American companies performed, on average, lower in the customer satisfaction levels, particularly in the general manufacturing and the automotive sectors. | | | |

We review a group of 200 publicly listed enterprises profiled by the indexes' creators, of which 158 had been scored by ACSI, 32 by NCSI, and 10 by both indexes in parallel (as they run multiple brands in American and European markets). However, in our research sample we include a balanced longitudinal panel data set of 103 companies that were consistently scored by at least one of the indexes within a longer time period of five years (2005–2009) and had a full range of financial details available, so that our final sample has 515 multiyear observations in total. The observed firms reported over US$ 3.298 billion revenues in 2009 and employed more than 10.7 million people. The data sample includes 97 companies that provide consistent ACSI data and 6 companies that are continuously covered by both indexes.

Additionally, we include a range of independent determinants that have been found by different researchers to have an impact on CS. Table 18 provides a summary of the major determinants of customer satisfaction scrutinized by different studies on CS. Anderson et al. (1994) find a negative association between market share and customer satisfaction in the short term, arguing that companies might dilute their customers' experience while instantly differentiating business offerings and overstretching firms' responses to too many niche markets

simultaneously. A proprietary Swedish survey and database also indicate that price and quality as well as quality expectations may have a positive impact on CS. Anderson et al. (1994) use a Pearson correlation and analyze the relationship between CS and market share (in 1989–90) and find a significantly negative relationship. Our market share (MARKET SHARE) data is calculated from individual company revenues and the total market value (on a 5-digit NAICS level) in 2007, released by the US census. Due to the lack of publicly and readily available information, we cannot test Anderson et al.'s variables (1994), which was tested with a proprietary dataset—such as the impact of quality, price, and customer expectations on consumer satisfaction.

Mittal et al. (2005) discover a significant positive relationship linking different corporate cost categories to customer satisfaction and attest a negative relationship for sales efficiency. They identify advertising expenses (ADDS); sales efficiency (SALES EFFICIENCY); sales, general, and administrative expenses (SG&A); and cost of goods sold (COGS) as valid input variables to their regression analysis on CS. They do not claim "to have identified the 'correct' set of satisfaction inputs, nor have (they) included the 'exhaustive' set of satisfaction inputs*" (p. 548),* since their selection has been based on data availability and some preliminary theoretical justifications. We extract the SG&A and COGS directly from 10K reports. For firms that do not disclose advertising spending in their regular accounting publications, we used the data from Schonfeld and Associates (2010). We calculate the annual sales efficiency as a ratio of total company headcount divided by total revenues per anno (in million US$). The costs ratios for SG&A, advertising expenses, and COGS are estimated by dividing the respective cost aggregates by the total revenues of a company in the corresponding years.

Simon and De Varo (2006) confirm that companies distinguishing themselves by an employee friendly human resource policy can achieve significantly higher customer satisfaction scores. Company profitability measured by return on assets impacts CS significantly and positively, but an opposite relation is stated for total assets. Simon and De Varo (2006) deploy "Best Company" status (BEST COMPANY)—a binary variable—as a positive driver of CS. They also control for financial and organizational factors, such as return on assets (ROA), logarithm of employees' count (ORGSIZE), logarithm of total assets (TAS), unemployment rate, and industry fixed effects or multiple brands. We leverage similar key performance indicators on headcount and finance for all of the companies in our sample and for all five years, which we source from company financial reports. Annual corporate

profitability is measured by return on assets and computed as a ratio of earnings before interest and taxes (EBIT) to total assets per company.

Information on a "Best Company" status for the years 2005 to 2009 was taken from an online database of The Great Place to Work Institute website (http://www.greatplacetowork.net/), published by *Fortune* magazine in a list of top employer brands. We included "best company" data per firm as a dummy variable with a value of 1 for companies awarded by the institute in the respective years. We also followed Simon and De Varo (2006) by controlling for industry affiliation of a company (consumer goods, utilities, technology, media, telecom, retail, automotive, and financial services). We did not include the unemployment rate in our model, due to its insignificance in the findings of Simon and De Varo (2006).

Singh et al. (2010), based on some 400 questionnaires from Indian companies, find a positive correlation between inventory management and CS, suggesting that a smooth supply chain and effective product delivery capability are crucial for customer satisfaction. Influenced by this thought, we proxy delivery capability by the indicator, ″days of inventory outstanding″ (DIO), which measures the number of days it will take a company to sell its entire inventory. Lower values are better from the cost perspective; however, minimized stock levels may conflict with steady sales' delivery capacity and consumer satisfaction in the end. We calculate DIO as an annual ratio of total inventory value on the balance sheet divided through total sales per year. This financial data was based on individual company reports.

Chan et al. (2011) detect a significant impact of well-programmed product design attributes on CS. Inspired by these scholars, we use annual research and development (R&D) expenses in % of company sales (2005–2009) as a proxy input variable. R&D data was captured from the annual reports of the respective companies in the mentioned years.

In addition to the exogenous variables used by the other scholars, we control for the female component on the board of directors. We build a proprietary data set and collect the company data in order to install several control parameters in this context, such as number of women on the board of directors (FEMALE BOARD COUNT), size of the board (BOARD SIZE), and annual share of female directors (in %) per firm (WBOARD). Alternatively, we include dummy variables for the companies (and years) with a female share of 0%, 1–9%, 10–19%, 20–24%, and 25–33%. There are only 12 observations out of our N=515 data set with more >33% female share, hence we test this interval separately. Table 20 presents a full list of variables and their descriptive statistics. Fig. 1. shows that female share in our sample slowly

but surely increased over time by 13% and the female count by 10%. In 2005 exactly 13 boards had an exclusive male representation vs. 8 boards in 2009.

**Fig. 1** Female directors' statistics of our sample over time

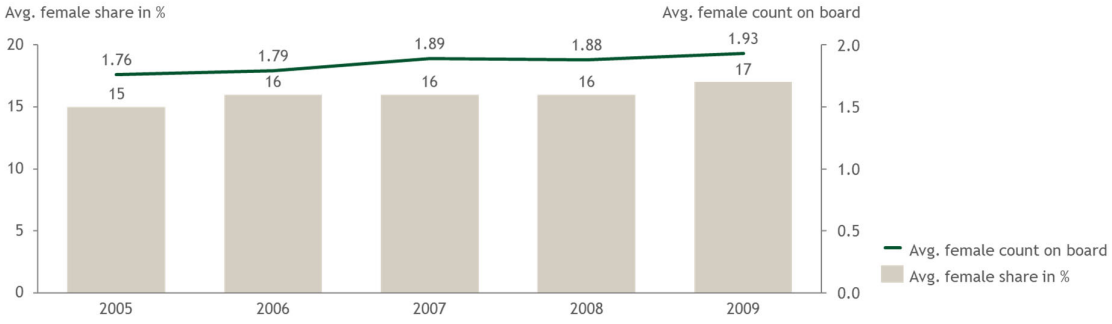

**Table 20**
Descriptive statistics

| Variables | Mean | Median | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| CUSTOMER SATISFACTION (CS) [0-100] | 76 | 77 | 7 | 51 | 91 |
| MARKET SHARE [%] | 0.11 | 0.04 | 0.16 | 0.002 | 0.93 |
| SALES EFFICIENCY* | 3.98 | 2.47 | 5.08 | 0.51 | 38.4 |
| COGS [in %] | 0.6 | 0.61 | 0.17 | 0.09 | 0.97 |
| ADVERTISING SPEND [in %] | 0.03 | 0.02 | 0.04 | 0 | 0.2 |
| SG&A [in % of sales] | 0.21 | 0.2 | 0.1 | 0.02 | 0.52 |
| BEST COMPANY** | 0.07 | 0 | 0.26 | 0 | 1 |
| RETURN ON ASSETS (ROA) [in %] | 0.05 | 0.05 | 0.09 | -0.85 | 0.68 |
| ORGSIZE [1000 Persons] | 101 | 36 | 212 | 0.53 | 2.100 |
| TOTAL ASSETS [in Bn US$] | 44 | 20 | 99 | 0.35 | 1.310 |
| R&D [in % of sales] | 0.01 | 0 | 0.03 | 0 | 0.19 |
| DAYS INVENTORY (DIO) | 27 | 25 | 22 | 0 | 113 |
| BOARD SIZE | 12 | 12 | 3 | 2 | 25 |
| FEMALE DIRECTORS COUNT | 2 | 2 | 1 | 0 | 6 |
| WOMEN ON BOARD SHARE [%]) | 0.16 | 0.17 | 0.09 | 0 | 0.46 |
| NO WOMEN ON BOARD* | 0.1 | 0 | 0.31 | 0 | 1 |
| WBOARD_1_9_PC** | 0.12 | 0 | 0.33 | 0 | 1 |
| WBOARD_10_19_PC** | 0.43 | 0 | 0.5 | 0 | 1 |
| WBOARD_20_24_PC** | 0.18 | 0 | 0.39 | 0 | 1 |
| WBOARD_25_33_PC** | 0.14 | 0 | 0.35 | 0 | 1 |
| WBOARD_34_46_PC** | 0.02 | 0 | 0.15 | 0 | 1 |
| CONSUMER GOODS** | 0.36 | 0 | 0.48 | 0 | 1 |
| UTILITIES** | 0.21 | 0 | 0.41 | 0 | 1 |
| RETAIL** | 0.17 | 0 | 0.38 | 0 | 1 |
| TECHNOLOGY ** | 0.17 | 0 | 0.37 | 0 | 1 |
| AUTOMOTIVE ** | 0.05 | 0 | 0.22 | 0 | 1 |
| FINANCIAL SERVICES ** | 0.04 | 0 | 0.19 | 0 | 1 |

Notes: * Total Headcount/ Total sales in Mio. US$; **Dummy variable; Data from 2005 to 2009, N=515; Calculations on the basis of data from annual reports and customer satisfaction surveys

Table 21 shows the correlations of the independent variables. As the variables “Female directors count” / “women on board share”/ "zero women on board” are multicollinear, we use them separately in our estimations.

**Table 21**
Correlation matrix

| # | Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Customer satisfaction (CS) [0-100] | 1 | | | | | | | | | | | | | | | | | | | | |
| 2 | Market share [%] | 0.19*** | 1 | | | | | | | | | | | | | | | | | | | |
| 3 | Sales efficiency* | -0.06 | -0.04 | 1 | | | | | | | | | | | | | | | | | | |
| 4 | COGS [in %] | 0.06 | 0.09** | 0.11** | 1 | | | | | | | | | | | | | | | | | |
| 5 | Advertising spend [in %] | 0.27*** | 0.14*** | 0.07 | -0.22*** | 1 | | | | | | | | | | | | | | | | |
| 6 | SG&A [in % of sales] | 0.16*** | 0.10** | -0.10** | -0.54*** | 0.39*** | 1 | | | | | | | | | | | | | | | |
| 7 | Best company** | 0.20*** | 0.13*** | -0.02 | -0.02 | 0.04 | 0.07* | 1 | | | | | | | | | | | | | | |
| 8 | Return on Assets (ROA) [in %] | 0.24*** | 0.08* | 0.04 | -0.11** | 0.15*** | 0.03 | 0.11** | 1 | | | | | | | | | | | | | |
| 9 | Orgsize [1000 Persons] | 0.02 | 0.46*** | 0.18*** | 0.24*** | -0.06 | -0.08* | 0.01 | 0.07 | 1 | | | | | | | | | | | | |
| 10 | Total assets [in Bn US$] | -0.02 | 0.13*** | -0.08* | 0.04 | -0.02 | -0.18*** | -0.01 | -0.06 | 0.26*** | 1 | | | | | | | | | | | |
| 11 | R&D [in % of sales] | 0.19*** | 0.18*** | -0.16*** | 0.00 | 0.13*** | 0.00 | 0.33*** | 0.12*** | -0.03 | 0.06 | 1 | | | | | | | | | | |
| 12 | Days inventory (DIO) | 0.32*** | 0.09** | 0.01 | 0.24*** | 0.01 | 0.11** | -0.12*** | 0.00 | 0.07 | -0.11** | -0.11** | 1 | | | | | | | | | |
| 13 | Board size | -0.03 | 0.16*** | -0.01 | 0.00 | 0.06 | 0.01 | 0.00 | -0.11** | 0.25*** | 0.32*** | 0.03 | 0.03 | 1 | | | | | | | | |
| 14 | Female directors count | 0.06 | -0.05 | 0.01 | 0.00 | 0.08* | 0.07* | 0.17*** | -0.02 | 0.12*** | 0.09** | -0.14*** | -0.01 | 0.19*** | 1 | | | | | | | |
| 15 | Women on board share [%] | 0.09** | -0.10** | 0.02 | 0.03 | -0.10** | 0.05 | 0.17*** | 0.01 | 0.03 | -0.05 | -0.12*** | 0.01 | -0.08* | 0.93 | 1 | | | | | | |
| 16 | No women on board** | 0.09** | 0.16*** | -0.02 | -0.04 | 0.12*** | 0.09* | -0.05 | -0.03 | -0.02 | 0.07 | 0.09** | -0.03 | -0.07* | -0.61*** | -0.62*** | 1 | | | | | |
| 17 | Women on Board_1_9_PC** | -0.08* | -0.07 | -0.03 | 0.00 | -0.03 | -0.01 | -0.04 | -0.06 | -0.00 | 0.04 | 0.08* | 0.14*** | 0.25*** | -0.30*** | -0.35*** | -0.13*** | 1 | | | | |
| 18 | Women on Board_10_19_PC** | -0.16*** | -0.04 | 0.06 | -0.03 | -0.02 | -0.09** | -0.06 | 0.05 | -0.05 | -0.12*** | -0.07 | -0.13*** | -0.00 | -0.08* | -0.11** | -0.30*** | -0.32*** | 1 | | | |
| 19 | Women on Board_20_24_PC** | 0.01 | 0.08* | -0.01 | 0.04 | -0.02 | -0.01 | -0.04 | 0.03 | 0.11** | 0.07* | 0.00 | 0.03 | -0.10** | 0.22*** | 0.27*** | -0.16*** | -0.17*** | -0.41*** | 1 | | |
| 20 | Women on Board_25_33_PC** | 0.20*** | -0.07 | -0.04 | 0.04 | -0.02 | 0.00 | 0.14*** | -0.01 | -0.02 | 0.01 | -0.03 | 0.03 | -0.05 | 0.51*** | 0.55*** | -0.14*** | -0.15*** | -0.35*** | -0.19*** | 1 | |
| 21 | Women on Board_34_46_PC** | 0.02 | -0.08* | 0.04 | -0.01 | -0.06 | 0.18*** | 0.15*** | -0.02 | 0.00 | -0.04 | -0.06 | 0.01 | -0.01 | 0.39*** | 0.41*** | -0.05 | -0.06 | -0.13*** | -0.07 | -0.06 | 1 |

Notes: * Total Headcount/ Total sales in Mio. US$; **Dummy variable; Data from 2005 to 2009, N=515

Women on corporate board of directors and consumer satisfaction

We use annual data from 2005 to 2009. Our methodological approach is twofold. In the first step, we simultaneously test all variables in an OLS regression as Mittal et al. (2005), implying the following model:

$y_{iT} = \alpha + \beta_1 X_{1,\,it} + \ldots + \beta_k X_{k,\,it} + \gamma_i S_{it} + \delta_1 WBOARD_{1,\,it} + \ldots \delta_e WBOARD_{j,\,it} + \varepsilon_{it,}$

where $y_{iT}$ is the customer satisfaction score of firm i at Period t. Following Simon and De Varo (2006), we use the logarithms of customer satisfaction values. $X_1$ to $X_k$ and $S_i$ are the set of firm level control variables as described above, and the terms WBOARD are the main corporate governance indicators related to gender.

In the second step, we add gender-specific data to test our hypothesis of the positive impact that women on a board of directors have on customers' satisfaction. The results of step 1 are shown in Table 22, column (1). The output of step 2 is shown in the other columns of Table 22 as well as in Table 23, which controls for potential non-linear effects of women´s participation. Finally, as a test of robustness, we include the same data in a stepwise regression (Table 24). We are aware of the critics of the stepwise method—such as, *"a bias in parameter estimation, inconsistencies among model selection algorithms, an inherent (but often overlooked) problem of multiple hypothesis testing, and an inappropriate focus or reliance on a single best model"* (Whittingham et al., 2006, p.1) —and use this "hands-off" approach as a robustness test only.

## 4.3 Results

Column (1) of Table 22 displays the result of a regression, which simultaneously controls for all variables that have been found to have a significant relationship to CS in earlier studies. The results confirm the findings of Mittal et al. (2005) of a positive and significant association of sales, general, and administrative expenses with CS and a negative significant impact of sales efficiency. We find a positive (but insignificant) effect of advertising expenses. Note that some promotional expenditures are included in the broader SG&A cost category. Marketing activities are uniquely important in the early-stage innovation, hence the phase between R&D and the beginning of the new product development (Schoonmaker, Carayannis and Rau 2012). In this estimation model, the cost of goods sold does not have any significant association to CS. Mittal et al. (2005) conducted their regression analysis to ascertain, if the four mentioned inputs were

statistically related to satisfaction and if the coefficients go in the assumed direction, which we were able to confirm to some extent.

Furthermore, we observe a positive but insignificant relationship of market share to customer satisfaction. Anderson et al. (1994) find a significantly negative relationship (slope) in the short term, when CS may drop, while company's market share is increasing, as bigger firms must often serve diverse and heterogenous customers. However, the scholars also discuss a theoretical possibility of a positive influence of higher market share on buyers' contentedness in the short-term, particularly when an enterprise is specialized in a niche or enjoys great economies of scale and scope. They also theoretically consider a short-term vs. long-term phenomenon, where customer satisfaction may grow in parallel with market share increase also in the long run.

Our estimation (1) also replicates the significant findings of Simon and De Varo (2006), who discover positive relationships of an *employee friendly company policy*, acknowledged by a "best company status". In our equation being a "best company" improves the CS by 3.2% to 4.2%, which is on average 2,4 to 3,1 CS points. Simon and De Varo (2006) estimated an improvement of 2,3 to 3 CS points in their models (excluding firm fixed effects). Similarly, we also find a positive relationship to control variables such as firm's *profitability* (expressed by ROA), and *organizational size* to CS. Like these scholars, we also find a negative significant association to *total assets*. We also confirm existing *industry effects* regarding sector variation in customer satisfaction, specifically for the consumer goods industry, utilities, and retail as well as for the technology, media, and telecom industries.

Reflecting upon a positive association between our proxy variable *inventory management* and customer satisfaction as researched in a correlation analysis by Singh et al. (2010), we confirm a significant positive effect of *days inventory outstanding* on CS. Finally, in adherence to results from Chan et al. (2011), who emphasize a significant impact of well-programmed product design attributes such as "photo quality" and "take distant image" on CS, we detect a favorable

impact of our proxy variable research and development expenditures on CS. Voutsinas et al. (2018) confirm a long-run relationship between R&D expenditure and innovation, too.

**Table 22**

Effects of Women on the Board of Directors on Customer Satisfaction$^{L}$ (OLS) (Part I)

| Columns | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Model | Variables of earlier studies | Number of female directors | Female board share [in %] | Number of female directors^2 | Number of female directors$^{Time\ FE}$ | Female board share [in %]$^{Time\ FE}$ |
| CONSTANT | 4.263*** (-0.06) | 4.318*** (-0.07) | 4.290*** (-0.07) | 4.295*** (-0.07) | 4.322*** (-0.07) | 4.294*** (-0.07) |
| MARKET SHARE | 0.013 (-0.02) | 0.024 (-0.02) | 0.024 (-0.02) | 0.024 (-0.02) | 0.024 (-0.02) | 0.025 (-0.02) |
| SALES EFFICIENCY$^{L}$ | -0.052*** (-0.01) | -0.049*** (-0.01) | -0.049*** (-0.01) | -0.053*** (-0.01) | -0.048*** (-0.01) | -0.048*** (-0.01) |
| COGS$^{L}$ | -0.002 (-0.01) | -0.007 (-0.01) | -0.007 (-0.01) | -0.007 (-0.01) | -0.007 (-0.01) | -0.007 (-0.01) |
| ADVERTISING EXP. | 0.012 (-0.12) | 0.074 (-0.12) | 0.074 (-0.12) | 0.119 (-0.12) | 0.072 (-0.12) | 0.072 (-0.12) |
| SG&A$^{L}$ | 0.048*** (-0.01) | 0.045*** (-0.01) | 0.045*** (-0.01) | 0.042*** (-0.01) | 0.044*** (-0.01) | 0.045*** (-0.01) |
| BEST COMPANY$^{D}$ | 0.042*** (-0.01) | 0.034** (-0.01) | 0.034** (-0.01) | 0.032** (-0.01) | 0.032** (-0.01) | 0.032** (-0.01) |
| RETURN ON ASSETS | 0.129*** (-0.04) | 0.123*** (-0.04) | 0.124*** (-0.04) | 0.121*** (-0.04) | 0.129*** (-0.04) | 0.130*** (-0.04) |
| ORGSIZE$^{L}$ | 0.038*** (-0.01) | 0.036*** (-0.01) | 0.036*** (-0.01) | 0.041*** (-0.01) | 0.036*** (-0.01) | 0.035*** (-0.01) |
| TOTAL ASSETS$^{L}$ | -0.035*** (-0.01) | -0.033*** (-0.01) | -0.032*** (-0.01) | -0.036*** (-0.01) | -0.032*** (-0.01) | -0.032*** (-0.01) |
| DIO | 0.001*** (0.00) | 0.001*** (0.00) | 0.001*** (0.00) | 0.001*** (0.00) | 0.001*** (0.00) | 0.001*** (0.00) |
| R&D EXPENSES | 0.802*** (-0.16) | 0.859*** (-0.16) | 0.849*** (-0.16) | 0.905*** (-0.16) | 0.860*** (-0.16) | 0.850*** (-0.16) |
| BOARD SIZE$^{L}$ | | -0.040** (-0.02) | -0.027* (-0.02) | -0.040** (-0.02) | -0.040** (-0.02) | -0.027* (-0.02) |
| FEMALE BOARD COUNT | | 0.010*** (-0.003) | | -0.008 (-0.01) | 0.010*** (-0.003) | |
| FEMALE BOARD COUNT^2 | | | | 0.004** (-0.002) | | |
| WOMEN ON BOARD (%) | | | 0.124*** (-0.04) | | | 0.124*** (-0.04) |
| INDUSTRY EFFECTS | YES | YES | YES | YES | YES | YES |
| TIME FIXED EFFECTS | NO | NO | NO | NO | YES | YES |
| **Adj. $R^2$** | **0.426** | **0.437** | **0.438** | **0.441** | **0.433** | **0.434** |
| **$R^2$** | **0.444** | **0.457** | **0.458** | **0.462** | **0.458** | **0.459** |
| **AIC** | **-2.41** | **-2.42** | **-2.42** | **-2.43** | **-2.41** | **-2.41** |

Notes: L=Logarithm. D=Dummy. FE=Fixed Effects. n=515
***p<0.01; **p<0.05; *p<0.1; Standard deviation values in brackets

In model (2) in Table 22, we add the control variables *board size* and *female count on the board of directors*. We find a significantly negative impact of the *board size*, where one standard deviation increases of board members (three persons) declines the CS by 0,7% to 1% in

CS rating (0,76 rating points on avg.). On the contrary (column 2) we find that the absolute *number of women directors* affects CS significantly positive. The effect is economically small, but statistically significant, where one female board member gives 1% increase in the CS score of a company. Consequently, doubling the average number of female directors on board would result in 4% growth of CS ratings. Accordingly, in column (3) we find a significant positive association of an annual *female share on board of directors* on CS. An all-female board would improve the CS rating by 12,4%. Or e.g., doubling the average female share on boards of directors to 33% (4 women) could increase the CS by 4% (hence ca. 3 CS rating points). Simultaneously, we confirm the positive significant effect of *SG&A*, *Best Company*, *ROA*, *organizational size*, *DIO*, and *R&D expenses* on CS. We can also confirm that *sales efficiency* and *total assets* can affect it in a significantly negative way. Model (4) in Table 22 shows a disproportionately high impact of the female directors on CS, at least for our sample range of up to 33%. We will return to the issue of nonlinearities.

The models (5) and (6) in Table 22 scrutinize a similar set of variables under the additional consideration of time fixed effects to control for events, possibly affecting all companies (e.g., financial crisis) but not being specific to any particular company. In this case, female directors on board as well as their percentage share also indicate a positive impact on CS. We tested our models also with company fixed effects (results are available on request) and obtained a significant and positive relationship for the female count on the board of directors as well as for the women share on a board. The magnitude of impact of the female board count on CS is however smaller, which suggests that, while women's presence on boards of directors can affect CS ratings positively, some part of this relationship is driven by unobserved firm characteristics. A similar reduction of magnitude is observable with the female share variable. However, other variables apart from the COGS turn out to be insignificant in this company fixed model specification, potentially indicating a shortcoming of fixed-effects models for panel data (Hill, Roos, & Davis, 2020; Bell & Jones, 2015).

**Table 23**

Effects of Women on the Board of Directors on Customer Satisfaction$^{L}$ (OLS) (Part II)

| Columns | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Model | Zero women on board | Female share on board (I) | Female share on board (II) | Female share on board (I)$^{TimeFE}$ | Female share on board (II)$^{TimeFE}$ |
| CONSTANT | 4.307*** (-0.07) | 4.242*** (-0.07) | 4.240*** (-0.07) | 4.244*** (-0.07) | 4.242*** (-0.07) |
| MARKET SHARE | 0.013 (-0.02) | 0.023 (-0.02) | 0.027 (-0.02) | 0.023 (-0.02) | 0.028 (-0.02) |
| SALES EFFICIENCY$^{L}$ | -0.052*** (-0.01) | -0.053*** (-0.01) | -0.053*** (-0.01) | -0.053*** (-0.01) | -0.053*** (-0.01) |
| COGS$^{L}$ | -0.002 (-0.01) | -0.009 (-0.01) | -0.010 (-0.01) | -0.009 (-0.01) | -0.010 (-0.01) |
| ADVERTISING EXP. | 0.033 (-0.12) | 0.108 (-0.12) | 0.117 (-0.12) | 0.107 (-0.12) | 0.117 (-0.12) |
| SG&A$^{L}$ | 0.048*** (-0.01) | 0.041*** (-0.01) | 0.040*** (-0.01) | 0.040*** (-0.01) | 0.040*** (-0.01) |
| BEST COMPANY$^{D}$ | 0.042*** (-0.01) | 0.034*** (-0.01) | 0.031** (-0.01) | 0.032** (-0.01) | 0.028** (-0.01) |
| RETURN ON ASSETS | 0.123*** (-0.04) | 0.126*** (-0.04) | 0.126*** (-0.04) | 0.132*** (-0.04) | 0.132*** (-0.04) |
| ORGSIZE$^{L}$ | 0.039*** (-0.01) | 0.042*** (-0.01) | 0.042*** (-0.01) | 0.042*** (-0.01) | 0.041*** (-0.00) |
| TOTAL ASSETS$^{L}$ | -0.034*** (-0.01) | -0.038*** (-0.01) | -0.038*** (-0.01) | -0.038*** (-0.01) | -0.037*** (-0.00) |
| DIO | 0.001*** (-0.00) | 0.001*** (-0.00) | 0.001*** (-0.00) | 0.001*** (-0.00) | 0.001*** (-0.00) |
| R&D EXPENSES | 0.820*** (-0.16) | 0.834*** (-0.16) | 0.854*** (-0.16) | 0.838*** (-0.16) | 0.859*** (-0.16) |
| BOARD SIZE$^{L}$ | -0.024 (-0.02) | -0.014 (-0.02) | -0.017 (-0.02) | -0.014 (-0.02) | -0.017 (-0.02) |
| ZERO WOMEN ON BOARD$^{D}$ | 0.005 (-0.01) | | | | |
| WBOARD_1_9_PC$^{D}$ | | -0.023 (-0.01) | -0.016 (-0.02) | -0.024* (-0.01) | -0.017 (-0.02) |
| WBOARD_10_19_PC$^{D}$ | | -0.021* (-0.01) | -0.015 (-0.01) | -0.022* (-0.01) | -0.015 (-0.01) |
| WBOARD_20_24_PC$^{D}$ | | -0.011 (-0.01) | -0.005 (-0.01) | -0.012 (-0.01) | -0,005 (-0.01) |
| WBOARD_25_33_PC$^{D}$ | | 0.025* (-0.01) | 0.032** (-0.01) | 0.024* (-0.01) | 0.032** (-0.01) |
| WBOARD_34_46_PC$^{D}$ | | | 0.031 (-0.02) | | 0.032 (-0.02) |
| INDUSTRY EFFECTS | YES | YES | YES | YES | YES |
| TIME FIXED EFFECTS | NO | NO | NO | YES | YES |
| Adj. $R^2$ | 0.427 | 0.45 | 0.451 | 0.447 | 0.448 |
| AIC | -2.405 | -2.44 | -2.439 | -2.427 | -2.427 |

Notes: L=Logarithm. D=Dummy. FE=Fixed Effects. n=515
***p<0.01; **p<0.05; *p<0.1; Standard deviation values in brackets.

The models in Table 23 take up the idea of a non-linear relationship between female participation and CS due to minimum critical masses found in other business outcomes (Kanter, 1993; Rosener, 1995; Konrad, Kramer, & Erkut, 2008; Torchia, Calabro, & Huse, 2011; Elstad and

Ladegard 2012, Joecks et al. 2013, Schwartz-Ziv, 2017; Amorelli & Garcia-Sanchez, 2019, Saggese, Sarto, Vigano, 2020). Column (1) of Table 23 indicates that a complete lack of females on a board of directors does not significantly affect the CS. Column (2) and Column (3) show that a positive ratio of women directors of 25%–33% implies a 2.5% to 3,2% improvement on the CS score (ca. 2 rating points on average). Also, the lack of a critical mass (below 1/5 of directors) can negatively affect CS performance by 2.1%. Similar results are achieved if controlled for the time fixed effects in columns (4) and (5). Our outcome suggests that a minimum 1/4 of female directors' ratio permits an effective action on customer satisfaction.

As a robustness test, Table 24 displays the results of stepwise regression analyses. We provide the best three models determined by the forwards stepwise algorithm in columns (1), (2), and (3). The results highlight a significant positive effect of a company's effective inventory policy; advertising expenditures; "best company" awarded employee policy; firm's profitability; research and development expenses; sales, general, and administrative expenditures; and organizational size. Significantly negative effects on CS have been indicated for sales efficiency [headcount/per earning] and total assets. Female directors' shares of more than 1/4 significantly improves CS by 2,1% to 4,9%, while zero or less than a 25% share may significantly negatively affect it by 2,1% to 4,7%. The downside risk for customer satisfaction of not having enough gender diverse boards roughly equals the premium for establishing a set quota.

**Table 24**
Effects of Women on the Board of Directors on Customer Satisfaction[L] (Stepwise LS)

| Columns | 1 | 2 | 3 |
|---|---|---|---|
| Model | Top 7 variables | Top 19 variables | Top 21 variables |
| CONSTANT | 4.251***<br>(-0.01) | 4.277***<br>(-0.06) | 4.290***<br>(-0.07) |
| DIO | 0.001***<br>(0.00) | 0.001***<br>(0.00) | 0.001***<br>(0.00) |
| ADVERTISING EXPENSES | 0.496***<br>(-0.09) | | 0.133<br>(-0.12) |
| BEST COMPANY[D] | 0.063***<br>(-0.01) | 0.033**<br>(-0.01) | 0.031**<br>(-0.01) |
| RETURN ON ASSETS | 0.210***<br>(-0.04) | 0.133***<br>(-0.04) | 0.128***<br>(-0.04) |
| WBOARD 25_33_PC[D] | 0.049***<br>(-0.01) | 0.021*<br>(-0.01) | |
| R&D EXPENSES | | 0.873***<br>(-0.15) | 0.859***<br>(-0.16) |
| SG&A[L] | | 0.047***<br>(-0.01) | 0.043***<br>(-0.01) |
| SALES EFFICIENCY[L] | | -0.052***<br>(-0.01) | -0.053***<br>(-0.01) |
| BOARD SIZE[L] | | -0.012<br>(-0.02) | -0.017<br>(-0.02) |
| ORGANIZATION SIZE[L] | | 0.040***<br>(-0.01) | 0.042***<br>(-0.01) |
| TOTAL ASSETS[L] | | -0.035***<br>(-0.01) | -0.038***<br>(-0.01) |
| WBOARD_10-19_PC | | -0.021*<br>(-0.01) | -0.045***<br>(-0.01) |
| WBOARD_1-9_PC | | -0.024*<br>(-0.01) | -0.047***<br>(-0.01) |
| WBOARD_20-24_PC | | -0.012<br>(-0.01) | -0.036***<br>(-0.01) |
| ZERO WOMEN ON BOARD[D] | | | -0.030**<br>(-0.01) |
| MARKET SHARE | | | 0.027<br>(-0.02) |
| INDUSTRY EFFECTS | YES | YES | YES |
| Adj. $R^2$ | 0.306 | 0.451 | 0.452 |
| AIC | -2.236 | -2.447 | -2.446 |

L=Logarithm, D=Dummy, FE=Fixed Effects, n=515
Notes: ***p<0,01; **p<0,05; *p<0,1; Standard deviation values in brackets

## 4.4 Conclusion and outlook

We analyze the determinants of customer satisfaction (CS). We start by re-estimating earlier tested variables on CS with our data and add to the literature by testing the variables simultaneously. In a second step, we add variables that control for women´s participation on a board of directors. As a robustness test, we conduct a stepwise regression.

Our study confirms that optimizing certain determinants of organizational performance is key to increasing customer satisfaction, and that gender diversity at the executive level can be an additional lever for improving customer satisfaction. We find a significant positive impact of sales, general, and administrative expenditures to CS, confirming the findings of Mittal et al. (2005). Our findings also confirm Simon and DeVaro (2006), who find that employee-friendly, generously staffed, and profitable companies attract more satisfied customers and who also acknowledge industry variation in consumer satisfaction. Our results reaffirm the importance of the capability to quickly respond to fluctuating demand and optimize inventory management levels (Singh et al., 2010) and that long-term corporate investments in research and innovation can pay off in terms of increased customer satisfaction (cf. Chan et al., 2011). We find that a larger female representation in corporate governance can significantly and positively affect consumer satisfaction. In our linear estimation model, as well as in the quadratic polynomial specification, a larger share of women directors has a significant and positive impact on customer satisfaction. Testing in more detail for further non-linearities, we find that a critical mass of female board members—beyond one fourth of directors—is needed to favorably influence CS scores. Companies with less than 25% of female board members may experience decreased CS levels.

We acknowledge the limitations of our analysis. As with any empirical study, our results are based on a particular data sample that is specific to the time period chosen, geography, and data availability. Better access to proprietary and consistently measured firm characteristics as well as personnel-related data (e.g., biographical details of board members or detailed customer profiles), which are often protected by privacy policies, could presumably uncover further insights into the relationship between board member gender and customer satisfaction or other firm performance. In addition, employing other measures of gender diversity (e.g., female CEOs/ CFOs / COOs etc.) or additional types of diversity (e.g.: ethnic) could be interesting for future research. Note, however, that with broader resource inequality data that include diverse data on demographic,

leadership, and formal, personnel, and organizational factors, any analysis of gender causality may become (too) complex (Cruz-Castro and Sanz-Menendez 2019, Mazur and Spierings 2016).

Taken together, our findings suggest larger implications for the consumer goods or consumer services sector but could also stimulate further studies in other areas (e.g.: public services). At first glance, studies like ours might be relevant also for firms with manufacturing operations that are largely absorbed by women. And, in sophisticated and transparent markets where the public is pushing for inclusion, the value of a brand may increasingly depend on a higher proportion of women directors. Further studies could examine how board dynamics and director emancipation affect customer satisfaction, taking into account, for example, specific cultural dimensions. In traditionally patriarchal countries, a shift in the selection process for women on boards from family ties to more performance-based quality criteria could be encouraged. Occasionally, it is argued that female leaders are less "driven by the rules" (Pace 2009, p. 1); and (Pesonen et al. 2009, p. 337) state, that there is “a distinct possibility that you’d stir things up, disturb their [i.e., men’s] established ways [. . .]." Thus, an examination of the impact of women's representation in the executive ranks of companies operating in markets with rapidly changing market trends or in markets with particularly creative and innovative products may be of particular interest.

Our study could not only be a starting point for studies on other sectors. Rather, it could also be a stimulus for other business dimensions, whether for studies or for implementation attempts in practice. For example, it is clear that the human factor is the primary driver of innovation (Martinidis, 2017) - our study could animate attention to the role of women in this regard. Overall, our findings could inspire companies to make further efforts to improve governance, with particular attention to the inclusion of women. It is not unlikely that a better balanced composition of management ranks would not only have a positive impact on customer satisfaction. Rather, it could improve a company's reputation, its ability to expand into new markets, and its enterprise value.

If a sufficient number of companies in an economy were to achieve a better balanced composition of their management levels (through appropriate regulations or as a result of findings such as ours), this could even have positive consequences for national economic growth. In this respect, our results are not only of managerial importance, but of macroeconomic importance, implying a potential role for policy makers and regulators. Our nuanced findings on the positive effects of increased female participation on boards, particularly a breaking point of 25% of board seats, should be able to help policymakers develop effective strategies to achieve a critical mass of female representation in the corporate world and beyond.

Women on corporate board of directors and consumer satisfaction

Another key question remains whether there are other ways of transmitting empirical evidence like ours on the positive effects of increased women's participation in economic life outside of policy or regulatory requirements. In this context, the finding that nongovernmental organizations can play roles in bridging the gender gap may be interesting (Lindberg, Lindgren, and Packendorff 2014).

In sum, our study results may encourage more targeted gender research in business and economics, helping legislators around the world to enact balanced laws that promote work-life balance, free up infrastructure spending for women's education, and reduce gender discrimination to eliminate the "glass ceiling" in leadership positions.

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# Appendix

## Content

Appendix

## List of Tables

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## Appendix I: Logistics service quality and women in the corporate governance of transportation companies

In Table A1-1 I place the results of the model discussed in Tab. 7 incl. the company fixed effects. In this setting the cost of goods sold and ROI variables turn negatively significant and all other determinants loose the significance apart from the female director count, which stays significantly negative as in the models with time and industry fixed effects. This may indicate a valid hypothesis in a slightly negative impact of higher number of women directors on board of transportation and logistics companies, who could ineffectively drive a rather hermetic and homogeneous male dominated board supervisory processes.

As a further robustness check, I conduct a robust least squares regression analysis with all variables considered thus far, controlling my model estimates for the impact of outliers (in dependent, independent, and both types of variables) and use the M-, S-, and MM- estimation functions, respectively. My research outcomes confirm the mixed results on gender impact, such as the negative effect of the number of female directors and the positive effect of the proportion of women in executive management on LSQ. These results are presented in Table A1-2.

Additionally, I confirm a significant effect of total assets, ROA, revenue growth (YoY), and economic, social, and environmental policy. Moreover, I run a stepwise regression analysis with all variables considered thus far (Table A1-3), presenting the best three models determined by the forward stepwise algorithm in columns (1), (2), and (3). The results demonstrate a significant positive effect of organizational size, ROA, CAPEX. Significantly negative effects on LSQ are revealed for the number of female directors, while a proportion of female executive officers of maximum 10% significantly improves LSQ. I present in Tab. A1-4 the effects of female executive officers on logistics service quality (OLS), nonlinear and incl. company fixed effects, which confirm significance of the gender variable as well as suggest that ROA and COGS are also significant indicators, especially in the price and cost sensitive transportation industry.

Appendix

**TABLE A1-1** Effects of women on the boards of directors on logistics service quality (incl. company fixed effects)

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Model** | **Number of female directors$^{FE}$** | **Number of female directors^2$^{FE}$** | **Female board share [in %]$^{FE}$** | **Female board share^2 [in %]$^{FE}$** | **Female directors' Blau Index$^{FE}$** | **Female directors Blau Index^2$^{FE}$** |
| Constant | 66.550 *** | 58.356 *** | 60.345 *** | 60.613 *** | 60.792 *** | 61.624 *** |
| | *15.202* | *6.653* | *6.635* | *6.754* | *6.539* | *6.762* |
| COGS | -6.930 ** | -6.749 ** | -7.489 ** | -7.498 ** | -7.514 ** | -7.575 ** |
| | *2.904* | *2.920* | *2.904* | *2.913* | *2.901* | *2.910* |
| Total assets (L) | -0.568 | -0.558 | -0.750 | -0.760 | -0.772 | -0.817 |
| | *0.657* | *0.658* | *0.658* | *0.661* | *0.652* | *0.659* |
| ROA | -5.494 | -5.189 | -6.101 * | -6.130 * | -6.155 * | -6.218 * |
| | *3.585* | *3.618* | *3.591* | *3.603* | *3.586* | *3.596* |
| CAPEX | 7.002 | 7.221 | 7.148 | 7.206 | 7.267 | 7.523 |
| | *4.987* | *5.005* | *5.079* | *5.100* | *5.056* | *5.094* |
| Revenue growth (YoY) | 0.529 | 0.462 | 0.550 | 0.566 | 0.573 | 0.617 |
| | *0.766* | *0.773* | *0.771* | *0.776* | *0.771* | *0.778* |
| ESG | 0.004 | -0.0002 | 0,004 | 0.004 | 0.003 | -0.0007 |
| | *0.036* | *0.036* | *0.036* | *0.037* | *0.036* | *0.037* |
| Female directors count | -0.457 * | -0.210 | | | | |
| | *0.239* | *0.430* | | | | |
| Female directors count^2 | | -0.036 | | | | |
| | | *0.053* | | | | |
| Women on board share | | | -3.228 | -4.833 | | |
| | | | *2.988* | *7.553* | | |
| Women on board share^2 | | | | 3.753 | | |
| | | | | *16.222* | | |
| Blau Index (Female directors) | | | | | -2.730 | -5.698 |
| | | | | | *2.483* | *6.444* |
| Blau Index (Female directors)^2 | | | | | | 6.214 |
| | | | | | | *12.447* |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| **Adj. $R^2$** | **0.145** | **0.142** | **0.132** | **0.127** | **0.132** | **0.128** |
| **AIC** | **4.772** | **4.778** | **4.787** | **4.796** | **4.787** | **4.794** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

Appendix

**TABLE A1-2** Effects of women on the boards of directors on logistics service quality (Robust LS)

| **Columns** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|
| **Model** | **Number of female directors_M-estimation** | **Number of female directors_S-estimation** | **Number of female directors_MM-estimation** | **Female officers' share [in %]_M-estimation** |
| Constant | 43.507 *** | 39.153 *** | 43.643 *** | 45.252 *** |
| | *2.015* | *1.894* | *2.021* | *1.897* |
| COGS | 0.583 | -0.310 | 0.487 | -0.845 |
| | *1.401* | *1.318* | *1.406* | *1.385* |
| Total assets (L) | 0.309 ** | 0.804 *** | 0.309 ** | |
| | *0.152* | *0.143* | *0.153* | |
| Organizational size (L) | | | | 0.214 |
| | | | | *0.136* |
| ROA | 2.567 | 10.798 *** | 2.412 | 1.341 |
| | *1.941* | *1.825* | *1.947* | *1.944* |
| CAPEX | 1.950 | 0.292 | 1.483 | 1.690 |
| | *2.324* | *2.186* | *2.332* | *2.492* |
| Revenue growth (YoY) | 0.494 | 1.418 ** | 0.500 | 0.412 |
| | *0.631* | *0.594* | *0.633* | *0.655* |
| ESG | 0.012 | 0.017 ** | 0.012 | 0.005 |
| | *0.008* | *0.007* | *0.008* | *0.007* |
| Female directors count | -0.319 *** | -0.497 *** | -0.322 *** | |
| | *0.099* | *0.093* | *0.100* | |
| Size of Management Board (c) | | | | -0.026 |
| | | | | *0.056* |
| Women share in executive management_1-10 PC (D) | | | | 2.228 ** |
| | | | | *0.898* |
| Women share in executive management_11-25 PC (D) | | | | -0.203 |
| | | | | *0.400* |
| Women share in executive management 26-33 PC (D) | | | | 0.146 |
| | | | | *0.716* |
| Women share in executive management 34-56 PC (D) | | | | -0.648 |
| | | | | *0.775* |
| Industry fixed effects | No | No | No | No |
| Time fixed effects | No | No | No | No |
| Adj. $R^2$ | **0.097** | **0.133** | **0.037** | **0.021** |
| AIC | **213** | **NA** | **244** | **207** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

Appendix

**TABLE A1-3** Robustness test II: stepwise regression models (stepwise LS)

| **Columns** | **1** | **2** | **3** |
|---|---|---|---|
| **Model** | **Top 5 variables** | **Top 10 variables** | **Top 12 variables** |
| Constant | 42.905 *** | 42.446 *** | 42.418 *** |
| | *1.226* | *1.282* | *1.284* |
| Women share in executive | 2.423 *** | 1.794 ** | 1.806 ** |
| management_1-10 PC (D) | *0.828* | *0.873* | *0.874* |
| Organizational size (L) | 0.473 *** | 0.494 *** | 0.505 *** |
| | *0.130* | *0.149* | *0.150* |
| Female directors count | -0.326 *** | -0.415 *** | -0.418 *** |
| | *0.101* | *0.113* | *0.113* |
| ROA | 3.223 ** | 3.995 ** | 4.097 ** |
| | *1.520* | *1.591* | *1.593* |
| ESG | | 0.010 | 0.009 |
| | | *0.008* | *0.008* |
| CAPEX | | 3.590 | 4.085 * |
| | | *2.241* | *2.344* |
| Airlines industry (D) | | 0.663 | 0.600 |
| | | *0.460* | *0.464* |
| Personnel costs | | -1.613 | -1.949 |
| | | *1.260* | *1.284* |
| Women share on board_1-20 PC (D) | | -0.488 | -0.440 |
| | | *0.395* | *0.396* |
| Women share in executive | | | 0.744 |
| management_26-33 PC (D) | | | *0.678* |
| Railways industry (D) | | | -0.638 |
| | | | *0.636* |
| Adj. $R^2$ | **0.098** | **0.117** | **0.117** |
| AIC | **4.637** | **4.638** | **4.646** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

Appendix

**TABLE A1-4** Effects of female executive officers on logistics service quality (OLS), nonlinear (incl. company fixed effects)

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Model** | **Zero female officers$^{FE}$** | **Female officers' share intervals I [in %]$^{FE}$** | **Female officers' share intervals II [in %]** | **Female officers' share intervals III [in %]** | **Female officers' share intervals IV [in %]** | **Female officers' share intervals V [in %]** |
| Constant | 56.066 *** | 55.621 *** | 58.138 *** | 56.028 *** | 53.507 *** | 54,441 *** |
| | *11.824* | *11.870* | *11.925* | *11.923* | *11.823* | *11,811* |
| COGS | -7.935 *** | -8.022 *** | -8.103 *** | -7.739 *** | -7.595 ** | -8.193 *** |
| | *2.924* | *2.938* | *2.921* | *2.915* | *2.922* | *2.964* |
| Organizational size (L) | -0.202 | -0.165 | -0.401 | -0.174 | 0.068 | 0.160 |
| | *1.143* | *1.149* | *1.151* | *1.153* | *1.146* | *1.147* |
| ROA | -7.239 * | -7.233 * | -7.531 ** | -6.715 * | -6.294 * | -6.720 * |
| | *3.683* | *3.692* | *3.683* | *3.700* | *3.694* | *3.708* |
| CAPEX | 8.089 | 8.124 | 7.727 | 5.869 | 5.711 | 5.106 |
| | *5.078* | *5.091* | *5.077* | *5.171* | *5.201* | *5.221* |
| Revenue growth (YoY) | 0.0301 | 0.263 | 0.355 | 0.124 | 0.040 | 0.072 |
| | *0.766* | *0.773* | *0.766* | *0.770* | *0.775* | 0.775 |
| ESG | -0.005 | -0.005 | -0.004 | -0.006 | -0.010 | -0.015 |
| | *0.037* | *0.037* | *0.037* | *0.037* | *0.037* | *0.037* |
| Size of Management Board (c) | -0.055 | -0.052 | -0.074 | -0.093 | -0.077 | -0.078 |
| | *-0.090* | *0.091* | *0.091* | *0.091* | *0.091* | *0.091* |
| Zero women in management board (D) | -0.140 | | | | | |
| | *0.617* | | | | | |
| Women share in executive management _1-25 PC (D) | | 0.052 | | | | |
| | | *0.653* | | | | |
| Women share in executive management_26-56 PC (D) | | 0.337 | | | | |
| | | *0.775* | | | | |
| Women share in executive management_1-20 PC (D) | | | 0.555 | | | |
| | | | *0.698* | | | |
| Women share in executive management_21-56 PC (D) | | | -0.284 | | | |
| | | | *0.701* | | | |
| Women share in executive management_1-10 PC (D) | | | | 2.235 | | |
| | | | | *1.335* | | |
| Women share in executive management_11-20 PC (D) | | | | 0.301 | | |
| | | | | *0.673* | | |
| Women share in executive management_21-30 PC (D) | | | | -0.844 | | |
| | | | | *0.816* | | |
| Women share in executive management_31-56 PC (D) | | | | -0.028 | | |
| | | | | *0.757* | | |
| Women share in executive management_1-10 PC (D) | | | | | 2.233 * | 2.225 * |
| | | | | | *1.299* | *1.298* |
| Women share in executive management_11-25 PC (D) | | | | | -0.119 | -0.154 |
| | | | | | *0.654* | *0.654* |
| Women share in executive management_25-56 PC (D) | | | | | 0.223 | |
| | | | | | *0.770* | |
| Women share in executive management_26-33 PC (D) | | | | | | 0.744 |
| | | | | | | *0.891* |
| Women share in executive management_34-56 PC (D) | | | | | | -0.515 |
| | | | | | | *0.998* |
| Industry fixed effects | No | No | No | No | No | No |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj. $R^2$ | **0.112** | **0.107** | **0.115** | **0.125** | **0.122** | **0.124** |
| AIC | **4.814** | **4.882** | **4.813** | **4.807** | **4.808** | **4.809** |

Note: (c) Control variable D Dummy variable. L Logarithm. FE = Fixed Effects. N = 222. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

## Appendix II: Impact of women on corporate boards of directors on product quality

As a further robustness check, we run a robust least squares regression analysis with all variables considered thus far, controlling our model estimates for the impact of outliers (in dependent, independent, and both types of variables) and respectively use the M-, S-, and MM-estimation function. Our outcomes confirm the positive impact of the number and proportion of females in boards of directors on PQ. These results are presented in Table A2-1.

**Table A2-1** Effects of women on the boards of directors on product quality (Robust LS)

| **Columns** | **1** | **2** | **3** | **4** | **5** | **6** |
|---|---|---|---|---|---|---|
| **Model** | **Number of female directors_M-estimation** | **Number of female directors_S-estimation** | **Number of female directors_MM-estimation** | **Female board share [in %]_M-estimation** | **Female board share [in %]_S-estimation** | **Female board share [in %]_MM-estimation** |
| Constant | 1.066 *** | 0.828 *** | 1.067 *** | 1.049 *** | 0.958 *** | 1.091 *** |
| | *0.131* | *0.063* | *0.099* | *0.130* | *0.095* | *0.098* |
| Advertising expenses | 0.739 *** | -0.134 | 0.104 | 0.754 *** | -0.012 | 0.229 |
| | *0.234* | *0.122* | *0.190* | *0.228* | *0.189* | *0.195* |
| SG&A** | -0.084 *** | 0.035 ** | 0.022 | -0.088 *** | 0.037 * | 0.013 |
| | *0.028* | *0.014* | *0.022* | *0.028* | *0.022* | *0.023* |
| Innovative company* | -0.010 | | | -0.009 | | |
| | *0.046* | | | *0.046* | | |
| Relative product price** | -0.177 *** | -0.194 *** | -0.331 *** | -0.174 *** | -0.299 *** | -0.316 *** |
| | *0.050* | *0.026* | *0.040* | *0.049* | *0.040* | *0.041* |
| Best brand* | -0.068 | -0.103 *** | -0.036 | -0.057 | | |
| | *0.043* | *0.021* | *0.032* | *0.043* | | |
| Firm size** | -0.002 | 0.025 *** | -0.003 | 0.002 | 0.006 | -0.007 |
| | *0.013* | *0.006* | *0.010* | *0.013* | *0.009* | *0.009* |
| Fixed cost industry*© | -0.195 *** | | | -0.188 *** | | |
| | *0.071* | | | *0.070* | | |
| Board size© | -0.002 | -0.004 | -0.002 | -0.004 | 0.000 | -0.002 |
| | *0.004* | *0.002* | *0.003* | *0.004* | *0.003* | *0.003* |
| Female directors count | -0.031 *** | -0.014 ** | -0.011 | | | |
| | *0.012* | *0.006* | *0.010* | | | |
| Women on board share | | | | -0.460 *** | -0.252 ** | -0.230 * |
| | | | | *0.153* | *0.126* | *0.130* |
| Industry fixed effects | No | No | No | No | No | No |
| Time fixed effects | No | No | No | No | No | No |
| Adj. $R^2$ | **0.102** | **0.259** | **0.087** | **0.110** | **0.166** | **0.087** |
| AIC | **161** | **NA** | **238** | **165** | **NA** | **208** |

*Note:* © Control variable * Dummy variable. **Logarithm. FE=Fixed Effects. n=142. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

Additionally, we run a stepwise regression analysis with all variables considered thus far (Table A2-2), presenting the best three models determined by the forward stepwise algorithm in columns (1), (2), and (3). The results demonstrate a significant positive effect of relative product price, firm size, general sales, and administrative expenses, being part of a fixed cost industry and a strong corporate brand. Significantly negative effects on PQ are revealed for advertising expenditure. A proportion of female directors of more than 21% significantly improves PQ.

Appendix

**Table A2-2** Robustness test II: stepwise regression models (stepwise LS)

| **Columns** | **1** | **2** | **3** |
|---|---|---|---|
| **Model** | **Top 3 variables** | **Top 5 variables** | **Top 10 variables** |
| Constant | 1.379 *** | 1.316 *** | 0.193 *** |
| | *0.102* | *0.101* | *0.137* |
| Relative product price** | -0.122 ** | -0.138 *** | -0.120 ** |
| | *0.052* | *0.051* | *0.053* |
| Firm size** | -0.039 *** | -0.034 *** | -0.013 |
| | *0.010* | *0.010* | *0.013* |
| Women share_21_30* | | -0.149 *** | -0.166 *** |
| | | *0.052* | *0.051* |
| Advertising expenses | | 0.584 ** | 0.958 *** |
| | | *0.239* | *0.253* |
| SG&A** | | | -0.079 *** |
| | | | *0.029* |
| Fixed cost industry* | | | -0.180 ** |
| | | | *0.075* |
| Women share_31_50* | | | -0.127 |
| | | | *0.082* |
| Best brand* | | | -0.071 * |
| | | | *0.042* |
| Board size | | | -0.005 |
| | | | *0.004* |
| Adj. $R^2$ | **0.142** | **0.189** | **0.253** |
| AIC | **-0.375** | **-0.416** | **-0.466** |

*Note:* * Dummy variable. **Logarithm. n=142. ***p<0.01; **p<0.05; *p<0.1; Standard deviation values in italics.

To control for fixed effects, we also calculated models (3) and (6) in Table 16, testing a similar set of variables along with the additional consideration of industry and time fixed effects to control for events that possibly affect all companies (e.g., financial crisis) but are not specific to any company. In this case, female directors on boards and the associated proportion also indicate a positive impact on PQ. We also test our models with company fixed effects, and the results are available upon request. In this setting, all variables, apart from advertising expenditure, are insignificant, potentially indicating a shortcoming of applying the fixed effects models for panel data (Hill, Roos, & Davis 2020; Bell & Jones 2015). We also test the models in Table 17 with company fixed effects, and the relationship between female share ratios and PQ remains positive (results available upon request). All other variables are insignificant, which points to the above-mentioned controversial aspect of estimation models with (too many) fixed effects.

The gender research that we examine regarding robustness tests selectively use a broad variety of analyses individually matched to a specific research question (e.g., 2SLS, GLS regressions, Heckman selection models, lagged structures, fixed effects, and other methods). In this study, we focus on robustness methods, which correspond best with our sample and data set availability, and still allow us to construct relevant approximation models in our research context. Future research efforts could apply additional robustness methodologies.

# Appendix III: Dissertation Summary, Statutory Declarations, and Further Information

## Dissertation summary (English)

This dissertation discusses impact of women in corporate governance (on board of directors and on executive management boards) on goods quality measured via different quality performance indicators such as customer satisfaction, product quality, or logistics service quality. The empiric evaluations are based on different industries and economic segments (e.g. consumer goods, services, wholesale, business to consumer, or business to business channels). It contains three independent studies unravelling the relationship between the presence of female directors and executive officers and the particularly mentioned aspects of quality of goods and services. They show mixed evidence of how women in higher echelons of corporate power affect product and service reliability as well as the customer satisfaction.

The second chapter explores an association between the availability of women directors and executive managers in transportation companies and the logistics service quality of these firms. I deploy the LS regression models to control for variables impacting logistics service quality (LSQ) derived from previous studies and add the female related independent factors into my models. My results do not show unanimous picture and disclose that female participation on board of directors may have a negative impact on the LSQ scores, while a slim token share of women in executive management (10%) can increase the LSQ scores for freight companies.

Chapter three investigates if female ratio on board of directors affects product quality (PQ) as measured in independent consumer reports. We run LS regression procedures to test the level and the direction of impact between these two variables under consideration of some factors tested in prior research on goods' quality. We present evidence confirming that female directors can favorably affect product quality, and we also find that a critical mass of female board members—beyond a one-fifth proportion—is needed to positively influence PQ scores.

In chapter four we examine the impact of women directors on consumer satisfaction (CS) as regularly captured by an American index for over hundred companies in USA. In OLS regressions we first recap the relationship between customer satisfaction and its key influential parameters, and than add additional independent variables such as female representation on

company boards. We find that a larger female representation in corporate governance can significantly and positively affect consumer satisfaction. Testing in more detail for further non-linearities, we find that a critical mass of female board members—beyond one fourth of directors—is needed to favorably influence CS scores. Companies with less than 25% of female board members may experience decreased CS levels.

## Dissertation summary (German)

In dieser Dissertation werden die Auswirkungen von Frauen in der Unternehmensführung (im Aufsichtsrat und in der Geschäftsleitung) auf die Qualität von Gütern und Dienstleistungen untersucht, die anhand verschiedener Qualitätsindikatoren wie Kundenzufriedenheit, Produktqualität oder Qualität der Logistikdienstleistungen gemessen wird. Die empirischen Auswertungen basieren auf verschiedenen Branchen und Wirtschaftssegmenten (z. B. Konsumgüter, Dienstleistungen, Großhandel, Business-to-Consumer- oder Business-to-Business-Kanäle). Die Dissertation enthält drei unabhängige Studien, die den Zusammenhang zwischen der Präsenz von weiblichen Geschäftsführern und Topmanagern und den spezifisch erwähnten Aspekten der Qualität von Gütern und Dienstleistungen untersuchen. Sie zeigen gemischte Belege dafür, wie sich Frauen in höheren Rängen der Unternehmensmacht auf die Zuverlässigkeit von Produkten und Dienstleistungen sowie auf die Kundenzufriedenheit auswirken.

Im zweiten Kapitel wird ein Zusammenhang zwischen der Anwesenheit von Frauen in den Aufsichtsräten und in der Geschäftsführung von Transportunternehmen und der Qualität der Logistikdienstleistungen (Logistics Service Quality) in diesen Unternehmen untersucht. Ich verwende LS-Regressionsmodelle, um die aus früheren Studien abgeleiteten Variablen zu kontrollieren, die sich auf die Qualität der Logistikdienstleistungen auswirken, und füge die frauenbezogenen unabhängigen Faktoren in meine Modelle ein. Meine Ergebnisse zeigen kein einheitliches Bild und offenbaren, dass die Beteiligung von Frauen im Aufsichtsrat einen negativen Einfluss auf die Logistics Service Quality (LSQ) Werte haben kann, während schon ein geringer Anteil von Frauen in der Geschäftsführung die LSQ-Werte für Transportunternehmen erhöhen kann.

In Kapitel drei wird untersucht, ob der Frauenanteil im Aufsichtsrat die in unabhängigen Verbraucherberichten gemessene Produktqualität (PQ) beeinflusst. Wir führen LS-Regressionsverfahren durch, um das Niveau und die Richtung der Auswirkungen zwischen diesen

beiden Variablen unter Berücksichtigung einiger Faktoren zu testen, die in früheren Untersuchungen zur Produktqualität geprüft wurden. Wir legen Beweise vor, die bestätigen, dass sich weibliche Aufsichtsratsmitglieder positiv auf die Produktqualität auswirken können, und wir stellen außerdem fest, dass eine kritische Masse an weiblichen Aufsichtsratsmitgliedern - über einen Anteil von einem Fünftel hinaus - erforderlich ist, um die PQ-Werte positiv zu beeinflussen.

In Kapitel vier untersuchen wir die Auswirkungen weiblicher Aufsichtsrats-mitglieder auf die Verbraucherzufriedenheit (CS), die regelmäßig durch einen amerikanischen Index für über hundert Unternehmen in den USA erfasst wird. In OLS-Regressionen rekapitulieren wir zunächst die Beziehung zwischen der Kundenzufriedenheit und ihren wichtigsten Einflussparametern und fügen dann zusätzliche unabhängige Variablen wie die Vertretung von Frauen in den Aufsichtsräten hinzu. Wir stellen fest, dass ein höherer Frauenanteil in einem Aufsichtsrat die Kundenzufriedenheit signifikant und positiv beeinflussen kann. Bei einer genaueren Prüfung auf weitere Nichtlinearitäten stellen wir fest, dass eine kritische Masse an weiblichen Aufsichtsratsmitgliedern - mehr als ein Viertel der Aufsichtsratsmitglieder - erforderlich ist, um die CS-Werte positiv zu beeinflussen. Bei Unternehmen mit weniger als 25 % weiblichen Aufsichtsratsmitgliedern kann das CS-Niveau sinken.

Appendix

## Statement of Personal Contributions and List of Publications

**Selbstdeklaration bei kumulativen Promotionen (Fachbereich Sozialwissenschaften)**

**Konzeption/Planung:** Formulierung einer originalen wissenschaftlichen Fragestellung, basierend auf bisher unbeantworteten theoretischen Ansätzen inklusive der Zusammenfassung der aktuell bekannten Theorien und Forschungsbeiträge. Planung der Analysen und Spezifizierung der methodischen Vorgehensweise, inklusive Wahl der Methoden und unabhängige methodologische Entwicklung.
**Durchführung:** Graduelle Einbindung in die einzelnen Analysen und in die Literaturübersicht.
**Manuskripterstellung:** Präsentation, Interpretation und Diskussion der erzielten Ergebnisse in Form eines wissenschaftlichen Artikels, so wie in Doktorandenseminaren.
Die Einschätzung des geleisteten Anteils erfolgt mittels Punkteinschätzung von 1 –100 %.

1. Für den ersten vorliegenden Artikel liegt die Eigenleistung bei 100 %.
Eingereicht beim Research in Transportation Business & Management am 12. Mai 2026.

2. Für den zweiten vorliegenden Artikel liegt die Eigenleistung für

- das Konzept/die Planung bei 90%
- die Durchführung bei 80%
- die Manuskripterstellung bei 70%

*Publiziert als:* Korenkiewicz, D., Maennig, W., (2024). Impact of women on corporate boards of directors on product quality, Journal of Management and Governance, 28, 841–874
*Link zum Artikel:* https://doi.org/10.1007/s10997-023-09677-6

3. Für den dritten Artikel liegt die Eigenleistung für

- das Konzept/die Planung bei 80%
- die Durchführung bei 70%
- die Manuskripterstellung bei 60%

*Publiziert als:* Korenkiewicz, D., Maennig, W., (2023). Women on a Corporate Board of Directors and Consumer Satisfaction, Journal of the Knowledge Economy, New York, 14(4), 3904-3928
*Link zum Artikel:* https://doi.org/10.1007/s13132-022-01012-y

Appendix

Die vorliegende Einschätzung in Prozent über die von mir erbrachte Eigenleistung wurde mit den am Artikel beteiligten Koautoren einvernehmlich abgestimmt.

| | |
|---|---|
| _____ | _____ |
| Ort/Datum | Unterschrift Doktorandin |

Appendix

## Statutory declaration I

Ich, Dorota Korenkiewicz, versichere an Eides statt, dass ich die Dissertation mit dem Titel „Impact of gender diversity in corporate govenance on customer satisfaction, product, and logistics service quality" selbst und bei einer Zusammenarbeit mit anderen Wissenschaftlerinnen oder Wissenschaftlern gemäß den beigefügten Darlegungen nach § 6 Abs. 6 der Promotionsordnung der Fakultät für Wirtschafts und Sozialwissenschaften vom 18. Januar 2017 verfasst habe. Andere als die angegebenen Hilfsmittel habe ich nicht benutzt.

_____ _____

Ort/Datum Unterschrift Doktorandin

## Statutory declaration II

Hiermit erkläre ich, Dorota Korenkiewicz, dass ich keine kommerzielle Promotionsberatung in Anspruch genommen habe. Die Arbeit wurde nicht schon einmal in einem früheren Promotionsverfahren angenommen oder als ungenügend beurteilt.

_____ _____

Ort/Datum Unterschrift Doktorandin