ESSAYS ON SUSTAINABLE PRODUCT INNOVATIONS: FIRM GROWTH AND PERFORMANCE

by

YOUNGTAK M. KIM

(Under the Direction of Sundar Bharadwaj)

ABSTRACT

This dissertation consists of three chapters that focus on corporate sustainability and its implications on firm performance and growth. Chapter I investigates the relationship between corporate sustainability (CS) and firm performance and finds that this relationship remains fragmented and inconclusive even after decades of research. To reconcile these mixed findings, the essay focuses on analyzing the contingency factors (i.e., moderators and mediators) using a systematic review approach, which may be the underlying cause of the varied results. In addition, it complements the systematic review with a machine learning approach (topic modeling) to better understand and reconcile the heterogeneity of the CS–firm performance link across studies. Chapter II determines whether and when sustainable product innovations contribute to firm market value. It draws on the marketing literature on sustainability and uses product benefit claims and description information to develop a typology for categorizing

sustainable products. In addition, it uses natural language processing methods to complement and help refine the classification. A conceptual model and hypotheses are developed and empirically tested that link sustainable product innovations to firm performance. Further, it observes market-based assets such as sustainable innovation ability, product innovativeness, and branding strategies that moderate this relationship. Additional conjoint analyses are used to validate the categorization of sustainable product types. It also provides evidence of the similarities between consumer and investor preferences for sustainable benefits in product innovations. Chapter III decomposes the sales growth of sustainable product innovations to determine if they are sources of primary and secondary demand. Using a time-varying vector autoregressive model with exogenous variables (VAR-X), it decomposes the base sales of sustainable product introductions into its constituent sources of growth. This model allows managers to estimate each of the effects of primary (new growth) and secondary (cannibalization and brand switching) demand growth which helps calculate the net demand for sustainable new products entering the market. Further, it shows how different demand sources from sustainable new products vary over time and discusses the managerial implications for both the focal brand and competitors.

INDEX WORDS: Corporate sustainability, Innovation, Marketing-finance, Environmental, Social, Natural language processing, Retail measurement, Demand decomposition, Vector autoregressive models

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by

YOUNGTAK M. KIM

B.B.A., Sungkyunkwan University, Republic of Korea, 2008

M.B.A., University of Oregon, 2011

A dissertation submitted to the graduate faculty of the University of Georgia

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YOUNGTAK M. KIM

Major Professor: Sundar Bharadwaj

Committee: Son K. Lam
Tatiana Dyachenko
Karen Page Winterich

Electronic Version Approved:

Ron Walcott
Vice Provost for Graduate Education and Dean of the Graduate School
University of Georgia
May 2022

DEDICATED

To my wife, family, and friends.

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CORPORATE SUSTAINABILITY AND FIRM PERFORMANCE: A SYSTEMATIC REVIEW AND TOPIC MODELING APPROACH

1.2 INTRODUCTION

Companies can no longer develop their strategies based on assumptions of having infinite natural resources (Kotler 2011). In addition, ignorance of environmental imperatives can lead to severe consequences such as tarnished brand reputation and litigation costs. Advocates of sustainable corporate practices are found among non-equity stakeholders and investors alike and have made sustainability a vital business goal for multiple stakeholders (Sheth, Sethia, and Srinivas 2011). These stakeholders are aware of sustainability's profound significance as to how it not only creates a competitive advantage but also acts as a necessity for firms' survival in the market – the cost of competing (Lubin and Esty 2010; Porter and Kramer 2011). For instance, Walmart announced in 2012 its sustainability mandate on more than 60,000 of its suppliers to source 95% of production and materials through environmentally friendly practices (Gielens et al. 2018). In addition, the Forum for Sustainable and Responsible Investment estimated that more than $8 trillion was invested by U.S. fund managers who incorporated sustainability into their criteria for

decision making which is up from $1.4 trillion in 2012 (Kerber and Flaherty 2017). Therefore, investors are not only paying attention to sustainability but are also profiting from it. They recognize the long-term financial benefits of good corporate governance, sustainable activities, and products which are represented in terms of enhanced cash flows (Kiron and Unruh 2018). Increasingly the investor community is emphasizing the incorporation of sustainability-related actions as a criterion for their investment decisions.[1]

Despite the growing momentum and evidence from the industry, the relationship between *corporate sustainability* (CS) and *corporate firm performance* (CFP) remains inconclusive in the CS literature. Some studies have shown positive (Dowell, Hart, and Yeung 2000; Fraj-Andrés et al. 2009; Lev, Petrovits, and Radhakrishnan 2010; Russo and Fouts 1997; Surroca, Tribó, and Waddock 2010), neutral (Dangelico, Pontrandolfo, and Pujari 2013; Gilley et al. 2000) or even negative (Cordeiro and Sarkis 1997; González-Benito and González-Benito 2005; Graves and Waddock 2000; López, Garcia, and Rodriguez 2007) relationships between X and Y. Therefore, the relationship between *corporate sustainability* (CS) and corporate *firm performance (CFP)* remains highly fragmented despite decades of research.

To reconcile these discrepancies, scholars have looked to methodologies such as systematic reviews and meta-analyses to further examine the CS–CFP linkage (Aguinis and Glavas 2012; Margolis and Walsh 2003; Margolis, Elfenbein, and Walsh 2009; Orlitzky and Benjamin 2001; Orlitzky, Schmidt, and Rynes 2003). These studies have shed light on the various theoretical and methodological shortcomings in the CS literature, however, have not closely examined the contingency (i.e., moderators and mediators) factors that may serve as the

[1] https://www.morganstanley.com/ideas/sustainable-investing-growing-interest-and-adoption; https://www.blackrock.com/corporate/literature/publication/blk-esg-investment-statement-web.pdf

key to unraveling the inconsistencies in the CS–CFP relationship (Grewatsch and Kleindienst 2017; Wang and Sarkis 2017). One of the reasons may be that studies have assumed that the CS–CFP relationship is linear; albeit recent work has taken a stance on the non-linear relationship between X and Y (Barnett and Salomon 2012; Flammer 2015; Misani and Pogutz 2015; Nollet, Filis, and Mitrokostas 2016; Trumpp and Guenther 2017). Such empirical studies have explored nonlinear relationships and have argued that CS cannot universally produce favorable returns for every firm all the time (Wang and Sarkis 2017). Thus, a contingency perspective is required to understand *how* and *when* CS leads to positive relationships with CFP.

First, moderating effects of the contextual factors need to be considered to better understand the heterogeneity of the CS–CFP linkage. Given the empirical evidence that contingency factors (e.g., level of dynamism in firms' operational environment and industrial characteristics) may be important variables in understanding the inconclusive results, it is surprising that extant meta-analyses have not taken extra scrutiny into the moderating effects of such contextual variables on the relationship between CS and CFP (Dixon-Fowler et al. 2013; Wang and Sarkis 2017).

Second, more attention has been devoted to supporting the direct relationship between CS and firm performance, but less focus on the complementary factors or means of how CS affects firm performance (Barnett 2007). Only recently have studies examined other latent variables that would influence the CS-CFP link to derive significant results (Mishra and Modi 2016; Hirunyawipada and Xiong 2018). For these reasons, I examine the mechanisms that potentially lie in between or contextually influence the CS–CFP link. Therefore, this essay seeks to reconcile mixed findings in prior research between CS and CFP by analyzing moderators and mediators using a systematic review approach.

Third, there lacks a common and clear definition of CS and its dimensions (Hult 2011). Extant literature indicates that no single dimension is enough to define CS and there are multiple dimensions or types with several social activities under its umbrella (Jayachandran, Kalaignanam, and Eilert 2013; Mishra and Modi 2016). Naturally, this leads to different measurements and scoring of CS due to its multi-faceted nature, which further attenuates efforts in clarifying the CS-CFP linkage. Hence, I investigate the domains and dimensions of CS in the literature to outline its scope and definition.

This essay seeks to reconcile the mixed findings in prior literature on the CS-CFP linkage by analyzing contingency factors (i.e., moderators and mediators) using a systematic review approach, which may be the cause of the varied results. In addition, I combine the systematic review with a machine learning approach using latent Dirichlet allocation (LDA) topic modeling to complement traditional literature review methods. Prior research in topic modeling for CS has used sustainability and CSR reports as well as social media (Twitter) to identify trends and changes in topics over time (Chae and Park 2018; Jaworska 2018; Jaworska and Nanda 2018; Székely and vom Brocke 2017). However, there has been limited work on the use of academic journal articles to analyze topics and define the domains of CS.

In the next section, I describe the methodological approach and data for this study.

1.3 DATA

To identify the body of literature to be reviewed, I adopted the list of articles from prior research that have conducted a systematic literature review on the CS–CFP relationship with consideration for mediators and moderators (Aguinis and Glavas 2012; Van Beurden and Gössling 2008). I also extracted articles from various meta-analyses and literature review papers

(Grewatsch and Kleindienst 2017; Margolis, Elfenbein, and Walsh 2009; Orlitzky, Schmidt, and Rynes 2003; Wang and Sarkis 2017). However, studies were predominantly conducted in the field of management and had only included a handful of marketing journal articles. Thus, I complemented the list with key articles from premier journals in marketing and management.[2]

In addition, I decided to apply the term *corporate sustainability* (CS) rather than corporate social responsibility (CSR) due to the following reasons. First, from a theoretical perspective, CSR can be seen as a subset of CS issues (Elkington 1997; Hult 2011). Both terms have similar conceptualizations, but small differences exist related to applied questions and theories. CSR is socially oriented and associated with the communication aspects of people and organizations. However, CS offers a wider focus and considers from the tridimensional perspective of the Triple Bottom Line (TBL) and emphasizes the integration of economy, society, and environment for a firm's success (Elkington 1997; Montiel 2008; Van Marrewijk 2003). Moreover, CS observes the environment as the third main element, whereas CSR refers to the environment as a subset of social issues. Thus, CS is the ultimate goal while CSR as an intermediate stage where companies try to balance the Triple Bottom Line (Van Marrewijk 2003). Second, from a practical perspective, firms use both terms interchangeably but are leaning towards CS as it accounts for all social and environmental issues in the organization (Montiel 2008). Therefore, I follow the recommendation of various scholars on using a single terminology – CS. Studies related to CSR, environmental marketing (EM), corporate responsibility (CR), and

[2] The set of journals included in the review are from the following: *Academy of Management Journal (AMJ), Academy of Management Review (AMR), Administrative Science Quarterly (ASQ), Journal of the Academy of Marketing Science (JAMS), Journal of Business Ethics (JBE), Journal of Management (JOM), Journal of Management Studies (JOMS), Journal of Marketing (JM), Journal of Marketing Research (JMR)*, *Management Science (MS), Organization Studies (OSt), Organization Science (OS), and Strategic Management Journal (SMJ).* I could not find any publications in Marketing Science that address the relationship between corporate sustainability and firm performance. Lunde (2018) also indicates in his review that there are no "Sustainability" articles from Marketing Science.

corporate philanthropy (CP) will all be considered as part of CS and included in the review. However, I include the terms that are used by each study to capture the fine-grained, detailed information of the applied sub-construct of CS. This is to observe how CS is operationalized and measured which may potentially have an influence on the moderators or mediators as well as the performance measures.

1.4 REVIEW PROCESS

For the systematic review, I utilized an initial list of 153 studies from prior CS literature review papers and meta-analyses. After carefully reviewing the abstracts of each study, I excluded 71 studies that did not cover the CS–CFP relationship and were not within the scope of my essay. Next, I examined the theory and method sections of the remaining 82 studies to ensure they focused on studies that explicitly used the terms moderator or mediator but also included studies with an implicit argumentation for a moderating or mediating effect. Through this process, I eliminated another 41 studies. Finally, I scanned the references of the remaining articles to identify prominent studies that were not included. The final sample of studies consists of 30 empirical, six literature reviews and meta-analyses, and five conceptual papers.

Table 1 provides details on the literature review and the set of journals I used. Table 2 summarizes the literature review into my variables of interest (CS, Firm performance, mediators, and moderators) and their conceptualizations or operationalizations. In addition, Table 2 categorizes the mediators and moderators depending on the dimensions - 1) internal (those originating from within the firm) and 2) external (influences coming from outside the firm).

Table 1. Prior Research on the CS-Firm Performance (FP) Link

Empirical Studies

Study	Journal	Mediator	Moderator	Theoretical approach	Independent variable (measure)	Dependent variable (measure)	Main findings (empirical results)	Significance of Mediators-Moderators
Baird, Geylani, and Roberts (2012)	JBE	X	Industry context	Stakeholder theory	CSP **Other external measures** KLD	FP **Market based** Stock price	CSP– FP: negative	Industry context**
Baker and Sinkula (2005)	JAMS	New product success	X	RBV	CSP **Perceptual measures** Survey	FP **Accounting based** Market share	CSP–FP: positive	New product success*
Ballings, McCullough, and Bharadwaj (2018)	JAMS	X	• Focal brand's feature • Focal brand's price	X	CSP **Perceptual measures** Marketing campaign	FP **Accounting based** Profitability	CS-FP: positive	• Focal brand's feature** • Focal brand's price (n.s.)
Blanco, Guillamón-Saorín, and Guiral (2013)	JBE	Innovation	X	X	CSP **Other external measures** KLD	FP **Accounting based** Profitability **Market based** - Tobin's q - Market to equity - EBIT to assets	CSP–FP: positive	Innovation**
Brammer and Millington (2008)	SMJ	X	• Time • Intensity of CSP	X	CSP **Disclosure** Annual reports	FP **Market based** Sharpe ratio (ex-post reward-to-variability ratio)	CSP– FP: curvilinear	• Time** • Intensity of CSP**
Brown and Dacin (1997)	JM	Corporate evaluation Product social responsibility	X		CSR **Perceptual measures** survey	FP **Perceptual measures** Product evaluation	CSR– FP: positive	• Corporate evaluation** • Product social responsibility (n.s.)

Flammer (2013)	AMJ	X	• Events (Eco-friendly/harmful) • Time	X	CSP **Other external measures** KLD	FP **Market based** Cumulative abnormal return	CSP–FP: positive	• Time** • Event**
Gilley et al. (2000)	JOM	X	Type of greening initiative: - Process-driven - Product-driven	X	CEP **Other external measures** Wall street journal printed index	FP **Market based** Cumulative abnormal return	CEP–FP: no effect	• Product-driven† • Process-driven†
Godfrey, Merrill, and Hansen (2009)	SMJ	Stakeholder related CSR (institutional vs. technical CSR)	X	X	CSP **Other external measures** KLD	FP **Market based** Cumulative abnormal return	CSP–FP: positive	• Institutional CSR** • Technical CSR (n.s.)
Homburg, Stierl, and Bornemann (2013)	JM	• Business practice • CSR reputation • Philanthropic CSR reputation • Trust • Customer-company identification	• Market-related uncertainty • Competition intensity • Product importance • Relationship extendedness • Customer's CSR orientation	Stakeholder theory	CEP **Reputation rating** - Business practice CSR reputation - Philanthropic CSR reputation	CSP **Perceptual measures** Customer loyalty	CSP–FP: positive	• Business practice CSR reputation** • Philanthropic CSR reputation** • Trust* • Customer-company identification** • Market-related uncertainty ** • Competition intensity** • Product importance** • Relationship extendedness** • Customer's CSR orientation**
Hull and Rothenberg (2008)	SMJ	X	• Innovation • Industry differentiation	RBV	CSP **Other external measures** KLD	FP **Accounting based** Return on assets	CSP–FP: positive	• Innovation** • Industry differentiation**
Jayachandran, Kalaignanam, and Eilert (2013)	SMJ	X	• Product-based SP (PSP) • Environment-based SP (ESP)	Stakeholder theory	CSP **Other external measures** KLD	FP **Market based** Tobin's q	CSP–FP: asymmetric	• Product-based SP** • Environment-based SP (n.s.)

Kim and Statman (2012)	JBE	X	Managerial action(s)	RBV	CSP **Other external measures** KLD	FP **Accounting based** Return on assets **Market based** Tobin's q	CEP–FP: trade-off	Managerial action**
Klassen and McLaughlin (1996)	MS	X	Industry context	X	CEP **Reputation rating** NEXIS database	FP **Market based** Stock equity return	CEP–FP: positive	Industry context**
Korschun, Bhattacharya, and Swain (2016)	JM	Customer orientation	CSR importance	Social identification	CSR **Perceptual measures** Survey	CSP **Perceptual measures** Job performance	CSR–FP: positive	• Customer orientation** • CSR importance*
Lenz, Wetzel, and Hammerschmidt (2017)	JAMS	X	Corporate social irresponsibility (CSI) - Occurrence - Proneness - Externalization	Stakeholder theory	CSP **Other external measures** KLD	FP **Market based** Tobin's q	CEP–FP: positive (partial - other domain)	Corporate social irresponsibility (CSI) - Occurrence* - Proneness (same**, other*) - Externalization (same: n.s., other*)
Leonidou, Katsikeas, and Morgan (2013)	JAMS	X	• Competitive intensity • Slack resources • Industry-level environmental reputation	Stakeholder theory	CSR **Perceptual measures** Survey	FP **Accounting based** Return on assets **Perceptual measures** Product-market performance	CP–FP: positive (partial)	• Competitive intensity (n.s.) • Slack resources* (partial) • Industry-level environmental reputation* (partial)
Lev, Petrovits, and Radhakrishnan (2010)	SMJ	Consumer satisfaction	X	X	CP **Other external visible measures** Taft corporate giving directory + National Center for Charitable Statistics (NCCS)	FP **Accounting based** Net revenues	CP–FP: positive	Consumer satisfaction**
Luo and Bhattacharya (2006)	JM	Customer satisfaction	Corporate abilities - innovativeness capability - product quality	Stakeholder theory	CSR **Other external measures** Fortune (FAMA)	FP **Market based** - Tobin's q - Stock returns	CP–FP: positive	• Customer satisfaction** • Corporate abilities - innovativeness capability* - product quality**

Luo and Bhattacharya (2009)	JM	X	Advertising R&D	Stakeholder theory	CSR **Other external measures** Fortune (FAMA)	FP **Market based** Idiosyncratic risk	CP–FP: positive	• Advertising** • R&D*
Mishra and Modi (2016)	JM	X	Marketing capability	Dynamic capability	CSR **Other external measures** KLD	FP **Market based** - Tobin's q - Idiosyncratic risk	CP–FP: positive (partial)	Marketing capability**
Ruf et al. (2001)	JBE	X	Changes in CSR engagement	Stakeholder theory (with transaction cost theory and RBV)	CSP **Other external measures** KLD	FP **Accounting based** - Return on equity - Return on sales - Growth in sales	CSP–FP: positive	Changes in CSR engagement**
Russo and Fouts (1997)	AMJ	X	Industry growth	RBV	CEP **Other external visible measures** Franklin Research and Development Corporation (FRDC) rating	FP **Accounting based** Return on assets	CEP–FP: positive	Industry growth**
Schreck (2011)	JBE	X	• Industry classification • Quality of CSR reporting activities	X	CSP **Reputation rating** Oekom rating	FP **Market based** Tobin's q	CSP–FP: no effect	• Industry classification(n.s.) • Quality of CSR reporting activities (n.s.)
Servaes and Tamayo (2013)	MS	X	Customer awareness	X	CSP **Other external measures** KLD	FP **Market based** Tobin's q	CSP–FP: positive	Consumer awareness**
Surroca, Tribó, and Waddock (2010)	SMJ	Intangible resources - Innovation - Human capital - Reputation - Culture	X	Natural RBV, Stakeholder theory	CRP **Other external visible measures** Sustainalytics platform ratings	FP **Market based** Tobin's q	CRP–FP: no effect	Intangible resources - Innovation** - Human capital** - Reputation** - Culture**

Tang, Hull, and Rothenberg (2012)	JMS	X	• Pace of CSR engagement • Relatedness of CSR engagement • Consistency of CSR engagement • Path of CSR engagement	Absorptive capacity theory, related perspectives	CSP **Other external measures** KLD	FP **Market based** Tobin's q **Accounting based** Return on assets	CSP–FP: positive	• Pace (n.s.) • Relatedness** • Consistency** • Path**
Van der Laan, Van Ees, and Van Witteloostuijn (2008)	JBE	X	Interactions with different stakeholder groups	Stakeholder theory (with resource dependence theory, prospect decision theory)	CSP **Other external measures** KLD	FP **Accounting based** - Return on assets - Earnings per share	CSP– FP: asymmetric	Stakeholder group interactions**
Wang and Bansal (2012)	SMJ	X	Long-term orientation	X	CSP **Disclosure + perceptual measures** Survey and webpages	FP **Accounting based** - Sales level - Market share - Sales growth - Cash flow - Return on assets - Return on equity - Return on sales - Ability to fund business growth from profits - Overall firm performance	CSP– FP: negative	Long-term orientation**
Wang and Choi (2013)	JOM	X	• Temporal consistency • Inter-domain consistency	Instrumental stakeholder theory, RBV	CSP **Other external measures** KLD	FP **Market based** Tobin's q	CSP–FP: positive	• Temporal consistency ** • Inter-domain consistency**

CEP corporate environmental performance, CP corporate philanthropy, CR corporate responsibility, CRep corporate reputation, CRP corporate responsibility performance, CS corporate sustainability, CSP corporate social performance, CSR corporate social responsibility, eCSR environmental corporate social responsibility, EM enviropreneurial marketing, FP firm performance, RBV resource-based view

*† p<.10; * p<.05; ** p<.01*

Table 1 (continued)

Meta-Analyses and Literature Reviews

Article	Journal	Mediator	Moderator	Theoretical approach	Independent variable (measure)	Dependent variable (measure)	Main findings (empirical results)	Significance of Mediators-Moderators
Aguinis and Glavas (2012)	JOM	Different factors across levels: - Institutional - Organizational - Individual	Different factors across levels: - Institutional - Organizational - Individual	X	CSP	CSR outcomes	CSP–outcomes: positive	X
Crittenden et al. (2011)	JAMS	X	Stakeholder involvement	Market orientation, Stakeholder theory, Dynamic capabilities	CS **Perceptual measures**	Performance Management	CS–FP: positive	Stakeholder involvement: positively
Dixon-Fowler et al. (2013)	JBE	X	• Environmental strategy • Firm characteristics • Methodological issues	X	CEP **Disclosure, reputation rating, other external visible, perceptual measures**	FP **Market based** **Accounting based** **Perceptual measures**	CEP–FP: positive	• Environmental strategy (n.s.) • Firm characteristics* • Methodological issues (n.s.)
Orlitzky, Schmidt, and Rynes (2003)	OSt	• Competencies, learning, and efficiency • Reputation building	• Artifacts • Measurement strategies	X	CSP **Disclosure, reputation rating, other external visible, perceptual measures**	FP **Market based** **Accounting based** **Perceptual measures**	CSP–FP: positive	• Artifacts* • Measurement strategies* • Competencies (n.s.) Reputation*
Van Beurden and Gössling (2008)	JBE	X	• Firm size • Industry • R&D • Risk	X	CSP	FP	CSP–FP: positive	X

CEP corporate environmental performance, CP corporate philanthropy, CR corporate responsibility, CRep corporate reputation, CRP corporate responsibility performance, CS corporate sustainability, CSP corporate social performance, CSR corporate social responsibility, eCSR environmental corporate social responsibility, EM enviropreneurial marketing, FP firm performance, RBV resource-based view

*† p<.10; * p<.05; ** p<.01*

Table 1 (continued)

Conceptual Papers

Article	Journal	Mediator	Moderator	Theoretical approach	Independent variable (measure)	Dependent variable (measure)	Main findings	Significance of Mediators-Moderators
Aragón-Correa and Sharma (2003)	AMR	X	• Uncertainty • Complexity • Munificence	Contingent natural RBV	CEP	FP	CEP–FP: positive	• Uncertainty: positively and negatively • Complexity: positively • Munificence: negatively
Barnett (2007)	AMR	Stakeholder relations	X	Stakeholder theory	CSP	FP	CSP–FP: U-shaped	Stakeholder relations: positively and negatively
Halme and Laurila (2009)	JBE	X	Types of CR strategies	X	CRP	FP	CRP–FP: positive	Types of CSR: positively
Husted and de Jesus Salazar (2006)	JMS	X	Types of strategic approaches towards CSR	Microeconomic theory	CSP	FP	CSP–FP: trade-off	Types of CSR: positively
Maignan and Ferrell (2004)	JAMS	X	CSR communications	Stakeholder theory	CSR	CSR outcomes	CSR–FP: positive	CSR communications: positively
Menon and Menon (1997)	JM	X	Industry reputation	Political-economy framework, Institutional theory	EM	FP CRep	EM–FP: positive EM–CRep: positive	Industry reputation: positively
Schuler and Cording (2006)	AMR	• Information intensity • Consumer decision processes	X	Stakeholder theory, theory of planned behavior	CSP	FP	CSP–FP: unclear	• Information intensity: positively • Consumer decision: positively

CEP corporate environmental performance, CP corporate philanthropy, CR corporate responsibility, CRep corporate reputation, CRP corporate responsibility performance, CS corporate sustainability, CSP corporate social performance, CSR corporate social responsibility, eCSR environmental corporate social responsibility, EM enviropreneurial marketing, FP firm performance, RBV resource-based view

Journal abbreviations are as follows: *Academy of Management Journal (AMJ), Academy of Management Review (AMR), Administrative Science Quarterly (ASQ), Journal of the Academy of Marketing Science (JAMS), Journal of Business Ethics (JBE), Journal of Management (JOM), Journal of Management Studies (JOMS), Journal of Marketing (JM), Journal of Marketing Research (JMR), Management Science (MS), Organization Studies (OSt), Organization Science (OS), and Strategic Management Journal (SMJ).*

Table 2. Preliminary Findings from the Systematic Review

Variable	Measure	Details	Comments / Arguments
Independent			
Corporate Sustainability	Externally visible	Kinder, Lydenberg, Domini and Company (KLD), oekom, FRDC (Franklin Research and Development Corporation), Sustainalytics	• Non-systematic exclusion/inclusion of items – exclude corporate governance, human rights, or other controversial issues (Sharfman 1996)
	Reputation/ Disclosure	ISS ESG, FAMA (Fortune's Most Admired Companies)	• Can lack strong foundation in the literature; often subjectively coded (Rahman and Post 2012)
	Perceptual	Company webpages, Surveys	• Has been less frequently utilized in literature as measures can be subjective
Dependent			
Firm Performance	Market-based	Tobin's q, Cumulative abnormal returns	• Tobin's q preferred due to forward-looking nature; overcome limitations of accounting-based measures (Servaes and Tamayo 2013). • Market-based shows a more diverse relationships between CS and firm performance (e.g., non-effects, trade-offs, or asymmetry)
	Accounting-based	Return on Assets/Equity, Sales growth, Earnings per share, Net revenues	• Stronger positive coefficients between CS and firm performance; may be perceived as myopic and not lead to immediate returns
	Perceptual	Self-reported financial benefits	• Subjective and difficult to compare across studies or firms (Orlitzky et al. 2003)
Mediators			
Internal	Resources/ Capabilities	• Managerial competencies and commitment (Orlitzky et al. 2003) • Innovation (Baker and Sinkula 2005; Surroca et al. 2010) • Culture (Surroca et al. 2010) • CS reputation (Orlitzky et al. 2003)	• Developing capabilities will increase firm's preparedness for dynamic, complex environments and turbulent times
External	Stakeholder Relations	Stakeholders' assessment, attitude, and actions/responses towards a firm's CS actions (Freeman 1984) • Stakeholder actions and responses towards CS activities (Schuler and Cording 2006). • Needs of stakeholders are at the heart of CS activities (Surroca et al. 2010)	• CS activities and disclosure provide signaling (Orlitzky et al. 2003), information diffusion, and consistency (Schuler and Cording 2006) to reduce information asymmetry between stakeholders to increases stakeholders' knowledge. • Communication about CS activities helps build an image of quality, honesty, and reliability; positively affect stakeholder (customer) loyalty and satisfaction (Lev et al. 2010; Luo and Bhattacharaya 2006). • However, CS activities and behavior must support the communicated information to sustain a firm's reputation (Wang and Bansal 2012) • Need to acquire legitimacy in the eyes of the stakeholders by addressing stakeholders' expectations and communicating appropriately with them (Grewatsch and Kleindienst 2017)

Table 2 (continued)

Variable	Measure	Details	Comments / Arguments
Moderators			
Internal	Firm Characteristics	Firm resources and capabilities such as firm size or age	<u>*Firm size*</u> • Small: More flexible, effective in responding to environmental challenges and organizational change if slack resources are not lacking (Dixon-Fowler et al. 2013). • Large: Typically have more financial resources to strengthen the CS–firm performance relationship (Aguinis and Glavas 2012; Van Beurden and Gössling 2008). <u>*Firm age*</u> • Younger firms have less knowledge, limited capabilities, and fewer financial resources; however, long-term orientation reverses this negative impact. (Wang and Bansal 2012). • Investments and engagements in CS activities need time to pay off • Limited capabilities and resources are less restricting than assumed
	Innovativeness	Firm's receptivity and inclination to adopt new ideas and launch new products (Erickson and Jacobson 1992; Hurley and Hult 1998; Rubera and Kirca 2012).	• Negative: Low innovative firms benefit financially by differentiating products/services; highly innovative firms differentiate through innovation rather than CS (Hull and Rothenberg 2008). • Positive: Higher R&D investments lead to greater positive impacts (Aguinis and Glavas 2012).
	Managerial Characteristics	Individual characteristics, behaviors, and actions of managers as moderators	• Manager commitment to ethics and sensitivity to equity influences employees within the organization (Aguinis and Glavas 2012).
	CS engagement and intensity	• Commitment to sustainability influences degree of stakeholders' confidence to firm • Not all CS initiatives yield the same results – distinguish between product versus process-driven CS (Gilley et al. 2000; Jayachandran, Kalaignanam, and Eilert 2013).	• Product outperforms process (environmental) due to stakeholder perceptions and acceptability; development of sustainable products more appreciated, easier and more transparently communicated and understood by stakeholders (Jayachandran, Kalaignanam, and Eilert 2013; Leonidou, Katsikeas, and Morgan 2013; Servaes and Tamayo 2013). • Internal processes or environmental efforts lack reliability due to information uncertainty and less relation to customer values (Lins, Servayes, and Tamayo 2017; Servaes and Tamayo 2013). • Harder for stakeholders to evaluate this information and perceive non-product-related CS activities as inappropriate (Jayachandran, Kalaignanam, and Eilert 2013).

Table 2 (continued)

Variable	Measure	Details	Comments / Arguments
Moderators			
External	Stakeholder Influence	Financial value of CS is contingent upon the ability to influence stakeholders and their perception of the firm's CS activities (Grewatsch and Kleindienst 2017).	• Need to reduce information asymmetry and uncertainty between different stakeholders by promoting/communicating CS reputation (Van der Laan et al. 2008). • Reduce information gap through mechanisms such as advertising intensity (Servaes and Tamayo 2013), high qualitative CS reports (Schreck 2011), consistent stakeholder management over time (Wang and Choi 2013). • Stakeholders discover more about the firm's CS engagement and reward such efforts through firm performance (Grewatsch and Kleindienst 2017).
	Industry Characteristics	Variance due to the heterogeneity of the environmental, social, and financial concerns each industry operates under (Baird et al. 2012; Schreck 2011).	*Industry Type* • Stakeholder demands differ among clean or less pollution-intensive industries versus high pollution-intensive ones. • High pollution industries face higher media attention, regulations, and pressure by stakeholders; more to win from a good but more to lose from bad environmental performance (Dixon-Fowler et al. 2013). • On the contrary, CS–firm performance linkage may be stronger in high pollution industries because they earn greater legitimacy (Baird et al. 2012; Schreck 2011). *Industry Growth* • High-growth industries have fast growth rates and are more profitable than other industries; more attractive for entries by new players (Russo and Fouts 1997). • High growth industries generally have higher attitude to riskier investments, more flexible and organic organizational management structures, and promote intangible assets (e.g., reputation); differentiate from competitors and new players (Russo and Fouts 1997).
	Business Environment	Macro view on external norms, regulations, governmental subsidiaries, tax incentives, interest rates, and research from universities (Aragon-Correa and Sharma 2003; Flammer 2013).	• Firms punished for non-sustainable behavior as more CS becomes an institutional norm and less rewarded as they employ more of the CS norms (Flammer 2013). • Uncertainty, complexity, and hostility of the business environment requires different strategic CS approaches (Aragon-Correa and Sharma 2003). • Proactive CS can achieve competitive advantage in an uncertain, complex environment; difficult for competitors to imitate information and environmental capabilities (Varadarajan 2017). • However, this may not be the same in a more certain, less complex/hostile environment; easier for competitors to imitate such initiatives (Aragon-Correa and Sharma 2003).

1.5 FINDINGS FROM SYSTEMATIC REVIEW

1.5.1 CS and CFP

There are four different forms of measurement for CS: 1) reputation rating, 2) other externally visible measures, 3) disclosure, and 4) perceptual measures. Many studies rely on other external visible measures, in particular the Kinder, Lydenberg, Domini, and Company (KLD) database, which has evolved into becoming the most widely used form of measuring CS. This development is driven by prominent studies in both marketing and management (Chin, Hambrick, and Treviño 2013; Gielens et al. 2018; Godfrey, Merrill, and Hansen 2009; Hull and Rothenberg 2008; Jayachandran, Kalaignanam, and Eilert 2013; Kang, Germann, and Grewal 2016; Mishra and Modi 2016; Servaes and Tamayo 2013; Sharfman 1996; Waddock and Graves 1997).

In general, the recurring application of a specific dataset is vital to building a cumulative and reliable body of literature. However, I find that there is no consistent application of the KLD database. The choice regarding what items to include or exclude is at times random and items such as corporate governance, human rights, and controversial issues are excluded, even though these topics are obviously of special interest to certain stakeholders (Sharfman 1996). To overcome some of the limitations of the KLD database, some studies relied on alternative databases such as oekom, FRDC (Franklin Research and Development Corporation), and Sustainalytics. However, such measures lack a strong foundation in the literature and are often subjectively coded (Rahman and Post 2012). Disclosure and reputation rating (e.g., FAMA–Fortune's Most Admired Companies) as forms of measuring CS were even used less often.

CFP is categorized into three different forms: 1) market-based, 2) accounting-based, and 3) perceptual measures (Orlitzky, Schmidt, and Rynes 2003). There is a slight preference for using market-based measures, in particular Tobin's q, since it has been argued to overcome the shortcomings of accounting-based measures of CFP (Servaes and Tamayo 2013). Comparing the results of studies using market-based measures with those using accounting-based measures, I find a similar pattern uncovered in previous reviews and meta-analyses (Margolis, Elfenbein, and Walsh 2009; Peloza 2009). However, studies using market-based measures of CFP show a more diverse picture of the CS–CFP relationship (e.g., non-effects, trade-offs, or asymmetry) while studies using accounting-based measures tend to demonstrate stronger positive relationships between CS and CFP. Therefore, the construct of choice used to operationalize CFP should be reflected in the theoretical development since short-term, backward-looking performance (accounting-based) represents a different aspect of performance as opposed to long-term, forward-looking performance (market-based) (Gentry and Shen 2010).

1.5.2 Mediators

1.5.2.1 Internal Mediators

Internal mediators are internal factors through which an indirect relationship between CS and CFP occurs. Such include intangible resources, capabilities, and reputation.

Intangible Resources and Capabilities. Intangible resources and capabilities include 1) managerial competencies and commitment (Orlitzky, Schmidt, and Rynes 2003), 2) innovation (Baker and Sinkula 2005; Blanco, Guillamón-Saorín, and Guiral 2013; Surroca, Tribó, and Waddock 2010), 3) culture (Surroca, Tribó, and Waddock 2010), 4) stakeholder integration (Sharma and Vredenburg 1998), and 5) CS reputation (Orlitzky, Schmidt, and Rynes 2003).

1.5.2.2 External Mediators

Reviewing the literature, I have found that external mediators focus on a single factor – stakeholder relations.

Stakeholder Relations. Stakeholder relations are grounded in stakeholder theory (Freeman 1984), with stakeholder relations referring to the stakeholders' assessment, attitude, and actions/responses towards a firm's CS actions. Studies in this stream are based on two main arguments: 1) the need of stakeholders is at the heart of any CS activity (Surroca, Tribó, and Waddock 2010), and 2) stakeholders' actions and responses toward a firm's CS activity (Schuler and Cording 2006).

By engaging in CS, a firm proactively considers the social and environmental challenges of its environment and aims at dealing with numerous stakeholders (Surroca, Tribó, and Waddock 2010). CS activities and disclosure provide signaling (Orlitzky, Schmidt, and Rynes 2003) as well as information diffusion and consistency (Schuler and Cording 2006) to reduce information asymmetry between stakeholders and the firm, leading to increases in stakeholders' knowledge. Communication about CS activities helps a firm build a positive image of quality, honesty, and reliability, which, in turn, is argued to positively affect stakeholder (customer) loyalty and satisfaction (Lev, Petrovits, and Radhakrishnan 2010; Luo and Bhattacharaya 2006). However, at the same time, the firm's CS activities and behavior must support the communicated information, to sustain this reputation (Wang and Bansal 2012). Therefore, to enhance financial performance, a firm needs to acquire legitimacy in the eyes of the stakeholders by addressing their expectations and communicating with them appropriately.

1.5.3 Moderators

1.5.3.1 Internal Moderators

A broad variety of internal, organization-oriented factors have been explored as potential moderators of the CS–CFP relationship. I categorize this array of factors into categories of firm characteristics, managerial characteristics, and CS engagement/importance.

Firm Characteristics. Firm characteristics represent a firm's resources and capabilities such as firm size/age, innovation, and strategic orientation. Dixon-Fowler et al. (2013) posit that smaller firms are more flexible as compared to large firms and are more effective in responding to environmental challenges and associated organizational change if slack resources are not lacking. However, Aguinis and Glavas (2012) and Van Beurden and Gössling (2008) conclude that larger firms typically have more financial resources, which in turn strengthens the CS–CFP relationship.

On another note, Wang and Bansal (2012) emphasize the age of the firm. Due to less knowledge, limited capabilities, and fewer financial resources, younger firms (less than 8 years old) are more likely to experience negative returns on CS. However, Wang and Bansal (2012) show that a long-term orientation reverses this negative impact. Thus, investments and engagements in CS activities need time to pay off and that limited capabilities and resources are less restricting than assumed in the CS–CFP relationship.

Another moderating firm characteristic is the degree of innovation. Hull and Rothenberg (2008) show that the level of innovation negatively moderates the CS–CFP relationship and argue that low-innovative firms benefit more financially from CS activities. Their logic is that firms engaging in CS are able to differentiate themselves from competitors and give customers a

reason to buy their products and services. However, Aguinis and Glavas (2012) come to the opposite conclusion in their review. They find that higher R&D investments lead to greater positive impacts of CS on CFP.

Managerial characteristics. A few studies have focused on the individual characteristics, behaviors, and actions of managers as moderators. Aguinis and Glavas (2012) provide evidence that managers' commitment to ethics and sensitivity to equity have a strong positive moderating effect on the CS–CFP relationship since it influences employees within the organization.

CS engagement and intensity. Firms have varied approaches towards their CS engagement and intensity. The firm's commitment to sustainability influences the degree of confidence that stakeholders have in the firm in addition to the organization's capabilities and resources. Tang, Hull, and Rothenberg (2012) argue that the pace, path, relatedness, and consistency of the CS engagement have different implications on CFP.

Other studies consider the different types of CS engagement as a moderating variable. This is based on the idea that not every kind of CS initiative yields the same or positive result (Gilley et al. 2000; Jayachandran, Kalaignanam, and Eilert 2013). Thus, these studies pursue a disaggregated view of CS by distinguishing between product-driven and process-driven initiatives. The findings reveal that product-oriented CS outperforms process-oriented (environmental) CS. This is due to the perception and acceptability by stakeholders since the development of new sustainability-oriented products are more appreciated, easier, and more transparently communicated through its products as opposed to its internal processes (Jayachandran, Kalaignanam, and Eilert 2013; Leonidou, Katsikeas, and Morgan 2013; Servaes and Tamayo 2013). Furthermore, internal processes or the environment outside the firm lack reliability due to information uncertainty and less relation to customers' value (Lins, Servayes,

and Tamayo 2017; Servaes and Tamayo 2013). For stakeholders, it is harder to evaluate this information, thereby perceiving non-product-related CS activities as inappropriate and as 'failure preventers' rather than 'success producers' (Jayachandran, Kalaignanam, and Eilert 2013).

CS intensity refers to how proactive or reactive firms respond to CS initiatives and is based on strategic decision making (Brammer and Millington 2008; Dixon-Fowler et al. 2013; Halme and Laurila 2009). It is more beneficial for firms to follow a proactive rather than a reactive approach (Dixon-Fowler et al. 2013). The reactive approach limits CS activities to the compliance with existing laws and regulations and solves environmental and/or social issues only when they occur while the proactive approach goes beyond legal requirements and focuses on the alignment of a firm's business activities with growing sustainability concerns and expectations of stakeholders to cope with environmental and/or social issues (Grewatsch and Kleindienst 2017). Thus, proactive CS is not only a valuable organizational capability that has the potential to decrease costs and risk but also is viewed as a hard to imitate source of differentiation to the stakeholders (Brammer and Millington 2008; Dixon-Fowler et al. 2013).

1.5.3.2 External Moderators

External moderating variables are external factors that influence the strength and intensity of the CS–CFP relationship. I categorize these moderators into three areas: 1) stakeholder influence, 2) industry characteristics, and 3) the business environment.

Stakeholder influence. The financial value of CS is contingent upon the ability to influence stakeholders and their perception of the firm's CS activities (Grewatsch and Kleindienst 2017). Thus, a firm's CS involvement is only beneficial when it gains legitimacy from the stakeholder. Clear communication and reliable information create awareness and allow

stakeholders to assess the firm's CS performance (Jayachandran, Kalaignanam, and Eilert 2013). However, due to information asymmetry and uncertainty between different stakeholders, firms need to work on their CS reputation and communication (Van der Laan, Van Ees, and Van Witteloostuijn 2008). Therefore, firms need to reduce the information gap through mechanisms such as advertising intensity (Servaes and Tamayo 2013), high qualitative CS reports (Schreck 2011), and consistent good treatment of different stakeholders over time (Wang and Choi 2013). As stakeholders discover more about the firm's CS engagement, they will reward such efforts through CFP (Grewatsch and Kleindienst 2017).

Industry characteristics. The nature of the CS–CFP relationships vary across industries due to the heterogeneity of the environmental, social, and financial concerns each industry operates under (Baird, Geylani, and Roberts 2012; Schreck 2011). Since a firm's CS approach is a response to industry-specific stakeholder demands, such demands vary in terms of levels of activities and the areas of interest (Baird, Geylani, and Roberts 2012). In addition, stakeholder demands differ between clean industries, less pollution-intensive industries, or high pollution-intensive industries. Industries with a negative environmental reputation face higher media attention, regulations, and pressure from stakeholders (Dixon-Fowler et al. 2013). However, they have more to win from improvements in environmental performance (Schreck 2011). Therefore, CS–CFP linkage may be stronger in bad (versus clean) industries because they earn greater legitimacy (Baird, Geylani, and Roberts 2012; Schreck 2011).

In addition to the environmental reputation of an industry, the moderating role of industry growth (Russo and Fouts 1997) or the industry life cycle (Brammer and Millington 2008) has been explored. Based on the resource-based view of the firm (RBV), organizational benefits of CS are higher in high-growth industries than in low-growth industries (Russo and Fouts 1997).

High-growth industries have fast growth rates and are more profitable than other industries, which makes them more attractive for entries by new players. Also, firms in high-growth industries are more successful with their CS than firms in low-growth industries due to a general higher attitude to riskier investments, a more flexible and organic organizational management structure, and the promotion of intangible assets (e.g., reputation) to differentiate from competitors and new players (Russo and Fouts 1997).

Business environment. Various studies have considered the characteristics of the business environment. This includes the macro view on external norms, regulations, governmental subsidiaries, tax incentives, interest rates, and research from universities (Aragon-Correa and Sharma 2003; Flammer 2013). External pressure toward the institutionalization of sustainability impacts the value of CS. As more CS becomes an institutional norm, firms are punished for non-sustainable behavior (Flammer 2013). Consequently, as firms employ more of the CS norms, they are less rewarded for their CS activities (Flammer 2013).

Equally important are the characteristics of the business environment. Uncertainty, complexity, and hostility of the general business environment require different strategic CS approaches (Aragon-Correa and Sharma 2003). Based on "contingent RBV theory", a proactive environmental strategy can achieve a competitive advantage only in an uncertain and complex environment, because for competitors it is difficult to imitate the obtained particular information and environmental capabilities. In contrast, munificence or a low hostile environment makes it easier for competitors to obtain this information about a firm's proactive environmental strategy and to duplicate these capabilities. Thus, it becomes more difficult for firms to follow a consistent environmental strategy which weakens the relationship between CS and CFP (Aragon-Correa and Sharma 2003).

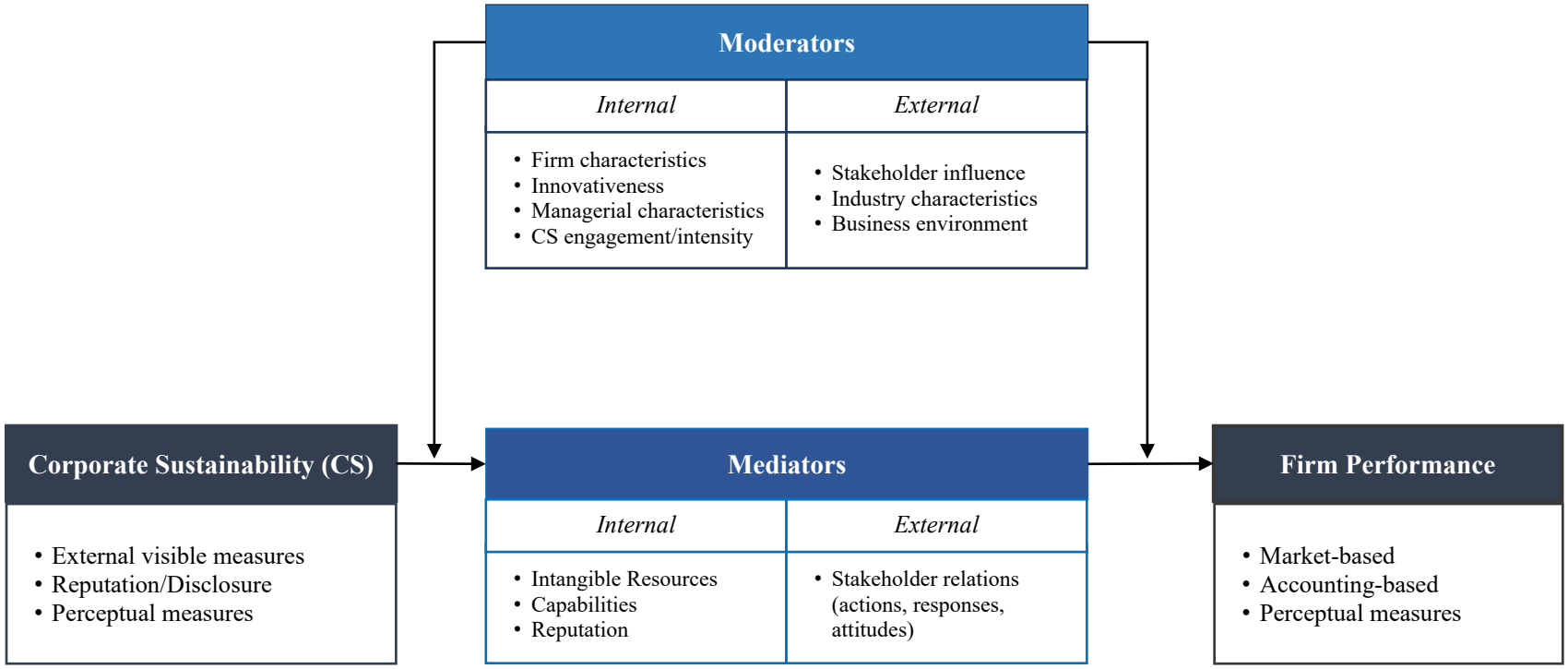


Figure 1. Framework of CS-Firm Performance (FP) and Contingency Factors

Based on this analysis, I delineate a conceptual framework that holistically captures the main constructs of CS and CFP along with the mediators and moderators in Figure 1.

1.6 TOPIC MODELING APPROACH

The topic modeling is considered a low-cost, replicable way of examining literature. First, words themselves embedded within each document (article) serve as the units of analysis and allows for researchers to make causal inferences from conceptual papers to measure terms, formalize patterns and concepts, automatically discover hidden latent structures from large text corpora (Berger et al. 2020; Nelson 2020). Second, it is an effective method for discovering useful structures in collections of data (Blei 2012). The discovery of new topics does not require trained data as it's an unsupervised machine learning-based content analysis technique and serves as a way of conducting "exploratory" literature reviews (Liu et al. 2016; Reisenbichler and Reutterer 2019). Lastly, it enables the *visualization* of topics for internal and external validation (Asmussen and Møller 2019).

For topic modeling, I extracted the abstracts of the papers by using scrapping techniques and based on accessing the articles through their digital object identifier (DOI) addresses. Prior to data analysis, documents were preprocessed using the following sequence of steps:

1. Splitting text into sentences identified through ".", ",", "!", or "?"; after the sentence split, all punctuation is removed.
2. Substituting capital letters with lower-case letters
3. Remove characters and tokenize

4. Removing stop words using a standard vocabulary of stop words in the English language. Also, include stop words such as 'author', 'paper', 'study', 'sample', 'result', 'literature', 'research' which make no contribution to the identification of topics
5. Create bigrams and trigrams models, then lemmatize to keep only the nouns. Lemmatization is generally better than stemming for topic modeling since it provides more information. Also, lemmatization looks at the surrounding text to determine a given word's part of speech and does not categorize phrases. Therefore, I avoid stemming as it may eliminate differences in meaning which, for identification and interpretation of latent topics, is not desirable.
6. Create corpus for analysis using LDA models and visual results

LDA is driven by two assumptions: 1) each document contains a number of topics (the hidden variables) which are represented by a fixed number of words (the observable variables), and 2) the proportions of topics vary in each document (Jaworska and Nanda 2018). As with any other method, this technique also comes with a number of caveats.

First, the number of topics needs to be specified by the researcher and since there is no given ideal number of topics, this may seem rather arbitrary. Given the probabilistic nature of the technique, a different number of topics will yield slightly different results. Thus, this should depend on measurements but also should be based on the knowledge of the field and how many themes one can reasonably expect to appear in the studied corpus (Jaworski and Nanda 2018).

Second, the labeling of topics need to be specified by the researcher since there is no given ideal solution (Berger et al. 2020). Topic modeling tools give each topic only a numerical ID and it is up to the researcher to name the topics based on the retrieved list of words and word

combinations. Hence, labeling is an intuitive process that relies on the researcher's knowledge and expertise in the field (Jaworska and Nanda 2018).

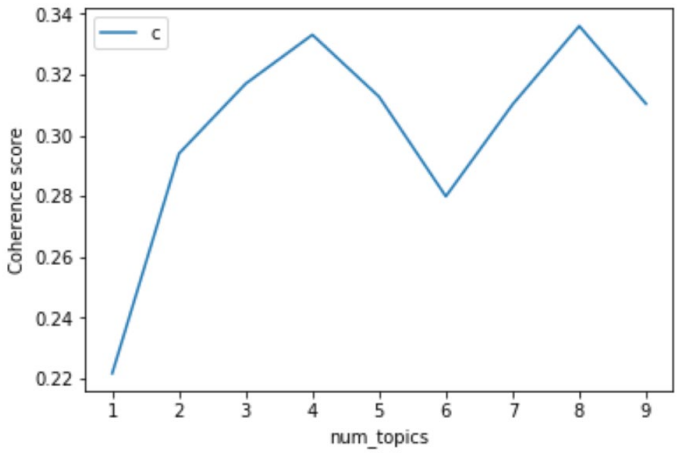


Figure 2. Coherence Scores for the Optimal Number of Topics

To address these issues, I first ran topic coherence measures which are designed for LDA and match well with human judgments of topic quality. Topic coherence measures the score of a single topic by measuring the degree of semantic similarity between high-scoring words in the topic. These measurements help distinguish between topics that are semantically interpretable topics which are artifacts of statistical inference. Figure 2 shows the results for coherence scores. Coherence scores initially peak at the levels of four and then at eight topics.

In addition to coherence measures, I based my decision on the number of topics by observing the KLD rating scheme. KLD is widely used in business studies to measure CS performance and includes sub-categories across seven main themes (environmental, governance, product, community, human rights, employee relations, diversity). However, not all topics are

covered within the literature with a tendency to conducting studies that concern verifiable CS efforts in the following areas – environment (e.g., clean energy), products (e.g., green/sustainable products), corporate governance (e.g., board orientation and top management commitment), employees (e.g., employee engagement). Thus, I conclude that the optimal number of topics is four (K=4) but further examine their context to derive the optimal number for coherence. Based on these results, I present the results of the topic models in Figure 3.

1) Sustainable Innovations/Products

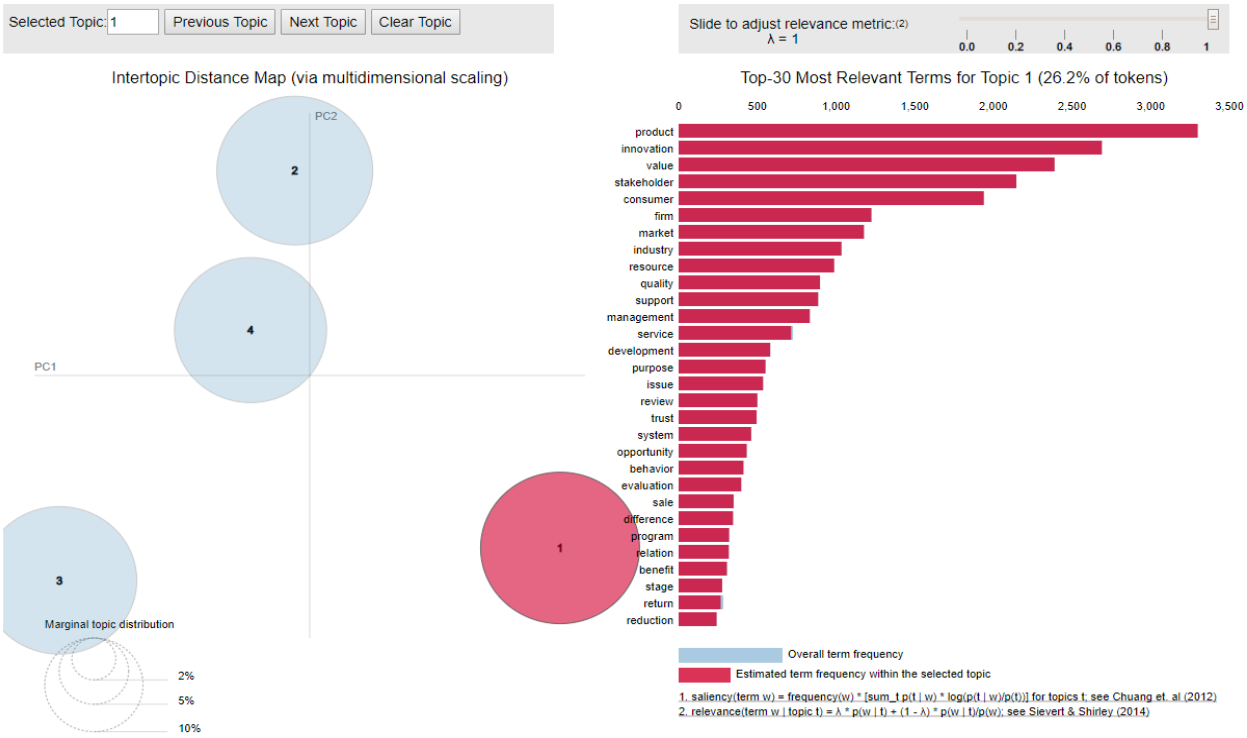
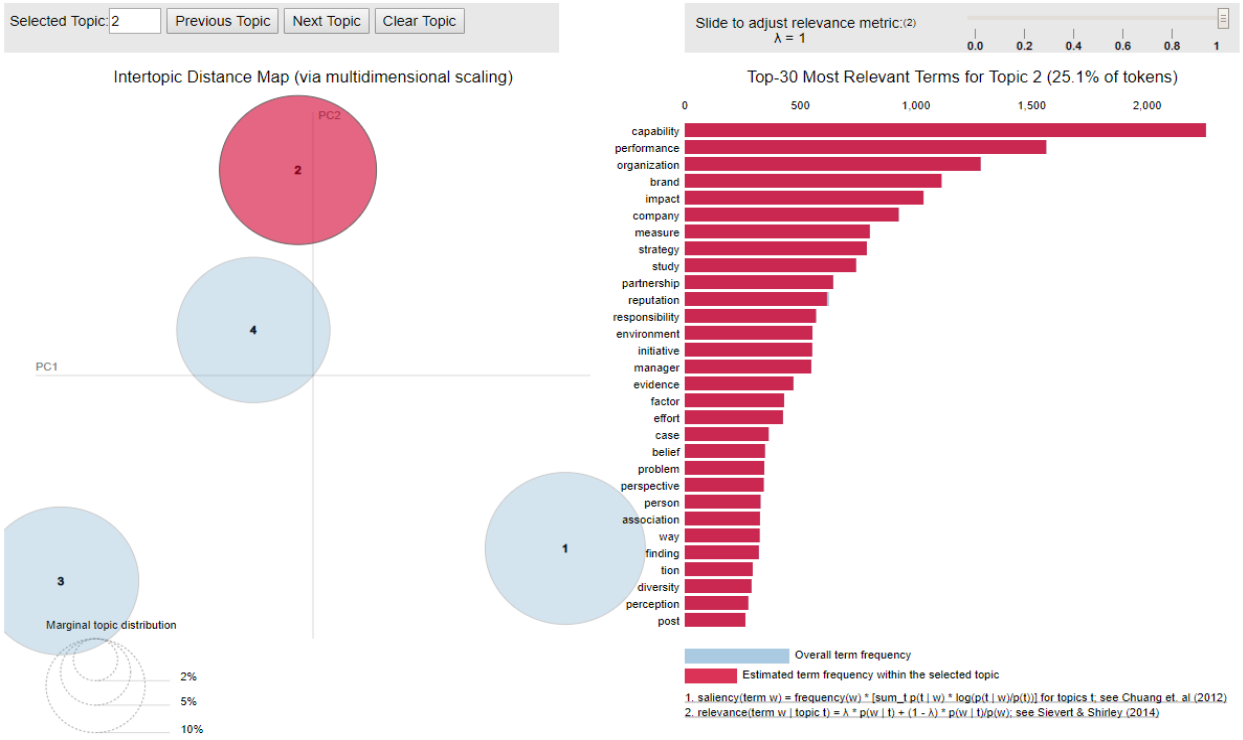


Figure 3. Topic Modeling Results

2) CS Capabilities



3) Firm CS Engagement

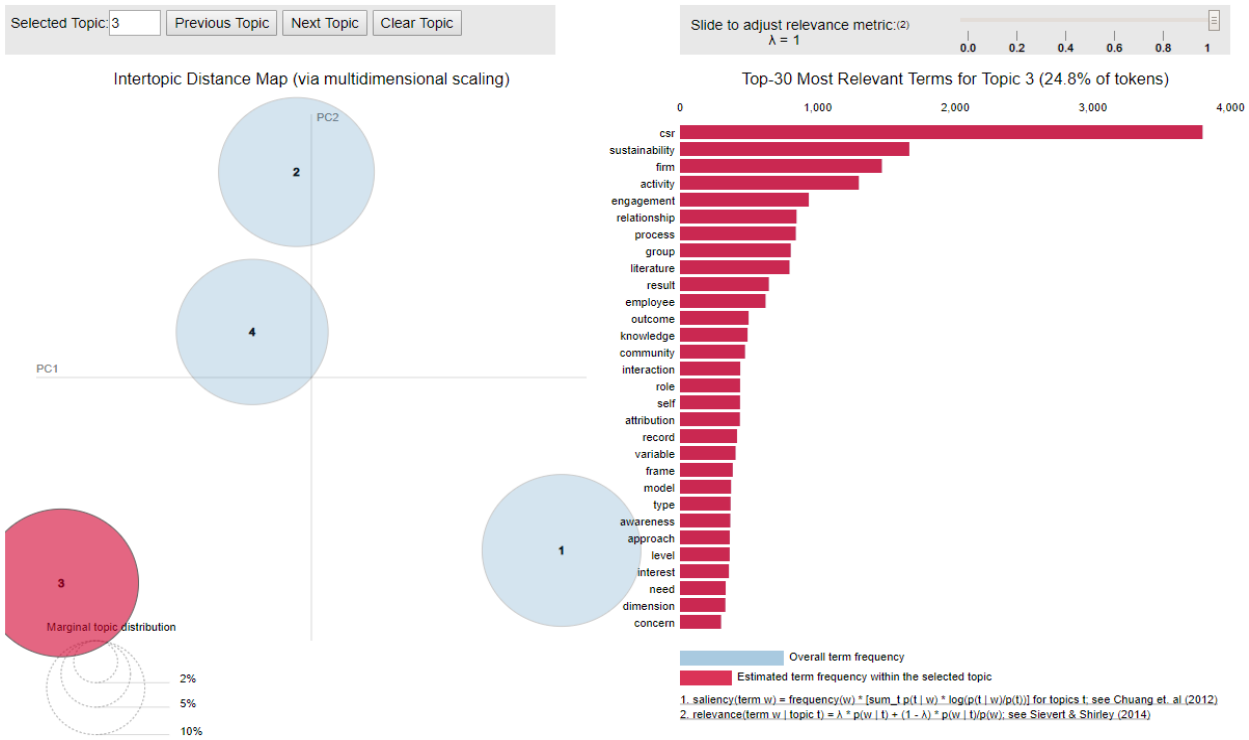


Figure 3 (continued)

4) Stakeholder Management

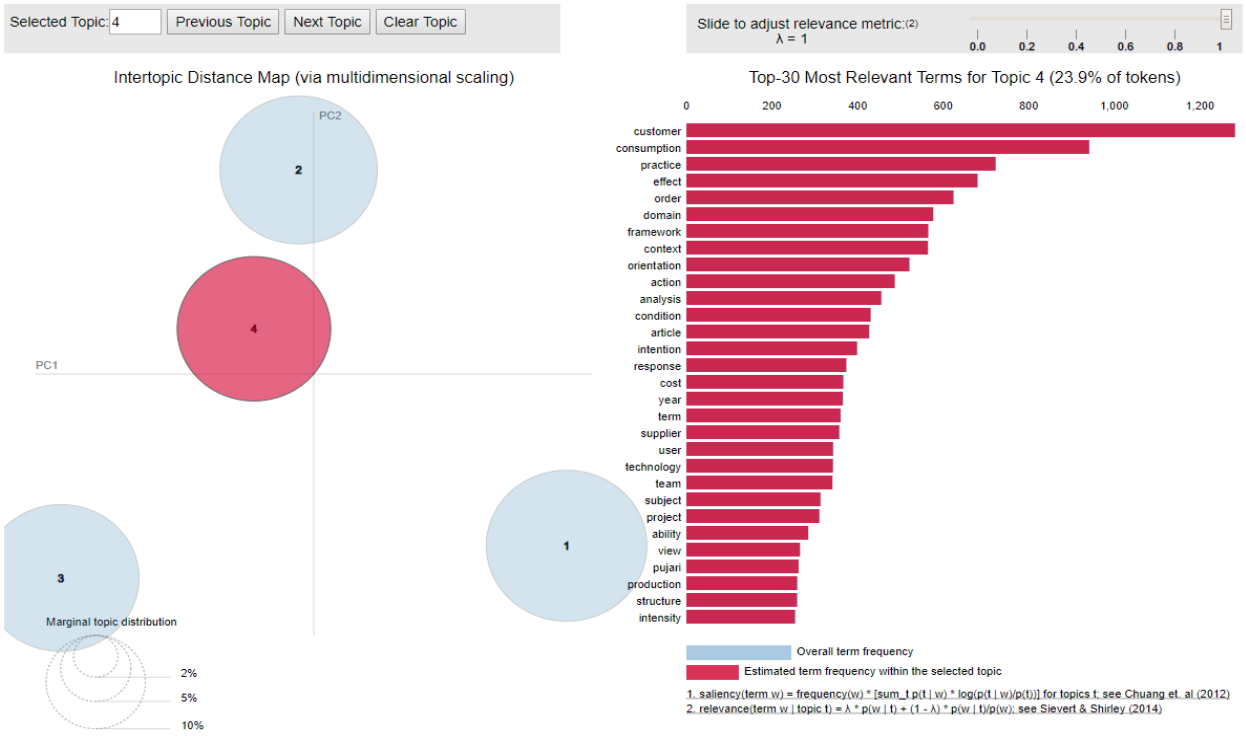


Figure 3 (continued)

1.7 RESEARCH INSIGHTS

Based on the combined analyses of the systematic review and topic modeling approach, I construct the following research propositions. The four topics in the model can be summarized into four areas for future research – 1) Sustainable Innovations & Products, 2) CS Capabilities, 3) Firm CS Engagement, and 4) Stakeholder Management. In addition, I connect these areas with the elements identified in the previous section on mediators and moderators of CS literature.

Research insight 1: *Sustainable innovations/products* are new to market or existing products/processes that are modified to provide environmental and social benefits to consumers. These serve as *internal moderators* in the CS-Firm performance link and represent *innovativeness* and *CS engagement/intensity*.

Sustainable innovations and products signal to stakeholders, both commercial and societal, that the firm is committed to sustainability initiatives. Also, this is relevant and easier to understand for customers as it caters to them by focusing on high-quality innovative products with social benefits. For firms, they are rewarded by investors for being responsive in addressing product quality and safety concerns (Hong and Liskovich 2015; Jayachandran, Kalaignanam, and Eilert 2013; Leonidou, Katsikeas, and Morgan 2013; Servaes and Tamayo 2013).

Research insight 2: *CS capabilities* pertain to integrating environmental, social, and economic issues into firms' strategies to enhance both processes and firm performance. From the framework, these are the *internal mediators* of *intangible resources* and *capabilities.*

The inclusion of the dimensions of social, environmental, and economic issues are in line with seminal papers that look into the triple bottom line and natural-resource-based view of the firm (Elkington 1997; Hart 1995; Hart and Dowell 2011). Companies with high CS capabilities outperform their counterparts as they have more established processes for stakeholder engagement, are more long-term oriented, and exhibit higher measurement and disclosure of non-financial information (Eccles, Ioannou, and Serafeim 2014). In addition, firms with high CS capabilities are able to allocate more resources for the development of sustainable products, routines, and capabilities (Pujari, Wright, and Peattie 2003).

Research insight 3: *Firm CS engagement* involves how employees and top management identify themselves with green companies, which leads to increased loyalty to the company and job satisfaction. This serves as an *internal moderator* and is associated with *firm characteristics, managerial characteristics, and CS engagement/intensity.*

Firm CS engagement inspires employees and management to identify themselves more with green companies leading to increased loyalty and job satisfaction (Korschun, Bhattacharya, and Swain 2016). For employees such as front-line staff, this promotes buy-in on the firm's CS initiatives and empowers them to advocate and communicate these views to customers through interactions (Homburg, Stierl, and Bornemann 2013). In addition, employees become more motivated when they perceive support from top managers who can inspire and support them to embrace sustainable practices and ethics (Menguc, Auh, and Ozanne 2010).

Research insight 4: *Stakeholder management* concerns the understanding of and responding to the voice of commercial and societal stakeholders and serves as an *external mediator*. In the framework, it represents *stakeholder relations*.

The consideration and inclusion of stakeholders into the framework is not necessarily a novel perspective. Yet, the perspective I take is more in the line with *instrumental* stakeholder theory (Donaldson and Preston 1995; Jones 1995), which emphasizes the link between stakeholder-directed activities (means) and corporate performance outcomes (ends). Stakeholder-directed activities need to create benefits that stakeholders value in order to enhance performance (Bhattacharya, Korschun, and Sen 2009; Homburg, Stierl, and Bornemann 2013). Also, companies need to identify stakeholder values created from CS activities to increase trust, social capital, and reputation (Cheng, Ioannou, and Serafeim 2014; Luo and Bhattacharya 2009; Mishra and Modi 2016; Lins, Servayes, and Tamayo 2017).

1.8 CONCLUSION AND FURTHER RESEARCH

In this essay, I have reviewed the literature with a focus on moderators and mediators in the CS–CFP relationship. Based on this contingency perspective, I have also categorized these key constructs into the internal and external domains of the firm. Also, I conducted topic modeling to complement the systematic review and have identified several themes to further research in the CS-CFP link using these combined methods.

However, there are limitations to the use of text-mining techniques that reduce the content of the documents to simple collections of terms. Thus, the findings depend on the researcher's interpretations of the results. Particularly, the labeling of the topics is based on the subjective opinion of the author. Still, I am convinced that the labels represent the content of each topic which is agreed upon by various scholars in the CS literature. Yet, this area still requires a deeper and more fine-tuned approach to understanding the various constructs used in the literature in both theory and methods.

One solution may be to combine the approach of a meta-analysis to strengthen arguments and justifications for the mediators and moderators. Another area of improvement would be to utilize techniques to enhance the performance of topic modeling. Methods such as guided LDA approaches (Toubia et al. 2019) or anchored correlation explanation (CorEx) (Gallagher et al. 2017) that can flexibly incorporate the use of word-level domain knowledge may be considered in the future. Other approaches that address word interdependencies and ordering using neural networks may be fruitful avenues to pursue (Handlan 2020, Yang et al. 2020).

CHAPTER II

DO SUSTAINABLE NEW PRODUCTS CONTRIBUTE TO FIRM VALUE? [3]

[3] Kim, Youngtak M. and Sundar Bharadwaj. Submitted to the *Journal of Marketing Research*, 6/21/20.

2.2 ABSTRACT

Consumer demands for sustainable products are growing and serving as key drivers of sales growth. As a result, companies have higher incentives to create sustainable products that serve consumer needs to increase firm value. However, the corporate sustainability (CS) literature has neglected product-related CS initiatives, especially in the context of financial outcomes. Therefore, this essay seeks to determine whether and when *sustainable product innovations* contribute to firm value. Drawing on the marketing literature on sustainability and using product benefit claims and description information, the authors develop a typology for categorizing sustainable products. Natural language processing methods complement and help refine the classification. I develop a conceptual model and hypotheses linking sustainable product innovation intensity to firm performance moderated by market-based assets. An empirical test of over 12,000 new products introduced over an eight year period shows that sustainable product types *do* have heterogeneous effects on firm value, and market-based assets such as sustainable innovation ability, product innovativeness, and branding strategies moderate this relationship. Additional analysis of the categorization of the sustainable product types using choice-based conjoint analysis finds that consumers show a similar pattern of preferences for sustainable benefits in product innovations to investors.

2.3 INTRODUCTION

Sustainability has become a key driver of sales for consumer products with the U.S. market for sustainable consumer packaged goods (CPG) projected to reach $150 billion by 2021 (Nielsen 2019). Sales of products with sustainable claims rose by 5.8%, in stark contrast to their conventional counterparts at 0.4%. Consumers are seeking products with sustainable benefit claims (e.g., organic, fair-trade, non-artificial) and connecting such attributes with values of higher quality, superior functionality, and safety, thus leading to higher price premiums for these products (International Food and Information Council (IFIC) 2019; Nielsen 2019). Studies report that 46% of global consumers are willing to forgo brand names to buy sustainable products while 73% of the world is willing to change consumption habits to reduce their impact on the environment (Nielsen 2019). Companies are also embracing sustainability as both a strategic necessity and differentiator (Ioannou and Serafeim 2019). Increasingly the investor community is emphasizing the incorporation of sustainability-related actions as a criterion for their investment decisions.[4] Not only are firms more actively disclosing information about their sustainability or ESG statuses, more importantly, they are also incorporating sustainability into their product offerings in terms of organic ingredients, eco-friendly packaging, and recycled materials (Nielsen 2019). For example, Unilever reveals that its sustainable brands grew 46% faster than the rest of the business and delivered 70% of its sales turnover growth (Unilever 2018). Certified B Corps (benefit corporations) in the U.K. have experienced an average year-on-year growth rate of 14%, which is 28 times higher than the national average (Sustainable Brands 2018).

[4] https://www.morganstanley.com/ideas/sustainable-investing-growing-interest-and-adoption; https://www.blackrock.com/corporate/literature/publication/blk-esg-investment-statement-web.pdf

Therefore, firms' interest in meeting the needs of other stakeholders beyond investors has become a driver of strategies towards sustainable products (Kotler 2011; Whelan and Fink 2016).

Sustainable product innovations (SPI) refer to modifications of existing or new to market products that provide environmental, social, and health benefits to consumers (Belz and Peattie 2009; Cronin et al. 2011). Such products have claims (e.g., fair trade, organic, recycled) that make their benefits more visible and easier to communicate to stakeholders (Dangelico and Pujari 2010). As a result, sustainable product innovations enable firms to meet environmental imperatives, build competitive advantages and propel future growth (Nidumolu, Prahalad, and Rangaswami 2009).

Despite its growing significance, there is limited empirical research on sustainable product innovations in the established corporate sustainability (CS) literature (Cronin et al. 2011; Katsikeas, Leonidou, and Zeriti 2016). Studies rarely distinguish between the types of sustainable products and primarily focus on integrating environmental issues into upstream/non-customer facing aspects of product development – reducing the use of materials, energy, or negative production externalities (e.g., air, water, noise pollution, and harmful materials). The reduction of negative externalities may be monetized by firms (e.g., cost reduction, increased efficiencies), however, the value of environmental and social benefits are difficult for consumers or investors to determine (Belz and Peattie 2009). More problematic is that not all sustainable products are perceived as valuable by customers and beneficial to firms. In fact, research finds that consumers may see sustainability attributes as attenuating product performance, i.e., a sustainability liability (Luchs et al. 2010). While firms continue to make significant investments in sustainable products, it is uncertain if all of these products will be viewed positively by the financial market (Nielsen 2019). I seek to address the following questions:

1. Whether and when do sustainable product innovations create value for the firm?
2. Are certain types of sustainable product innovations more conducive to creating firm value than others?
3. What firm characteristics moderate the relationship between sustainable product innovations and firm value creation?

This essay contributes to the literature and managerial practice in the following ways. First, I contribute to the intersection of marketing product innovation and sustainability by introducing a typology of sustainable product innovations based on benefit claims (e.g., organic, recycled, fair-trade) that deliver value on the dimensions of environmental, social, and healthy to meet the growing needs of the consumer. Past research examines performance implications of sustainable products but does not differentiate among its types (Olsen, Slotegraaf, and Chandukala 2014) or focuses on a single benefit claim such as organic (Bezawada and Pauwels 2013; Van Doorn and Verhoef 2015) or natural (Olsen, Germann, and Eilert 2020). Second, I demonstrate the financial market value that these different sustainable product innovations bring to the firm using financial performance measures from secondary data sources. Prior research has largely focused on survey methodologies to collect data and observe performance through operational and product development efficiency measures that can vary across studies (Katsikeas et al. 2016). The use of secondary data allows us to examine multiproduct firms using a product portfolio approach of both conventional and sustainable products over time because financial performance depends on firm-level business practices and resources. Third, I extend this literature stream by drawing on the resource-based view and market-based assets literature to examine managerially actionable factors that moderate the effect of sustainable product innovations on financial market value.

This essay is useful in demonstrating to senior managers the linkages between firm marketing efforts in sustainable products and performance metrics that matter at the CXO level (Katsikeas et al. 2016). I provide managers nuanced insights regarding the types of sustainable product innovations that financially benefit firms. Further, I identify managerially actionable factors that enhance the sustainable product innovation-firm value relationship to help managers anticipate when they should expect to benefit from investments in sustainable products. An additional analysis using a choice-based conjoint of sustainable benefit claims with a consumer sample should provide managers the confidence that the financial impact comes through by affecting consumer preference for sustainable products.

The rest of the essay is organized as follows. First, I present a review of relevant empirical studies on sustainable product innovations. Next, I introduce the typology of sustainable products and discuss their theoretical underpinnings, and present hypotheses regarding their relationship with firm value along with the role of moderators. I then empirically test the hypotheses using panel data assembled from multiple sources on new product introductions in the CPG industry, controlling for firm- and industry-specific factors and endogeneity. In an additional analysis, I conduct a choice-based conjoint analysis with consumers to test the preference, purchase intent, and willingness to pay for the theorized sustainable product innovation types in comparison to conventional new products. I conclude with a discussion of the findings and their implications, followed by limitations and directions for future research.

2.4 RELEVANT LITERATURE REVIEW

The focus of CS literature has been on the issues concerning corporate philanthropy or business practices with limited research about product-related CS. Most CS programs have excluded product-related initiatives because they are not expected to have much impact on functional or performance-related factors (Hoeffler and Keller 2002). The emphasis is evident in the disproportionate number of studies on corporate philanthropy or business practice CS in contrast to product-related CS. In a systematic review on CS, Peloza and Shang (2011) report that about 65% of studies are associated with corporate philanthropy (cause-related) and 51% in business practices (employee relations, fair trade). Only 19% are product-related CS, but these studies do not explicitly measure the value created by products through CS initiatives, despite their "potential to provide the broadest spectrum of value to consumers" (Peloza and Shang 2011, p.121). Studies instead consider "product" as one of many dimensions within a company's overall CS initiative (e.g., Gilley et al. 2000; Jayachandran, Kalaignanam, and Eilert 2013; Mishra and Modi 2016). Some acknowledge the significance of product innovations in CS, however, consider them as separate areas that firms invest in to achieve competitive advantage (e.g., Hull and Rothenberg 2008; Surroca, Tribó, and Waddock 2010). Consequently, the limited research specific to product-related CS is mostly conceptual and focuses on the integration of environmental issues into product development and innovation (e.g., Cronin et al. 2011; Varadarajan 2017). Table 3 summarizes empirical research on the sustainable product innovations–firm performance link.

Table 3. Empirical Studies on Sustainable Product Innovations and Firm Performance

Study	Data source	Nature of data	SPI variable	Firm performance variable	Type of SPI	Correct for endogeneity
Pujari, Wright, and Peattie (2003)	Survey	Cross-sectional	Environmental new product development (ENPD)	ENPD project market performance	N.A.	No
Sroufe (2003)	Survey	Cross-sectional	Environmental design practices	Operational performance	N.A.	No
González-Benito and González-Benito (2005)	Survey	Cross-sectional	Environmental product design and internal production processes	Operational performance	N.A.	No
Chen, Lai, and Wen (2006)	Survey	Cross-sectional	Performance of green product and process innovation	Corporate competitive advantage	N.A.	No
Pujari (2006)	Survey	Cross-sectional	Eco-innovation activities in ENPD	ENPD project performance	N.A.	No
Montabon, Sroufe, and Narasimhan (2007)	Corporate environmental reports	Cross-sectional	Environmental design, product and process innovation	ROI, sales growth	N.A.	No
Zhu, Sarkis, and Lai (2007)	Survey	Cross-sectional	Eco-design	Operational performance	N.A.	No
Fraj-Andrés, Martinez-Salinas, and Matute-Vallejo (2009)	Survey	Cross-sectional	Eco-design and green products	Operational performance	N.A.	No
Chang (2011)	Survey	Cross-sectional	Green product innovation	Competitive advantage	N.A.	No
Rennings and Rammer (2011)	Survey	Cross-sectional	Regulation-driven environmental innovations	Price–cost margin	N.A.	Yes (Heckman)
Doran and Ryan (2012)	Survey	Cross-sectional (pooled data)	Eco-innovation	Employee turnover	N.A.	Yes (Heckman)
Kam-Sing Wong (2012)	Survey	Cross-sectional	Green product & process innovation	Green new product success	N.A.	No
Zhu, Sarkis, and Lai (2012)	Survey	Cross-sectional	Eco-design	Operational performance	N.A.	No
Chen and Chang (2013)	Survey	Cross-sectional	Green dynamic capabilities	Green product development performance	N.A.	No
Dangelico, Pontrandolfo, and Pujari (2013)	Survey	Cross-sectional	Green manufacturing and product design	Creation of new opportunities, NPD sales and profitability	N.A.	No

Kurapatskie and Darnall (2013)	Firm sustainability reports	Cross-sectional	Sustainability activities (product and process)	Firms' reported financial benefit	N.A.	No
Leonidou, Katsikeas, and Morgan (2013)	Interviews	Cross-sectional, longitudinal (2 years)	Green marketing mix (product)	Product-market performance, Return on assets (ROA)	N.A.	No
Lin, Tan, and Geng (2013)	Survey	Cross-sectional	Green product innovation	Market position, reputation, sales volume, profit	N.A.	No
Amores-Salvadó, Martín-de Castro, and Navas-López (2014)	Survey	Cross-sectional	Environmental product innovation	Returns on assets (ROA), sales (ROS), capital employed (ROCE)	N.A.	No
Li (2014)	Survey	Cross-sectional	Environment innovation practices	Operational performance	N.A.	No
Mitra and Datta (2014)	Survey	Cross-sectional	Environmentally sustainable product design and logistics	Economic performance, competitiveness	N.A.	No
Olsen, Slotegraaf, and Chandukala (2014)	Secondary data	Panel data (4 years) - year, industry FE	Green new product introductions	Change in brand attitude (EquiTrend)	N.A.	Yes (3SLS)
Hartmann and Germain (2015)	Survey	Cross-sectional	Ecological product design	Manufacturing performance	N.A.	No
Jabbour et al. (2015)	Survey	Cross-sectional	Green product development	Operational, market, environmental performance	N.A.	No
Katsikeas, Leonidou, and Zeriti (2016)	Survey	Cross-sectional, longitudinal (2 years)	Eco-friendly product development	Product development effectiveness	N.A.	Yes (Heckman)
Dangelico (2017)	Survey	Cross-sectional	Green product characteristics	Green product market performance	Radical	No
Dangelico, Pujari, and Pontrandolfo (2017)	Survey	Cross-sectional	Eco-design and green innovation capabilities	Green product market performance	Radical	No
Ma et al. (2018)	Survey	Cross-sectional	Green product innovation	Customer satisfaction, customer retention, market share	N.A.	No
Yao et al. (2019a)	Secondary data	Panel data (4 years)	Eco-product and process innovation	Tobin's q (China Stock Market Financial Database)	N.A.	Partially (lagged variables)
Yao et al. (2019b)	Secondary data	Panel data (3 years)	Green product and process innovation	Brand equity (World Brand Lab annual reports)	N.A.	No
Zhou et al. (2019)	Survey	Cross-sectional	Green management	New product performance	N.A.	No
This research	**Secondary data**	**Panel data (8 years) - firm, year, industry FE**	**Sustainable new product introductions**	**Market value, Total q (Compustat/CRSP)**	**Environmental, Societal, Healthy, Radical**	**Yes (Heckman, Gaussian copulas)**

First, the review suggests that prior studies focus primarily on innovations that reduce the use of materials, energy, and negative production externalities (e.g., air, water, noise pollution, and harmful materials – "environmental"). Second, they use operational (González-Benito and González-Benito 2005; Zhu, Sarkis, and Lai 2012), manufacturing (Chang 2011; Mitra and Datta 2014), or product development effectiveness metrics as performance measures (Chen and Chang 2013; Katsikeas, Leonidou, and Zeriti 2016). While focusing on the cost reduction or efficiencies to mitigate the negative externalities (environmental) offers benefits for the firm, this may not resonate with consumers who value customer-facing actions, such as the social aspects of sustainable products (Belz and Peattie 2009). Third, most studies use survey or interview methodologies to collect cross-sectional data from non-U.S. companies, only a few correct for endogeneity (e.g., Katsikeas, Leonidou, and Zeriti 2016; Olsen, Slotegraaf, and Chandukala 2014). I address these gaps by studying the effect of sustainable product innovations that deliver environmental, health, and social benefits on investor and consumer responses and account for the strategic choice induced endogeneity in the empirical analysis.

2.5 THEORY AND HYPOTHESES

2.5.1 Typology of Sustainable Product Innovations

Since the emergence of the triple bottom line (TBL) and sustainability considerations, the primary focus has been on integrating the dimensions of environmental, social, and economic aspects into business practices as well as measuring firm performance and success (Elkington 1997; Van Marrewijk 2003). Scholars have expanded the concept of the triple bottom line into the consumer context to focus on the customer and to address challenges of sustainable consumption (Sheth, Sethia, and Srinivas 2011). From the consumer's perspective, sustainable

consumption has emerged in seeking to optimize the environmental, social, and economic consequences of the acquisition, use, and disposition of products to meet the needs of both current and future generations (Balderjahn et al. 2018; Phipps et al. 2013). Sheth and colleagues (2011) introduce the concept of "mindful consumption," the guiding focus to a customer-centric approach to sustainability that recasts the three sustainability dimensions (environmental, social, and economic) into the dimensions of caring for nature, community, and self.

Building on this framework, I categorize the types of sustainable products into three dimensions – environment (akin to caring for nature), social (related to caring for community), and healthy (akin to caring for self). First, prior literature has provided grounds for the dimensions of environmental and social conditions of sustainable products. Recent review papers highlight that the social and environmental dimensions of sustainable products are those that consumers associate most strongly with sustainability attributes (Catlin, Luchs, and Phipps 2017). Consequently, most sustainable labels focus on either the social or environmental dimension or a combination of both (Ecolabel Index).[5] Seminal papers in the sustainability literature also distinguish between environmental products and sustainable ones. Belz and Peattie (2009) define sustainable products, in comparison with purely environmental ones, as those that satisfy both *environmental* and *social* needs, in addition to customer requirements. Luchs et al. (2010) also view sustainable products as those that have positive attributes in the dimensions of social and environmental. Second, consumers consider the greater good (i.e., environment and social) and self-interest as part of a trade-off in market exchange relationships (Campbell and Winterich 2018). This implies that along with environmental and social aspects, self-interest is the basis for many market exchanges. Satisfying customer needs is essential to the survival of

[5] http://www.ecolabelindex.com/ecolabels/

sustainable products in the market (Belz and Peattie 2009). Also, the economic dimension of the TBL is a necessary condition for sustainable consumption that has often been neglected (Balderjahn et al. 2018). I translate the economic conditions of the TBL to the utility and functional benefits to customers (i.e., healthy) as a dimension of sustainable product innovations (Choi and Ng 2011; Huang and Rust 2011). I present my framework of the three dimensions and their specific benefit claims from the CPG industry in Figure 4.

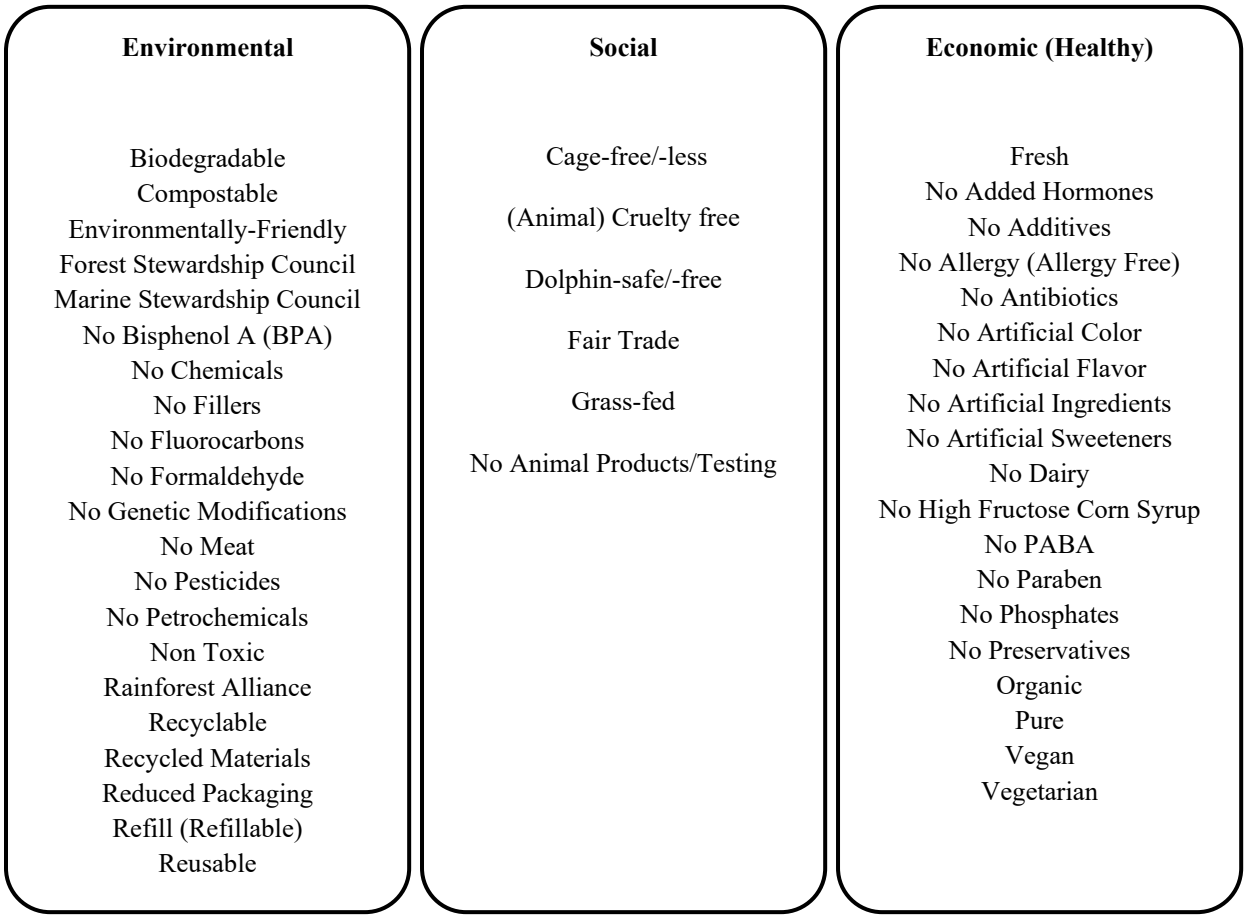


Figure 4. Sustainable Benefit Claims

Note: All benefit claims and descriptions are directly from GlobalData's Product Launch Analytics database

2.5.2 Single versus Multi-label Sustainable Product Innovations

Sustainable benefits across the three dimensions of environmental, social, and healthy may differ by the products and companies that launch them. A firm may choose to launch sustainable products by focusing on a few, specific benefit claims ("single-label") or release products with many benefits claims that go across multiple dimensions ("multi-label").

I define *single-label* sustainable product innovations as product innovations that provide sustainable benefit claims focusing on a single dimension. For example, Snyder's of Hanover Braided Twists Pretzels have a single benefit claim of No Genetic Modifications ("Environmental"). From a competitive perspective, a single sustainable benefit is likely to be easier for competitors to copy as they are less complex and can be substituted more easily by other sustainability claims. A single benefit claim is unlikely to be rare and hence not a long-term source of competitive advantage (Reed and DeFillippi 1990). From a customer's perspective, an increase in benefit levels may enhance customer utility and increase preferences. However, consumers may get confused by complex sustainable information (i.e., involving more than one type of sustainable benefit) that reduces comprehension to negatively affect their product choices (Levy, Fein, and Schucker 1996). For these reasons, firms may choose to focus on a few benefit claims within a single type of sustainable to highlight the sustainable aspects of the products more effectively. The focused type of sustainability claims is offered along with the functional benefits – the price of entry or baseline requirements to consumers. Having fewer sustainable claims is likely to be more effective in enhancing the relationship between sustainable product innovations and customer purchase due to (1) information overload and limited processing capacity of consumers (Malhotra 1982), (2) lowering confusion by using a focused approach to communicating product benefits, and (3) better targeted at customer needs

(Park, Jaworski, and MacInnis 1986). In addition, less information is more easily and fluently processed by consumers (Alter and Oppenheimer 2009). Prior research has shown a negative relationship between the volume of sustainable claims to brand attitude (Olsen, Slotegraaf, and Chandukala 2014). Other studies find that information surplus results in lower comprehension and difficulty making product choices (Iyengar and Lepper 2000; Thompson, Hamilton, and Rust 2005). Focused sustainable product innovations will reap the benefits in the short term as consumers understand them more easily for an immediate "warm glow" or positive effect (White, Habib, and Hardisty 2019). The increased purchases of a sustainable product with a focused set of benefits will enhance cash flows and positively affect market value.

A focused and specific claim also provides clear information and facilitates investors' attempts to quantify the effectiveness of R&D and new product development processes. In turn, investors would see the firm as targeting the right customer segments with the appropriate sustainability claim and thus using the R&D and marketing investment in sustainability wisely. Stock market investors rely on accurate and easy to diagnose evidence when evaluating a firm's market value (Jayachandran, Kalaignanam, and Eilert 2013). A single claim sends a central and straightforward message to stakeholders that the company can provide concrete evidence supporting the claimed sustainable benefit (Vila and Bharadwaj 2017). Thus,

H_1: The greater the proportion of single-label sustainable innovations in a firm's portfolio of new product innovations introduced, the greater is the firm value.

Multi-label sustainable product innovations refer to product innovations that provide sustainable benefit claims across two or more different dimensions. Companies may utilize multiple sustainable benefit claims across the three domains – environmental, social, and healthy – to reinforce these characteristics. For example, Bolthouse Farms introduced juices with claims

of (1) No BPA, (2) No Genetic Modifications, (3) Organic, and (4) Vegan. These benefit claims consist of both Environmental and Health dimensions. The greater the number of claims used on product packages on average, the greater the degree of sustainable emphasis (Cao and Yan 2016; Chandon and Wansink 2007). For consumers, a longer list of product benefit claims may act as important persuasion motives to buy as they perceive greater capability (Thompson, Hamilton, and Rust 2005). Listing more reasons to buy is usually more informative to consumers than having only a few (Shu and Carlson 2014). For companies, a stronger and broader emphasis not only enhances its image perceived by the market, but also sends to investors a more positive signal about a firm's capability and product quality. In a financial context, investors evaluate cumulative evidence about products (Sorescu, Shankar, and Kushwaha 2007). A stronger emphasis is more likely to prompt investors to update their firm evaluations and elicit positive market responses. Further, having a broader set of benefit claims across multiple areas enable firms to attract consumers from differentiated and niche markets, leading to market expansion (Neiman and Vavra 2019). A complex and diversified set of benefits allows the company to differentiate itself from the competition and makes it more difficult for its rivals to imitate (Srivastava, Shervani, and Fahey 1998). However, having multiple types of sustainable benefits may take longer for consumers to understand its benefits, slowing adoption speed and longer to reflect in market value. Despite these slower responses, given the greater utility delivered to customers, I expect that both consumers and investors highly value a greater sustainable emphasis on these product innovations. Formally,

H_2: The greater the proportion of multi-label sustainable innovations in a firm's portfolio of new product innovations introduced, the greater is the firm value.

2.5.3 Moderating Effects of Corporate Ability and Branding Strategies

Research in corporate sustainability (CS) finds that CS does not universally produce the same performance outcomes for all firms. The effects of CS on outcomes such as consumer relationships or stock returns are contingent on factors such as (1) corporate ability with respect to the expertise in producing and delivering product offerings (Brown and Dacin 1997) or product innovative abilities (Luo and Bhattacharya 2006; Luo and Bhattacharya 2009), and (2) corporate branding strategies (Berens, Van Riel, and Van Bruggen 2005; Brown and Dacin 1997). The resource-based view (RBV) also argues that market-based assets can be leveraged to enhance benefits delivered to customers, thus moderating the effects of sustainable product innovations on firm value (Srivastava, Shervani, and Fahey 1998). Specifically, I consider sustainable innovation ability and product innovativeness as key factors reflecting corporate ability. Drawing on the related market-based asset literature, I treat the use of new (versus existing) brands as a strategic option that firms choose to implement when launching new products within their brand portfolio. Figure 5 presents my conceptual model that consists of (1) single and multi-label sustainable product innovations, (2) firm value, and (3) corporate ability and branding strategy as moderators of this relationship.

Moderating role of sustainable innovation ability. I define sustainable innovation ability as the prior number of sustainable product innovations launched by the firm. Firms with a history of sustainable product innovations would have built the capability to understand customer needs better for such products and the skills required to create innovations to address those needs. Further, they would be in a position to make appropriate changes to sustainable product innovations to meet evolving customer needs. The knowledge spillover between prior sustainable product innovations and newer offerings can facilitate the complexity and causal ambiguity of it

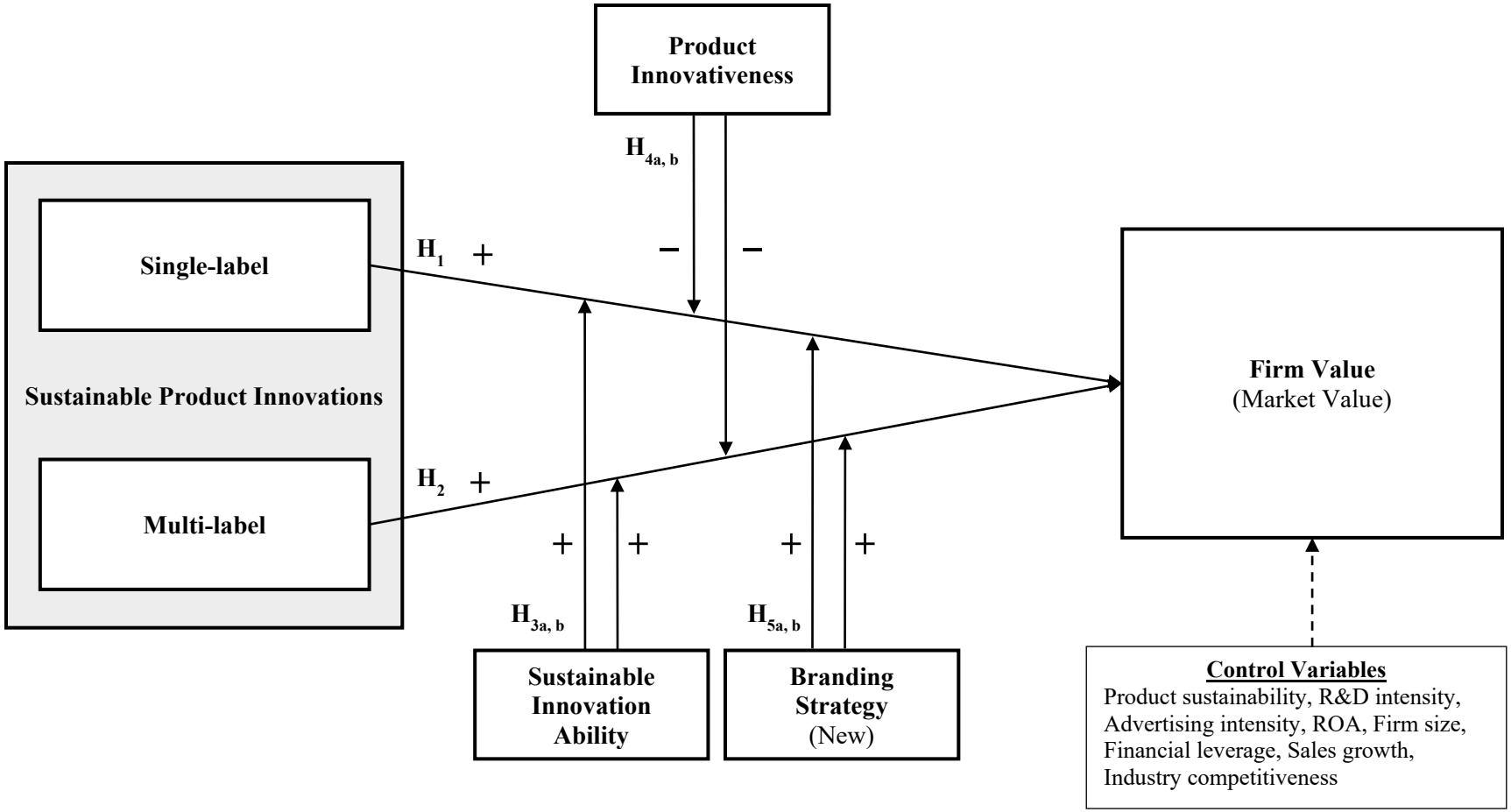


Figure 5. Theoretical Framework

resource endowments, protecting them from imitation by competitors (Reed and DeFillippi 1990). The history of past sustainable product innovations should enable a firm to gain greater returns from the current ones for the following reasons. First, firms with frequent new product introductions boost investors' expectations of their future innovative output, increasing their stock market value (Warren and Sorescu 2017). As new products are announced, their value is impounded into the market capitalization, leading to increases in firm value.

Second, a firm's history or track record of launching sustainable product innovations acts to increase confidence among stakeholders that the firm can "deliver on promise" (Homburg, Stierl, and Bornemann 2013; McWilliams and Siegel 2001). This increased confidence from investors and consumers about the firm's ability to deliver on sustainable claims will enhance their trust in the company and its sustainable product initiatives (Bhattacharya, Korschun, and Sen 2009; Homburg, Stierl, and Bornemann 2013). Firms with robust sustainability innovation practices can cater to consumers by emphasizing their heritage of high-quality new products with sustainable benefits (Mishra and Modi 2016). Together, firms with a history of launching sustainable product innovations will enhance customer and investor confidence, thus strengthening the effect that these product innovations have on firm value. Formally,

H_3: Sustainable innovation ability positively moderates the relationship between (a) single and (b) multi-label sustainable product innovations and firm value.

Moderating role of product innovativeness. Product innovativeness refers to the extent of novelty of a new product (Vincent, Bharadwaj, and Challagalla 2018). I focus on the categorization of radical versus incremental as an indicator of product innovativeness, which has been established in the innovation literature for CPG products (Cao and Sorescu 2013; Sorescu and Spanjol 2008). I posit that the radicalness of the product innovation will negatively moderate

the effect of sustainable product innovations on firm value for the following reasons. First, new products that are both *sustainable* and *radical* – having greater innovativeness – are associated with higher degrees of uncertainty as they require consumers to identify the benefits of the two regimes (Sorescu and Spanjol 2008; Varadarajan 2017). New product introductions, in themselves, can be difficult for customers to envision the new technological dimensions and their benefits, especially in a non-high tech industry (i.e., CPG) where the ratio of breakthrough innovations to total innovations (7%) is significantly low (Sorescu and Spanjol 2008). Consumers encounter sustainable and radical new products in the marketplace but are uncertain about judging their sustainable benefits (environmental, social, and healthy) in addition to functional ones such as product effectiveness (Luchs et al. 2010). This uncertainty by consumers may lead to decreased credibility of such products, further damaging perceptions of their overall quality as benefits are not fully understood. Ultimately, this decreases consumer preferences and sales of new products that are both sustainable and radical (Gershoff and Frels 2015; Luchs et al. 2010) as stakeholders deem such products to be risky investments, thereby leading to decreased cash flows and increased firm risk (Cao and Sorescu 2013).

Second, innovative products are already differentiated and including additional sustainability benefits may face ceiling effects and add limited marginal value. On the one hand, new products characterized by greater innovativeness are associated with higher risks to the innovating firm, but these risks are offset by above-normal stock returns and increases in firm value (Sorescu and Spanjol 2008). However, the benefits of adding sustainable attributes to an already risky and differentiated product may not be enough to offset the even higher risks involved with this new product (Worm et al. 2017).

Third, innovative and *sustainable* product innovations are not only disruptive for the originating firms but also require change and understanding from stakeholders such as retailers (Dangelico, Pujari, and Pontrandolfo 2017; Gielens et al. 2018). Due to uncertainties of how consumers may respond, retailers need to understand the benefits of both regimes – extent of innovativeness and sustainable – for them to decide on whether to distribute and display these novel products as their success is hard to predict (Kaufman, Jayachandran, and Rose 2006). Naturally, increased costs (e.g., more promotions and discounts for higher product turnover) and perceived risks (e.g., increase in distribution – shelving and number of stores) are associated with supporting and handling such products (Kaufman, Jayachandran, and Rose 2006). These uncertainties and costs associated with new product acceptance from retailers may lead to fluctuations in sales, thereby increasing the volatility and vulnerability of cash flows (Srivastava, Shervani, and Fahey 1998). In summary, product innovativeness will negatively moderate the effect of sustainable product innovations on firm value because of increased firm risks due to reduced and more volatile cash flows.

H_4: Product innovativeness (i.e., radical innovation) weakens the positive effect of (a) single and (b) multi-label sustainable product innovations on firm value.

Moderating role of branding strategies. I proxy branding strategies using new versus existing brands for sustainable product introductions. Existing brands are those that are currently being sold in the market while new brands have no current customers and for which the firm has made no investments (Moorman, Ferraro, and Huber 2012). For existing brands, the risk of improving the product with sustainable benefit claims is higher than for new ones. Managers of existing brands may reason that it is not worthwhile to put current brands at risk given the trade-off between infusing the product with sustainable attributes and losing prior brand associations,

identity, and meaning (Keller 1993). Also, consumers may have strong brand associations with existing brands that are enduring and resistant to change ("sticky priors"), making them especially challenging to incorporate new, sustainable attributes (Bolton and Reed 2004; Olsen, Slotegraaf, and Chandukala 2014).

New brands, on the other hand, do not have such prior brand associations (Swaminathan, Fox, and Reddy 2001). This provides opportunities to position themselves more readily as sustainable (Du, Bhattacharya, and Sen 2007). For instance, brands such as Patagonia, Seventh Generation, and Burt's Bees have integrated environmental, social, and health dimensions into their business from the start, and these benefits are deeply entwined with the products and services that they offer (Vila and Bharadwaj 2017).

For established firms with brand portfolios, new brands are more likely to be from a house of brands (HOB) than a corporate branding strategy (Rao, Agarwal, and Dahlhoff 2004). HOBs have a broader range of opportunities and degrees of freedom to embed sustainable benefits into novel brands, positioning, target market, attributes, and customer value propositions (Vila, Bharadwaj, and Varadarajan 2019). A case in point, Clorox's launch of Green Works – a new cleaning product brand that used plant-based ingredients and sustainable packaging with no harsh chemicals – to compete against Seventh Generation and Method (products created with sustainable attributes) in the mass market (Ofek and Barley 2012). Green Works started as a novel and niche offering but soon became the number one natural cleaning brand in the U.S. with a 42% share within a year after its launch (Ofek and Barley 2012). Instead of releasing a more sustainable bleach or cleaning product within an existing Clorox brand, which would have been difficult for the market to understand because of its prior brand associations with harsher chemical ingredients, the firm launched a new brand.

In summary, it is riskier to infuse existing brands with sustainable benefit claims given their prior brand associations. For new brands, there are more opportunities and degrees of freedom with fewer prior brand associations, making it easier to communicate and embed sustainable benefit claims for its new products. Formally,

H_5: The effect of (a) single and (b) multi-label sustainable product innovations on firm value will be higher (lower) in the case of new (existing) brands.

2.6 PANEL DATA REGRESSION

2.6.1 Data and Measures

I obtained data from GlobalData's Product Launch Analytics database that provides comprehensive and detailed information on CPG products introduced since 1980. This database has been extensively used in the marketing literature as it minimizes self-reported bias as it relies on market-based rather than firm-reported measures (Arunachalam et al. 2019; Cao and Sorescu 2013; Olsen, Slotegraaf, and Chandukala 2014). The information available in this database includes the product introduction date, product descriptions, brand and product categories, manufacturers, and product tags, as well as information about sustainable claims (e.g., organic, fair trade, not artificial). I used the product launch dates of all products introduced in the U.S. between 2010 and 2017. Next, I matched the companies from my dataset with the Center for Research in Security Prices (CRSP) and Compustat merged database to retrieve other variables of interest. I also obtained product sustainability measures from MSCI's Kinder, Lydenberg, and Domini Research and Analytics Inc. (KLD) database and the branding measures using Nielsen Retail Measurement data. This gave us an initial sample of 13,130 new product introductions, both conventional and sustainable. I also conducted Factiva searches to determine any record of

preannouncements or earlier information about the product before the introduction date listed on the Product Launch Analytics database. I excluded 1,119 preannouncements or previous mentions from newswires, blogs, or other press sources from the sample. Overall, this led to a panel data set of 12,011 new product introductions.

2.6.2 Independent Variables

Typology of sustainable product innovations. Following FTC's Green Guide and prior research (e.g., Olsen, Slotegraaf, and Chandukala 2014) as a framework, two expert coders independently examined each benefit claim in the sampling frame provided in the Product Launch Analytics database. Inter-coder reliability was .93, well above recommended levels, and disagreements were resolved through discussions. A product was designated as sustainable based solely on its on-pack claims, rather than considering other marketing efforts. On-pack claims are the most reliable indicator of consumer perceptions that a product is sustainability-marketed for in-person purchases, as they are the only type of marketing message that has the potential to be viewed by all consumers. Other forms of advertising are targeted to consumer segments based on the audience of the advertisement (e.g., online, television, etc.) and do not necessarily reach the entire consumer market (Kronthal-Sacco et al. 2020). Claims such as Natural, Real, Kosher, and Gluten-Free were excluded as these claims were not sufficient to classify a product as sustainable (Kronthal-Sacco et al. 2020). In addition to coding, I text-mined product descriptions provided by the Product Launch Analytics database to obtain additional claims and certification information (e.g., USDA organic, Forest Stewardship Council, Marine Stewardship Council, Rainforest Alliance, Fair Trade, cage-free/-less, dolphin-free/-safe, cruelty-free, etc.).

Multi-label text classification. To complement the coding approach for the product benefit claims and descriptions, I applied several text classification algorithms. Classification models can reveal insights or test hypotheses that may be otherwise buried in a large amount of data. Because classification methods do not define a word list a priori, latent elements, such as surprising combinations of words or patterns that may have been excluded in a top-down analysis (manual coding approach), may be revealed (Humphreys and Wang 2018). Tree-based approaches (Decision Tree, Random Forest, Gradient Boosted Classifier) performed well because of their conceptual simplicity (i.e., "white box" approach) and process of examining word combinations in a piecewise fashion (Humphreys and Wang 2018) (Appendix A provides performance measures across the classification algorithms). To evaluate performance, I used the F1 Score as it creates a balance between recall and precision by creating a harmonic mean of these two measures (Berger et al. 2020).

I also conducted additional Natural Language Processing (NLP) methods using K-means Clustering and Guide LDA Topic Modeling approaches to identify the appropriate number of categories (topics) for sustainable product innovations to validate my classification. Appendix A elaborates on the details of each of the NLP and classification approaches.

Product portfolio approach. I use a product portfolio approach to examine the effects of the different types of product introductions. Similar to Dotzel and Shankar (2019), I created dummy variables for each type of sustainable product innovation based on each of the dimensions (environmental, social, or healthy) but also products that had overlap in dimensions (e.g., environmental and social). I then summed the number of innovations for each type, both sustainable and conventional, by firm and year. Next, I divided each of these by the total number of new products launched by this firm in that year to create ratios for each type so that the sum of

Table 4. Product Portfolio Approach: Sustainable Benefit Claims by Type

A. Example of Portfolio Approach

	Single-label			Multi-label					
Type	**Environmental**	**Social**	**Healthy**	**Env & Soc**	**Env & Heal**	**Soc & Heal**	**Env & Soc & Heal**	**Conventional**	**Σ all new products**
Count	7	3	15	5	3	4	3	60	100
Percentage	0.07	0.03	0.15	0.05	0.03	0.04	0.03	0.60	1

B. Total Count of Benefit Claims by Year and Type

Year	Environmental	Social	Healthy	Env & Soc	Env & Heal	Soc & Heal	Env & Soc & Heal	Conventional	Σ all new products
2010	227	15	442	7	100	6	30	2205	3032
2011	259	3	294	3	101	31	20	1857	2568
2012	164	5	359	4	133	14	21	2296	2996
2013	129	21	268	5	141	8	14	1338	1924
2014	51	5	110	1	45	4	7	592	815
2015	48	3	80	4	37	5	1	508	686
2016	33	3	108	1	36	5	5	393	584
2017	27	2	108	2	35	9	5	337	525
Total	**938**	**57**	**1769**	**27**	**628**	**82**	**103**	**9526**	**13130**

all product ratios for each firm and year equals to one. Single-label was created by adding the ratio of products classified in any one dimension (e.g., environmental, social, or healthy). Multi-label was generated using the summated proportions of products that had overlap in two or more dimensions.

The operationalization of product portfolios allows the unit of analysis to be at the firm level for the inclusion of firm-level controls and moderators. For executives, it is more useful to look at the characteristics of the product portfolio as changing the portfolio mix depending on the different product types. Table 4 provides complete details about the product portfolio approach with the total number of new products introduced each year by type.

2.6.3 Dependent Variables

I use the log-transformed measure of market capitalization (market value of equity, MVE), calculated by multiplying the share by the number of outstanding shares, as firm value (Fornell et al. 2006; Joshi and Hanssens 2010; Srinivasan and Hanssens 2009). This is a forward-looking measure, providing market-based views of investor expectations of the firm's future profit potential. In addition, I use Total q as a robustness check. Total q is an improved Tobin's q proxy that includes intangible capital in the denominator, i.e., in the replacement cost of firms' capital. Peters and Taylor (2017) show that Total q captures firms' investment opportunities better than other popular Tobin's q proxies. This measure estimates the replacement cost of firms' intangible capital by accumulating past R&D and SG&A investments and has been recommended as an appropriate option for marketing-finance research to overcome the limitations of Tobin's q (Edeling, Srinivasan, and Hanssens 2020).

2.6.4 Moderator Variables

Sustainable innovation ability. I compute the sum of prior sustainable product innovations launched by the firm over rolling windows of 12 months preceding the day that the focal sustainable new product was launched by each firm (Warren and Sorescu 2017).

Product innovativeness. I use the ratings from Product Launch Analytics to classify new products as radical or incremental (Cao and Sorescu 2013; Sorescu and Spanjol 2008). This rating is assigned at the time of product introduction and identifies products that are new to the market in terms of formulation, packaging, positioning, or merchandising as radical. Product innovativeness is coded as a dummy variable – 1 for radical and 0 otherwise. I then include this into the product portfolio as a proportion of innovative new products among the total number of new products launched by each firm in that specific year.

New brands. I determine if a firm's brand is *new* (versus existing) by searching for this in the prior year using the Nielsen Retail measurement database. Following Moorman, Ferraro, and Huber (2012), I code this variable as 1 if the brand is new and 0 if present in the year before. Similar to product innovativeness, I use the proportion of new brands among the total number of new product introductions to incorporate into the product portfolio.

2.6.5 Control Variables

I used the following controls that are consistent with prior research in corporate sustainability (Gielens et al. 2018; Jayachandran, Kalaignanam, and Eilert 2013; Kang, Germann, and Grewal 2016; Mishra and Modi 2016). *Product sustainability* was proxied using the "product" dimension of MSCI's KLD ratings for each firm and operationalized as the net score of (Σ Product KLD Strength – Σ Product KLD Concern) or the materiality measure used by prior

literature (Jayachandran, Kalaignanam, and Eilert 2013; Khan, Serafeim, and Yoon 2016). *R&D* and *advertising intensity* were calculated as the firm's R&D and advertising expenditure relative to its sales (Kang, Germann, and Grewal 2016; Luo and Bhattacharya 2009). In the case of missing data, I include dummies for R&D (RD Miss coded 0 if missing; 1 if not) and advertising (ADV Miss coded 0 if missing; 1 if not) (Bharadwaj, Bharadwaj, and Konsynski 1999; Luo and Bhattacharya 2009). *Return on assets (ROA)* was measured using the ratio of net profits to total assets to control for firm performance. *Financial leverage* is the ratio of long-term debt to total assets (Jayachandran, Kalaignanam, and Eilert 2013; Kang, Germann, and Grewal 2016). *Firm* size was the log of the book value of total assets (Sorescu and Spanjol 2008). *Industry competitiveness* was the log of the ratio of the industry's Herfindahl concentration index[6] at time t to t–1 (Tuli, Bharadwaj, and Kohli 2010). *Sales growth* was the log of the ratio of firm sales at time t to t–1 (Tuli, Bharadwaj, and Kohli 2010).

I winsorized the data at a *p*-value of 95% to minimize bias from outliers. Table 5 presents the operationalization and sources of data for the key variables. Table 6 provides their correlations and descriptive statistics. The maximum variance inflation factor (VIF) was 3.01, indicating that multicollinearity was not a concern.

2.6.6 Addressing Endogeneity

The decision to launch sustainable product innovations as well as for deciding between single versus multi-label are strategic choices and thus likely endogenous. To correct for potential

[6] Herfindahl concentration index was calculated using the Global Industry Classifications Standard (GICS) codes.

Table 5. Key Variables and Data Sources

Variables	Data Source	Description
Market value	CRSP/Compustat	Log of market capitalization (end of year share price x number of shares outstanding)
Sustainable product innovations	Product Launch Analytics	Single- and multi-label sustainable product innovations using a product portfolio approach
Sustainable innovation ability	Product Launch Analytics	Sum of all sustainable product introductions by the firm during the 12 months prior to event
Product innovativeness	Product Launch Analytics	Innovativeness rating from Product Launch Analytics: 1 = radical; 0 = incremental
New brand	Nielsen Retail Scanner Data[7]	New versus existing brand for the firm: 1 = new; 0 = existing
Product sustainability	MSCI's KLD	Net score of the strengths (positive) minus concerns (negative) of the Product dimension
Advertising intensity	CRSP/Compustat	Ratio of advertising expenditures by sales
R&D intensity	CRSP/Compustat	Ratio of R&D expenditures by sales
Return on assets (ROA)	CRSP/Compustat	Net profits normalized by total assets
Financial leverage	CRSP/Compustat	Ratio of long-term debt to book value of equity
Firm size	CRSP/Compustat	Log of total assets
Sales growth	CRSP/Compustat	Log of the ratio of firm sales at time t to t – 1
Industry competitiveness	CRSP/Compustat	Log of the ratio of the industry's Herfindahl concentration index at time t to t – 1

[7] "The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein."

Table 6. Correlation Matrix and Descriptive Statistics

Variables		Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1	ln(MVE)	9.70	1.62													
2	Single-label	.22	.15	.03*												
3	Multi-label	.06	.11	–.11*	.23*											
4	Sustainable innovation ability	47.57	61.51	.11*	.29*	.24*										
5	Product innovativeness	.02	.05	.08*	.02*	.05*	–.09*									
6	New brand	.03	.07	.06*	–.15*	–.03*	–.05*	–.03*								
7	Product sustainability	–.16	1.08	–.22*	.03*	.14*	.12*	.01	–.04*							
8	Advertising intensity	.05	.18	.02	–.10*	–.06*	–.03*	.20*	.09*	.04*						
9	R&D intensity	.02	.80	–.02*	–.02	–.01	–.01	.19*	.01	.00	.93*					
10	ROA	.07	.09	.39*	.02*	.05*	.00	–.01	.07*	.06*	–.28*	–.32*				
11	Financial leverage	.26	.15	–.22*	–.14*	–.20*	–.29*	.00	.02*	–.14*	.00	–.02*	–.13*			
12	Firm size	9.54	1.44	.87*	–.04*	–.20*	.09*	.02	–.01	–.39*	–.07*	–.04*	.15*	–.08*		
13	Sales growth	.84	.70	.22*	–.01	–.05*	.03*	–.02	–.04*	–.09*	–.02*	–.01	.02*	–.02*	.30*	
14	Industry competitiveness	.71	.23	.04*	.00	.04*	–.04*	–.01	.01	–.05*	–.01	.00	.02	–.01	.02	.01

*$p < .05$; N = 12,011

endogeneity of sustainable product innovation types, I implement Gaussian copulas to account for unobservables and the Heckman two-stage correction for observable factors.

I apply Park and Gupta (2012)'s Gaussian copula approach to control for endogeneity by directly modeling the correlation between the endogenous variable and the error term by means of a copula. Specifically, the endogenous regressor is treated as a random variable, consisting of an exogenous (which is non-normally distributed) and endogenous component (which is normally distributed). This requires the endogenous regressor to be non-normally distributed as part of its identification condition (Papies, Ebbes, and Van Heerde 2017). I confirm the non-normal distribution of the endogenous regressors, single- and multi-label, by using the Shapiro–Francia test ($W_{single} = .939$, $p < .001$; $W_{multi} = .780$, $p < .001$). Following (Gielens et al. 2018), I retain copula terms that are statistically significant and then re-estimate the model. As recommended by Park and Gupta (2012), I bootstrap standard errors using 200 replications.

To address the potential for selection bias induced endogeneity, I test for the effect of unobservables on the decision to launch sustainable products, by conducting a Heckman model and estimating the following binary probit regression:

$$\begin{aligned}\Pr(SNP_{it} = 1) = {} & \gamma_0 + \gamma_1 Leverage_{i,t-1} + \gamma_2 Profit_{i,t-1} + \gamma_3 Slack_{i,t-1} + \gamma_4 R\&D_{i,t-1} \\ & + \gamma_{5-15} Controls_{i,t} + \sum_{c=1}^{K} \theta_c + \sum_{t=1}^{T} \theta_t + v_{i,t}, \end{aligned} \quad (1)$$

where $SNP_{it} = 1$ if firm i has launched a sustainable product innovation in year t, and 0 otherwise. Control(1)–Control(10) = product sustainability, advertising intensity, R&D intensity, return on assets (ROA), financial leverage, firm size, sales growth, industry competitiveness, and two dummy variables for RD Miss and ADV Miss. θ_c, and θ_t are category and year dummies. I include control variables from the regression below in equation 2. In addition to these controls, I

include four variables that will affect firms' choice of launching sustainable product innovations based on CS and innovation literature. CS research suggests a slack hypothesis that financially constrained firms are less likely to spend resources on CS and that, when these firms' financial constraints are relaxed, spending on CS increases (Albuquerque, Koskinen, and Zhang 2019; Luo and Bhattacharya 2009; Surroca, Tribó, and Waddock 2010). I also draw on the innovation literature and include other well-established exclusions restrictions, namely (1) R&D intensity, (2) profit (sales minus cost of goods sold normalized by total assets), (2) organizational slack (ratio of net cash flows from operating activities to total firm assets), and (4) leverage (Sorescu, Chandy, and Prabhu 2003; Sorescu and Spanjol 2008). I lag these by one year (t–1) so that they are correlated with the sustainable product innovation variables, but not correlated with the error term. I draw on the parameters to compute the Inverse Mills ratio ($IMR_{i,t}$).

2.6.7 Model

To test hypotheses, I use a fixed effects model and estimate the following equation:

$$\begin{aligned} Ln(MVE)_{i,t} = {} & \beta_0 + \beta_1 Single_{i,t} + \beta_2 Multi_{i,t} + \beta_3 SI_{i,t} + \beta_4 Innov_{i,t} + \beta_5 New_{i,t} \\ & + \beta_6 \left(Single_{i,t} \times SI_{i,t}\right) + \beta_7 \left(Single_{i,t} \times Innov_{i,t}\right) + \beta_8 \left(Single_{i,t} \times New_{i,t}\right) \\ & + \beta_9 \left(Multi_{i,t} \times SI_{i,t}\right) + \beta_{10} \left(Multi_{i,t} \times Innov_{i,t}\right) + \beta_{11} \left(Multi_{i,t} \times New_{i,t}\right) \\ & + \beta_{12-22} Controls_{i,t} + \sum_{c=1}^{K} \theta_c + \sum_{t=1}^{T} \theta_t + \lambda\, IMR_{i,t} + Single^{c}_{i,t} + Multi^{c}_{i,t} + \varepsilon_{i,t}, \end{aligned} \quad (2)$$

where i = 1, 2, …, 122 firms, t = 1, 2, ..., 8 years; $Single_{i,t}$ and $Multi_{i,t}$ represent single and multi-label sustainable product innovations; $SI_{i,t}$ refers to sustainable innovation ability; $Innov_{i,t}$ denotes product innovativeness; $New_{i,t}$ indicates a new versus existing brand; Control(1)–Control(10) = product sustainability, advertising intensity, R&D intensity, return on assets (ROA), financial leverage, firm size, sales growth, industry competitiveness, and two dummy variables for RD

Miss and ADV Miss, λ $IMR_{i,t}$ inverse Mills ratio and $Single^{c}_{i,t}$ and $Multi^{c}_{i,t}$ (two endogeneity correction terms); θ_f, θ_c, and θ_t are firm, category, and year fixed effects (FE); $\varepsilon_{i,t}$ is the error term that follows a normal distribution.

2.6.8 Results

Table 7 reports the results of the fixed effects regression model. As hypothesized in **H_1** and **H_2**, the main effects of single- ($\beta = .161$, $p < .01$) and multi-label ($\beta = .418$, $p < .01$) sustainable product innovations are positive and significant. Multi-label had a larger effect on firm value than single-label, in line with the expectation that multi-label sustainable product innovations payoff takes longer and thus measured with a long-term performance measure. An additional analysis finds that the effects of single-label are greater than multi-label when firm performance is measured by short-term stock market returns (i.e., cumulative abnormal returns (CAR).

Moderating effects analysis. As predicted in **H_{3a}** and **H_{3b}**, sustainable innovation ability strengthens the relationship between sustainable product innovations and firm value for both single- ($\beta = .004$, $p < .01$) and multi-label innovations ($\beta = .004$, $p < .01$). This offers support to the resource-based view that a prior history of sustainable product introductions (i.e., innovation capability) can be leveraged to facilitate greater returns from current sustainable new products launched by the company.

For **H_{4a}** and **H_{4b}**, I hypothesized that product innovativeness would negatively moderate the relationship between sustainable product innovations and firm value. The interactions are negative and significant for multi-label ($\beta = -1.246$, $p < .05$) but marginal for single-label ($\beta = -.736$, $p < .10$) which suggests that the attenuating effects are not as strong for this type.

Table 7. Regression Results

Variables	Hypothesis	Direction	DV: ln(MVE) Beta	SE	DV: Total q Beta	SE
Single-label (Single)	H_1	+	.161***	(.022)	–.131	(.096)
Multi-label (Multi)	H_2	+	.418***	(.052)	.445***	(.081)
Sustainable innovation (SI) ability			–.001***	(.000)	–.002***	(.000)
Product innovativeness			.153	(.109)	.439***	(.099)
New brand			–.360***	(.072)	–.682***	(.117)
Single x SI ability	H_{3a}	+	.004***	(.000)	.005***	(.001)
Single x Product innovativeness	H_{4a}	–	–.736*	(.447)	–1.335***	(.447)
Single x New brand	H_{5a}	+	1.452***	(.341)	2.913***	(.702)
Multi x SI ability	H_{3b}	+	.004***	(.000)	.009***	(.000)
Multi x Product innovativeness	H_{4b}	–	–1.246**	(.571)	–2.241***	(.771)
Multi x New brand	H_{5b}	+	.496**	(.206)	.620*	(.334)
Product sustainability			–.026***	(.003)	.012***	(.003)
Advertising intensity			2.219***	(.592)	6.259***	(.684)
R&D intensity			–6.903*	(3.811)	–2.863	(3.343)
ROA			4.876***	(.233)	3.216***	(.128)
Financial leverage			1.193***	(.223)	.178**	(.073)
Firm size			.814***	(.023)	.226***	(.016)
Sales growth			–.019***	(.006)	–.002	(.003)
Industry competitiveness			.040***	(.015)	–.013	(.016)
R&D missing			–.097***	(.025)	–.585***	(.048)
Advertising missing			–.220***	(.077)	–.932**	(.406)
inverse Mills ratio			–.005	(.187)	–.008	(.047)
Copula correction (Single)[a]			—	—	.048***	(.013)
Copula correction (Multi)			–.040***	(.006)	–.031***	(.008)
Constant			9.726***	(.473)	2.262***	(.428)
Firm, Year, Category FE			YES		YES	
Observations			12,011		11,972	
R-squared			.742		.529	

*** p <.01, ** p <.05, * p <.10; Standard errors in parentheses (bootstrapped SE using 200 replications)

[a]Re-estimated after removing non-significant copula

Single-labels have a fewer set of benefits claims for stakeholders to process, making it less risky and easier to comprehend when combined with the radicalness of innovativeness.

As posited in $\mathbf{H_{5a}}$ and $\mathbf{H_{5b}}$, the use of new brands positively moderates the relationship between sustainable products innovations and firm value for both single- ($\beta = 1.452$, $p < .01$) and multi-label ($\beta = .496$, $p < .01$). This offers evidence that new brands may serve as appropriate market-based assets for sustainable product innovations. New brands can more readily establish novel associations with sustainable benefits, while for existing brands, this may be less desirable as they have prior brand associations.

2.6.9 Robustness and Additional Analysis

Total q. I conduct robustness using an alternative firm value measure of Total q. Recent marketing-finance literature has indicated that the traditional Tobin's q measure is under "special scrutiny" despite being one of the most often and widely used metrics in the business literature (Edeling, Srinivasan, and Hanssens 2020). Total q is closer to the true Tobin's q measure and overcomes many of the problems of its accounting-based approximations. I find the pattern of results using Total q is similar for the hypothesized relationships (see Table 7).

Additional analysis using CAR. I provide post hoc explanations to the short-term implications of single-labels and long-term orientations of multi-label sustainable benefit claims argued in the hypotheses. Using stock market returns or cumulative abnormal returns (CAR), I find support for this perspective. As shown in Table 8, Panel A, the direction of single-label is positive while multi-label is negative when using CAR as the dependent variable. The results suggest that focused sustainability of a single type is reflected in short-term performance returns, while multiple benefit type sustainable product innovations take longer to pay off.

Table 8. Robustness Checks and Post-hoc Analysis

A. CAR Results

Variables	DV: CAR(–1:+1)	
	Beta	SE
Single-label (day)	.001*	(.000)
Multi-label (day)	–.009**	(.004)
Product sustainability	–.001**	(.000)
Advertising intensity	.065*	(.038)
R&D intensity	–.478**	(.242)
ROA	.003	(.011)
Financial leverage	.016*	(.009)
Firm size	.002	(.001)
Sales growth	–.000	(.000)
Information coverage	–.000	(.000)
Industry competitiveness	.002	(.001)
R&D missing	–.007**	(.003)
Advertising missing	–.001	(.004)
inverse Mills ratio (day)	.001	(.008)
Copula correction (Single)[a]	—	—
Copula correction (Multi)	.004*	(.002)
Constant	–.003	(.020)
Firm Year Industry FE	YES	
Observations	12,011	
R-squared	.017	

B. Pre 2014 Results

Variables	DV: ln(MVE)		DV: Total q	
	Beta	SE	Beta	SE
Single-label (Single)	.264***	(.081)	–.088	(.076)
Multi-label (Multi)	–.047	(.053)	.006	(.052)
Sustainable innovation (SI) ability	–.002***	(.000)	–.002***	(.000)
Product innovativeness	–.052	(.150)	.832***	(.218)
New brand	–.503***	(.120)	–.684***	(.142)
Single x SI ability	.005***	(.000)	.004***	(.000)
Single x Product innovativeness	.142	(.399)	–1.981***	(.595)
Single x New brand	1.429***	(.540)	3.738***	(.918)
Multi x SI ability	.006***	(.000)	.008***	(.000)
Multi x Product innovativeness	–8.363***	(.813)	–7.422***	(1.031)
Multi x New brand	1.609***	(.288)	.687*	(.369)
Product sustainability	–.020***	(.004)	.058***	(.003)
Advertising intensity	3.190***	(.939)	7.523***	(.913)
R&D intensity	–1.753**	(4.751)	–28.421***	(6.855)
ROA	5.901***	(.333)	3.476***	(.127)
Financial leverage	1.684***	(.368)	.251***	(.077)
Firm size	.830***	(.046)	.545***	(.018)
Sales growth	–.010	(.009)	.002	(.003)
Industry competitiveness	.020	(.020)	–.024*	(.013)
R&D missing	.105	(.078)	.216***	(.032)
Advertising missing	–.412***	(.090)	–.144**	(.061)
inverse Mills ratio	–.002	(.306)	–.007	(.058)
Copula correction (Single)	–.023**	(.012)	.023**	(.010)
Copula correction (Multi)[a]	–.017***	(.006)	—	—
Constant	9.677***	(.749)	.787***	(.159)
Firm, Year, Category FE	YES		YES	
Observations	9,869		9,979	
R-squared	.662		.626	

*** p <.01, ** p <.05, * p <.10; Standard errors in parentheses (bootstrapped SE using 200 replications)

[a]Re-estimated after removing non-significant copulas

Results before 2014. One potential concern of using the Product Launch Analytics is that the number of new product introductions reported in this database showed declines from 2013 onwards (see Table 8). Therefore, I test the same model specifications but restrict the data to observations from 2010–2013. As shown in Table 8, Panel B, I achieve similar results in terms of the direction of my hypothesized effects. The interaction between single-label and product innovativeness is not significant, again, indicating that the weakening effect of product innovativeness is not as strong or has no effect on single-label.

2.7 ADDITIONAL ANALYSIS USING CHOICE-BASED CONJOINT

I conduct a choice-based conjoint analysis experiment to (1) validate the theoretical framework of the typology of sustainable product innovations based on my coding of sustainable benefits claims (as Environment, Social, Healthy) and (2) examine if consumer preferences are in line with investor responses documented in market value analysis reported earlier. I examine consumer preferences, purchase intent, and willingness to pay premiums for sustainable and conventional products while controlling for product attributes (e.g., brand, price, flavor, etc.). The conjoint analysis is an indirect approach to estimating preferences for product attributes and pricing based on consumer choice (Toubia 2018).

2.7.1 Data and Methods

754 respondents who currently reside in the U.S. from an online panel (Prolific.co) completed the conjoint survey in April 2021. Respondents were required to have made at least one Greek yogurt purchase in the past three months to participate. I chose the Greek yogurt category to test the typology because respondents are familiar with this category (Ellickson, Lovett, and Ranjan 2019) and it typically includes all three dimensions of sustainable benefit claims. Prior to

launching the study, I conducted a pre-test on a student sample (n = 248) to validate the benefit claims (both conventional and sustainable). From my initial sample of 754 completes, I excluded responses after screening for purchase frequency, response times, and other data quality considerations (e.g., attention checks) for a final sample of 604 respondents.

I implement the Choice-Based Conjoint (CBC) survey design using Sawtooth Software. First, I asked about their preferences for the full range of benefit claims (both conventional and sustainable) to familiarize respondents with the variables of interest. Next, I provided generic instructions about the conjoint tasks. To avoid including a large variety of flavor options, I followed Ellickson, Lovett, and Ranjan (2019) and indicated that the respondents assume that the preferred flavor(s) was available. 300 different sets of 12 choice tasks were designed using Sawtooth Software's design module and randomly assigned to respondents. I used Dual-response conjoint tasks with four options of Greek yogurt. This design allows estimation of the "None" parameter more efficiently, with less biased estimates of other parameters if the incidence of "None" usage is high (Brazell et al. 2006). I provide complete details on the conjoint methodology, choice tasks, and attribute levels in Appendix B.

2.7.2 Model

For each of the individual observations, I use a hierarchical Bayesian model and estimate the utilities and their part-worths. I assume individual part-worths have a multivariate normal distribution and denote this as:

$$\beta_i \sim MVN(\alpha, D) \tag{3}$$

where β_i is a vector of preference parameters (part-worths) for individual i, α is a vector of means of the distribution of individuals' part-worths; D is a matrix of variances and covariances of the distribution of part-worths across individuals.

Next, utility (U_{ijt}) is a function of these individual part-worths, as follows:

$$U_{ijt} = X_{ijt}\,\beta_i + \varepsilon_{ijt}. \qquad j \in C_{it} \tag{4}$$

where i = 1, …, N (number of individual consumers), make choices over options j (number of options) in a series of decision opportunities t = 1, …, T_i (number of choice tasks). X_{ijt} are the products represented as bundles of attributes, including price; C_{it} is the set of options; ε_{ijt} is an error term that assumed to be independent and identically distributed (i.i.d.). The intuition is that individual i will choose a product that maximizes utility U_{ijt} given task t and option choices j that are part of the set of options C_{it}.

Lastly, I estimate the individual choice probability (P_{ijt}) implied by Equation 4:

$$P_{ijt} = \frac{\exp\left(X_{ijt}\,\beta_i\right)}{\sum_{k=0}^{C_{it}} \exp\left(X_{ikt}\,\beta_i\right)}. \tag{5}$$

2.7.3 Analysis and Results

Table 9, Panel A shows the utility part-worths for all attributes tested in the survey. The focal attribute, "Benefit Claims," I test across the combinations of single and multi-label benefits in both conventional and sustainable. The multi-label sustainable benefit claims are among the highest utilities ranging from 27.54 to 65.91, far outweighing the levels from any of the conventional benefit claims and their combinations. Sustainable benefit claims are preferred

more when combined, as multi-labels, rather than as single-labels. This is not always the case for conventional benefits claims where some combinations show a more negative utility when combined (e.g., Gluten Free & Fiber Added versus Fiber Added). Appendix B provides plots for part-worths on benefit claims based on the type of product and label.

Next, I conduct simulations using the utility part-worths to estimate willing to pay (WTP). The WTP is a demand-based measure used to value product features (Allenby et al. 2014). I obtain a monetary measure of the incremental utility by scaling the part-worth corresponding to the feature enhancement (Orme 2001). Within attributes, the level with the lowest utility serves as the reference (baseline) and the premiums for feature enhancement are calculated based on this reference level. In the case of the focal attribute "Benefit Claims," Gluten Free serves as the baseline (reference level) with other levels considered as adding premiums in comparison. Results indicate that the WTP for multi-label sustainable benefit claims are among the highest ranging from $0.66 to $1.18. Considering the average price of Greek yogurt tested was $1.29, consumers are willing to pay up to 92% of this amount for a sustainable benefit claim, excluding other factors such as brand, flavor, and fat.

Moreover, the price for the best-case scenario with attribute levels of **[**Chobani ($0.35) + Fruit ($0.45) + 2% low-fat ($0.05) + Env & Soc & Healthy ($1.18)**]** equals $2.03, a price premium of over 57% from the average price of $1.29.

Table 9. Conjoint Analysis Estimation and Summary of Key Results

A. Utility Part–worths and Willing to Pay (WTP)

Attribute	Levels	Utility	SD	WTP
Brand	Chobani	27.54	41.03	$0.35
	Dannon	–17.36	45.25	—
	Fage	–10.59	39.58	$0.04
	Oikos	0.41	29.57	$0.11
Flavor	Fruit	22.97	51.73	$0.45
	Plain	–22.97	51.73	—
Fat Content	0% (non-fat)	–4.01	34.50	—
	2% (low-fat)	4.01	34.50	$0.05
Benefit Claims	*Gluten Free*	–52.34	38.52	—
	Grade A Milk	–12.85	37.07	$0.27
	Fiber Added	–36.11	56.86	$0.16
	GF & Grade A	–9.88	33.35	$0.32
	GF & Fiber Added	–37.93	48.18	$0.13
	Grade A & Fiber	–2.90	52.27	$0.42
	GF & Grade A & Fiber Added	9.77	47.77	$0.52
	Environmental	–10.91	31.21	$0.28
	Social	–16.83	45.83	$0.28
	Healthy	9.26	27.02	$0.49
	Env & Soc	27.22	45.40	$0.66
	Env & Healthy	33.40	51.66	$0.75
	Soc & Healthy	34.19	49.09	$0.77
	Env & Soc & Healthy	65.91	67.32	$1.18
Price	0.99	29.92	47.73	—
	1.29	3.77	16.14	—
	1.59	–33.69	44.60	—
None	—	–57.42	146.87	—

Notes: SD = Standard Deviation; GF = Gluten Free, Grade A = Grade A Milk, Env = Environmental, Soc = Social; N=604
[a]Shares of Preference (SOP) calculated by holding attributes of Flavor, Fat Content, and Price constant.

B. Shares of Preference (SOP)

Benefit Claims	Shares of Preference (SOP)[a] by Brand			
	Chobani	Dannon	Fage	Oikos
Env & Soc & Healthy	23.4%	17.2%	16.2%	18.9%
Soc & Healthy	9.2%	7.0%	6.3%	7.3%
Env & Healthy	8.9%	7.1%	6.7%	7.2%
GF & Grade A & Fiber Added	7.3%	5.6%	5.6%	5.2%
Env & Soc	6.9%	5.9%	5.4%	6.3%
Grade A & Fiber Added	6.8%	5.1%	5.5%	5.1%
Healthy	4.8%	3.4%	4.5%	3.9%
GF & Grade A	4.1%	3.2%	3.6%	3.1%
Grade A milk	4.0%	3.1%	4.0%	3.0%
Fiber Added	3.8%	2.9%	3.0%	2.8%
Environmental	3.2%	3.0%	2.8%	2.8%
Social	3.2%	2.5%	3.1%	2.9%
GF & Fiber added	3.0%	2.5%	2.1%	2.2%
Gluten Free	1.6%	1.9%	1.7%	1.5%
None	9.9%	29.5%	29.7%	27.8%

Notes: Items in italics refer to conventional attributes

Table 10. Result Comparison of Regression and Conjoint Analysis

A. Regression Coefficients of Individual Sustainable Benefit Claims

Variables	DV: ln(MVE) Beta	SE
Environmental	–.530***	(.073)
Social	–.221***	(.058)
Healthy	.368***	(.062)
Environmental & Social	8.375***	(1.527)
Environmental & Healthy	.177***	(.060)
Social & Healthy	–.075	(.085)
Environmental & Social & Healthy	1.170***	(.228)
Product sustainability	–.027***	(.003)
Advertising Intensity	1.059	(.672)
R&D Intensity	.209	(4.450)
ROA	4.922***	(.259)
Financial Leverage	1.060***	(.267)
Firm Size	.809***	(.027)
Sales Growth	–.019**	(.008)
Industry Competitiveness	.039**	(.017)
R&D Missing	–.110***	(.027)
Advertising Missing	–.187**	(.085)
inverse Mills ratio	–.004	(.232)
Copula correction (Environment)	.073***	(.008)
Copula correction (Social)	.031***	(.009)
Copula correction (Healthy)	–.044***	(.008)
Copula correction (Environmental & Social)	–.267***	(.047)
Copula correction (Environmental & Healthy)	–.025***	(.007)
Copula correction (Social & Healthy)	–.153***	(.032)
Copula correction (Environmental, Social, Healthy)	–.530***	(.073)
Constant	1.186***	(.601)
Firm, Year, Category FE	YES	
Observations	12,011	
R–squared	.735	

B. Conjoint Utility Part-worths

Benefit Claims	Utility
Environmental	–10.908
Social	–16.829
Healthy	9.259
Environmental & Social	27.218
Environmental & Healthy	33.400
Social & Healthy	34.191
Environmental & Social & Healthy	65.907

*** p <.01, ** p <.05, * p <.10; Standard errors in parentheses (bootstrapped SE using 200 replications)

Lastly, I provide the results for the shares of preferences (SOP) simulations across the four brands in Table 8, Panel B. I hold constant all attributes (brand, flavor, fat, and price) except "Benefit Claims" to simulate demands based solely on this attribute. The multi-label sustainable benefits claims are among the highest and sum up to almost half (48.4%) of the shares of preference, in the case of Chobani. I also notice the changes in the shares of preference for each benefit claim and the "None" option (not purchasing Greek yogurt) depending on the brand. Appendix B provides more details about the simulation process and information about additional scenarios that were taken into consideration. These results serve as guidelines for companies that launch products with different benefit claims. While the SOP is not a direct representation of market share, it does reflect the changes in consumer preferences depending on key attributes such as benefit claims and brand when products are released into the market. These shifts in preference can be related to product sales and cash flows of a company, which are used by the financial market to calculate firm value.

2.7.4 Comparison between Regression and Conjoint Results

Table 10 reports the results from the conjoint analysis and a regression conducted using the individual sustainable product innovation type dimensions. The coefficients from the regression for each product type show a similar pattern to their corresponding benefit claim utility part-worths in terms of direction. Single-label benefit claims, excluding Healthy, have negative regression coefficients in the firm value model and some of the lowest part-worth utilities from the conjoint. Likewise, most multi-label sustainable benefit claims have positive betas in the firm value regression model with some of the highest part-worth utilities from the conjoint. Thus, the largely similar pattern of results suggests that consumers' preferences for sustainability benefits and willingness to pay influence investors' evaluations of these benefits.

2.8 DISCUSSION AND CONCLUSIONS

There are increasing concerns about practicing capitalism in its current forms, and calls have begun for reforming it (Gelles 2019; Henderson 2020). One big step in that direction is the need to focus on multiple stakeholders and thus the growing interest in sustainable firm actions (Gelles 2019; Nielsen 2019; Whelan and Fink 2016). Motivated thus, significant effort has been directed to the supply side to enhance sustainable manufacturing, while demand side or consumer facing actions have been more recent. Companies have begun to invest in developing sustainable products, but there is little guidance and information about whether and when such innovations benefit the firm. This essay offers insight into these questions by examining the types of sustainable product innovations and how they differ in affecting firm value. I also identify innovation capability and new brands as market-based assets that can be leveraged to enhance the returns to sustainable new products. The results also provide caution that accompanying radical innovation with sustainable attributes is not beneficial to the firm. By learning about these contingencies, I provide guidelines to managers on whether and when sustainable product innovations create value for the firm.

Substantial research observes sustainability in firm practices such as corporate philanthropy or business practices, however, knowledge is limited when product is the unit of analysis. Here, I focus on the unit of analysis that is more relevant to marketing, namely by linking sustainable product innovations with firm value. Prior research in marketing has either not distinguished or has focused on a single attribute (Bezawada and Pauwels 2013; Olsen, Germann, and Eilert 2020; Olsen, Slotegraaf, and Chandukala 2014; Van Doorn and Verhoef 2015). I extend the literature by theorizing and empirically demonstrating that types of

sustainable product innovations *do* matter. The categorization of sustainability benefits that I validate with alternative methods is nuanced and of refined value to researchers.

I extend prior research on the performance implications of sustainable products that are limited to attitudinal outcomes to behavioral and financial market outcomes. The parallels in the pattern of results between consumer and investor responses suggest that investors are cognizant of the heterogeneity in customer reactions in their valuation of the financial effects of sustainable product innovations with alternative benefits. Also, the finding that single- and multi-label benefit types of sustainable products have asymmetric time-based returns explained by the mechanism of customer information processing fluency is quite novel as it links it to stock market outcomes. Thus, it extends the literature on consumer information processing beyond customer-level outcomes.

Second, this essay finds market-based assets such as brands and innovation ability (proxied by prior history of innovation) as strategic levers. Having a track record of past sustainable product launches acts to boost confidence among stakeholders and signals to them that the firm can "deliver on promise" (Homburg, Stierl, and Bornemann 2013; McWilliams and Siegel 2001). It thus extends the resource-based view that often treats the assets as main effects to moderators with important implications for managerial practice. The focus on the "product" domain of corporate sustainability practices also sends positive signals to investors and shareholders as they are relevant and appropriate dimensions for CPG companies to invest their resources. In turn, these product initiatives increase legitimacy and credibility in sustainability for these firms as they are providing direct benefits and value to stakeholders (Jayachandran, Kalaignanam, and Eilert 2013).

Third, the characteristics of product innovativeness may help in better understanding the nature of sustainable new products. The results suggest that products with low innovativeness may be more appropriate because customers find it difficult to comprehend and assimilate the benefits of both *radical* and *sustainable* at the same time when judging their effectiveness (Gershoff and Frels 2015; Luchs et al. 2010). This finding provides empirical support to conceptual work in sustainability that advocates for sustainable innovations that are of low innovativeness to fulfill sustainability goals (Varadarajan (2017).

Fourth, branding strategies play a key role when considering the launch of sustainable new products. Companies should consider new brands instead of utilizing existing ones for their entry strategies as lower risks are involved when firms introduce sustainable product innovations through new brands rather than changing existing ones (Moorman, Ferraro, and Huber 2012). In addition, firms with a portfolio of brands may want to consider a strategy of releasing sustainable product innovations at the individual product or brand level (e.g., House of Brands) rather than a corporate branding strategy to decrease potential risks and to create new brand associations with sustainable benefits. House of Brands strategies have a broader range of opportunities and degrees of freedom to embed sustainable benefits into its product offerings to create new brand associations (Vila, Bharadwaj, and Varadarajan 2019). For instance, Unilever has purchased and continues to acquire small brands with loyal followings such as Seventh Generation, Sundial, and Pukka Herbs.

Table 11. Wealth Analysis of Companies with Sustainable Product Innovations

A. Wealth Analysis of Top 20 Companies

Company	Wealth gains ($ millions)	Market Value ($ millions)
Home Depot U.S.A., Inc.	2,412.77	68,227.43
Bristol-Myers Squibb	948.70	68,683.20
Costco	314.49	33,403.70
Green Mountain Coffee	302.27	11,785.83
BJ'S Wholesale Club	239.43	2,391.39
Brown-Forman	148.16	15,890.56
Enjoy Life Foods	111.10	62,032.85
Colgate-Palmolive	108.26	54,877.08
Kroger	75.36	23,515.35
3M CO	73.93	82,539.94
Panera Bread	70.46	4,198.93
Dr Pepper Snapple Group	65.85	12,543.92
Enray LLC	55.39	11,597.54
Helen of Troy	53.42	1,579.22
Alcoa Inc.	51.92	12,959.10
Avon Products	51.85	8,421.67
Rite Aid Corp.	49.04	3,016.79
Whole Foods Market	38.13	13,102.21
Fresh Market	37.76	1,844.22
Rubbermaid Inc.	34.26	8,310.01

B. Percentile of Earnings for Companies with Sustainable Product Innovations

Wealth gains ($ millions)			
Top 10%	**Top 25%**	**Top 50%**	**Top 75%**
473.45	215.72	114.97	70.51

Fifth, the secondary data allows us to address endogeneity issues. Also, the use of financial measures contributes to the marketing field's ability to build a solid and cumulatively growing knowledge base regarding marketing's impact on firm performance that adds to a greater understanding of issues that matter to other disciplines (Katsikeas et al. 2016).

Sixth, I use financial measures of firm value that are useful in explaining to senior managers the linkages between firm marketing efforts to types of sustainable innovations (Katsikeas et al. 2016). Importantly, financial measures serve as specific outcomes rather than as monetary costs to the firm's sustainable initiatives (Kumar and Christodoulopoulou 2014).

Seventh, sustainable product innovations are not only benefit large firms with high market valuations, but also smaller ones (see Table 11). Companies such as BJ's Wholesale (market value = $2.39B; wealth gain = $239.43M), Fresh Market (market value= $1.84B; wealth gain = $37.76M), Helen of Troy (market value = $1.58B; wealth gain = $53.42M), and Hostess Brands (market value=$0.96B; wealth gain = $33.52M) that have relatively smaller market values (mean of market value for firms with sustainable product innovations = $29.69B; median = $6.59B) also benefit. Regardless of firm size, companies may benefit from making investments to create the right type of sustainable product innovations to enhance firm value.

Eighth, firms criticized for their short-sightedness and score at the bottom of CS ratings tend to have negative abnormal returns for their innovations. For instance, Kraft Heinz has wealth losses of $379 million for its sustainable product innovations. Kraft Heinz has been called out by Paul Polman, former CEO of Unilever, as a company that "focuses on a few billionaires and is built on the concept of cutting cost" but also for being at the bottom of the various sustainability and social responsibility indexes (Gelles 2019). Hence, product sustainability

practices serve as concrete ways for CPG companies to focus on sustainability initiatives that are rewarded by both customers and stakeholder groups.

Finally, the wealth gains for the Top 20 companies that launch sustainable product innovations, on average, are about $262 million. Companies that have established corporate sustainability initiatives such as Home Depot, Green Mountain Coffee (Keurig), Dr. Pepper Snapple Group (acquired by Keurig in 2018), and Brown Forman are reaping benefits from their innovations. Brands that will be most successful are those that use CS activities to provide incremental enhancements to consumer value. Therefore, customers must be able to envision new technologies and their benefits. Companies need to alleviate concerns of uncertainty in sustainable product innovations as this may potentially degrade perceived product quality and effectiveness, negatively influencing their contribution to increasing firm value.

2.9 LIMITATIONS AND FURTHER RESEARCH

There are several limitations in this essay that may serve as opportunities for future research. First, my dataset is limited to companies that launch innovations captured in a secondary database (i.e., Product Launch Analytics) with the variables of interest, limited to publicly traded companies in the U.S. (i.e., Compustat and CRSP). Hence, it's not viable to retrieve information on new product launches from non-U.S. companies such as Nestle, GlaxoSmithKline, or Danone that have relatively high levels of sustainability embedded in their culture. Further research could expand the dataset to include these companies using product-level metrics such as sales or accounting-based performance measures. Second, I focus on market value and Total q to measure firm value. However, other firm-level financial measures such as firm risk, both systematic and idiosyncratic, may offer a more nuanced view on the effects of sustainable

products on firm value and financial performance (Srinivasan and Hanssens 2009). Lastly, future research may examine consumer and retail data that provides information on the marketing mix elements of sustainable product innovations. In addition to the "product," focusing on other marketing mix elements will shed further insights into how these innovations perform in the market and their contributions to the firm in meeting the needs of its commercial stakeholders – consumers, investors, and suppliers. Of equal importance is to create societal impact metrics that measure the costs and benefits of sustainable products and their effects on the firms' societal stakeholders – society at large and the communities in which they do business

CHAPTER III

WHERE DOES THE SALES OF SUSTAINABLE NEW PRODUCTS COME FROM?: NEW, COMPETITIVE, AND CANNIBALIZED GROWTH

3.2 INTRODUCTION

Sustainability is no longer a strategic differentiator but a strategic *necessity* (Ioannou and Serafeim 2019). Consumer demand for sustainable products continue to grow and are serving as key drivers of sales growth. According to research by the Center for Sustainable Business at NYU Stern,[8] the 5-year compound annual growth rate (CAGR) of sustainable products in the CPG industry was 5.86%. This is seven times greater than conventional CPG (0.83%) products and almost four times as large as the CAGR for the entire CPG market (1.56%). Although sustainable products have a limited presence in the overall market at 16.1% (versus conventional 83.9%), they are delivering 54.7% of the CPG market growth and outperforming their conventional counterparts (45.3%).

[8] https://www.stern.nyu.edu/experience-stern/about/departments-centers-initiatives/centers-of-research/center-sustainable-business/research/csb-sustainable-market-share-index

Despite the growing significance of sustainable products, less is known about their sources of growth and where the demand is coming from. Further, there are various costs that are involved with introducing new products into the market. Beyond the R&D and manufacturing costs of innovating and producing these products, there are the consumer and retail adoption costs that need to be taken into consideration. Another element of cost may come in the form of cannibalization, where the demand for a new product comes at the expense of other conventional and sustainable products within the same brand or product portfolio, making it unattractive to the firm (van Heerde, Srinivasan, and Dekimpe 2010). When ignored, the success of the new sustainable products will be overestimated and could be net detrimental to the firm deciding to launch sustainable products into the marketplace given these unforeseen costs tied to these introductions (Srinivasan et al. 2005).

On the other hand, the sales of the new sustainable products may lead to more attractive sources such as *brand switching* (secondary demand), which comes at a cost to competitors. Or *new growth* (primary demand) that comes at the expense of the outside goods and provides new sources of revenue for the company through market (demand) expansion (Albuquerque and Bronnenberg 2009). Therefore, it is important for managers to measure these various demand effects and to weigh their costs and benefits. Against this backdrop, I seek to address the following questions:

1. Where is the growth of sustainable new products coming from? Are these sustainable new products cannibalizing, taking from the competition, or new sources of growth?

2. Do these sources of sales from sustainable new products vary over time?

To answer these questions, I use a time-varying vector autoregressive model with exogenous variables (VAR-X) to decompose the base sales of sustainable product introductions into its constituent sources of demand – primary (new growth) and secondary (cannibalization and brand switching) growth – across the full spectrum of products that a brand offers in the marketplace both sustainable and non-sustainable. With the product being the sustainable and conventional (non-sustainable) offerings of a brand, I also incorporate price, promotion (display and feature), and distribution to account for the effects of the entire marketing mix elements into consideration.

I apply this methodology to the introduction of sustainable new products in the detergent category. I chose this category as it is the most conservative and difficult to infuse sustainable benefit claims into products. Prior research considers it as a strength-related category, where product effectiveness of cleaning strength is a valid concern and connected with functional benefits (Skard, Jørgensen, and Pedersen 2021). Consumers believe that detergents and toothpaste are likely to have inferior functional performance when these products are environmentally friendly than when they are not (Chernev and Blair 2021). Therefore, detergents are highly susceptible to sustainable liability, where the promotion of sustainable attributes may backfire causing consumers to prefer conventional products because they are perceived as more effective than sustainable alternatives (Lin and Chang 2012; Luchs et al. 2010; Newman, Gorlin, and Dhar 2014). In addition to being the most susceptible to sustainable liability, it is also one of the categories with the fewest number of sustainable new product introductions.

This essay contributes to the literature and managerial practice in the following ways. First, I observe the supply side mechanisms that operate to influence purchase behaviors of sustainable innovations using retail data and actual sales. In the process, I also observe the full

marketing mix elements of sustainable innovations that are introduced into the marketplace in comparison to conventional new products. To the best of my knowledge, no study has investigated the marketing mix elements of the entire scope of a sustainable new product that is present in the marketplace through the lens of a demand decomposition approach. Second, this approach allows managers to estimate each of the demand effects of cannibalization, brand switching, and new growth to help calculate the net demand for sustainable new products entering the market. I also show how the contribution of different demand sources vary over time and discuss the managerial implications for both the focal brand and competitors.

3.3 LITERATURE REVIEW

Multiple studies have investigated sustainable products that currently exist in the market using consumer panel data. For instance, Ngobo (2011) and Van Doorn and Verhoef (2015) use individual household data to investigate consumer demands for organic products. While they also observe supply-side variables of price, promotion, and distribution, however, this information is limited to the households they capture. Bezawada and Pauwels (2013) use retail data to observe supply-side variables and compare sales elasticities between existing organic and conventional products. Based on a previous review of sustainable product innovations and firm performance (see Table 3), studies do not observe the demand side of sustainable new products or consider the marketing mix elements of these products. In a recent study, Van Doorn, Risselada, and Verhoef (2021) observe unit sales of new products, both sustainable and conventional, introduced into the market using consumer panel data. They also account for the supply-side or marketing mix elements of price, distribution, and promotion as well as advertising expenditures but do not observe this from a demand decomposition perspective which requires retail measurement and scanner data.

On the other hand, empirical studies that use a demand decomposition methodology do not observe the effects of sustainable new products and their marketing mix elements (e.g., Albuquerque and Bronnenberg 2009; Van Heerde, Srinivasan, and Dekimpe 2010). In addition, most studies in this area are focused on the effects of promotion and distribution in the retail setting, which serve as the main factors for influencing change in the sales or volume of products (Van Heerde and Neslin 2017). Therefore, there is less focus on examining the impact of sustainable new products on sales from a perspective of demand decomposition. Figure 6 provides an overview of the key studies in the literature.

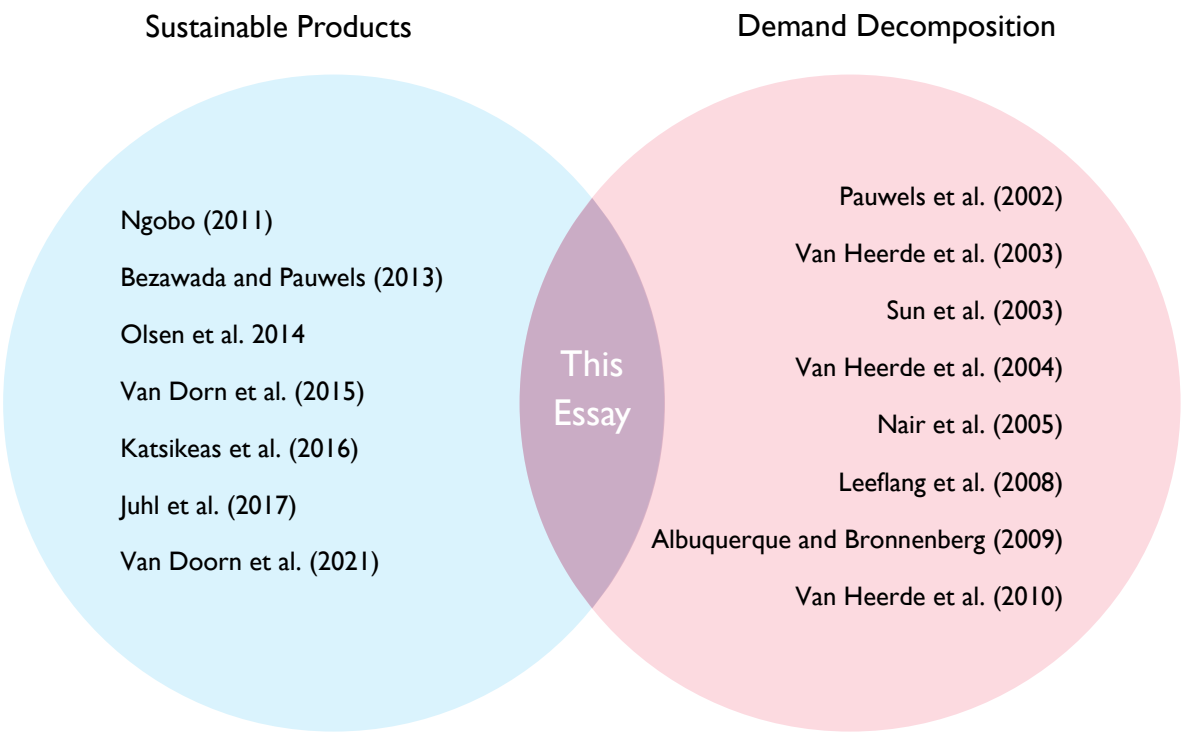


Figure 6. Empirical Studies on Sustainable Products and Demand Decomposition

Note: Representative studies from each of their respective areas. Not an exhaustive list

3.4 DATA

3.4.1 Data Processing

To build the dataset, I first utilize the Nielsen Retail Scanner[9] database, which contains weekly data at the UPC (Universal Product Code)–store level from participating retailers. This dataset consists of information on units, price, price multiplier, units, price, feature, and display generated by participating retail store point-of-sale (POS) systems in all U.S. markets from approximately 35,000 participating retail stores. However, the Nielsen dataset has limited information on sustainability claims and new product introductions that are essential to identifying the types of sustainable innovations. Therefore, I complement the product claims by using GlobalData's Product Launch Analytics database which provides comprehensive and detailed information on CPGs from 1980. This database includes the new product introduction dates, product descriptions, brand and manufacturer names, category names, shopkeeping unit (SKU), and most importantly, the information on product benefit labels which I use to determine sustainable claims (e.g., fair trade, non-GMO, biodegradable, etc.). Please refer to the process of identifying sustainable products based on their product claims (see Figure 4) and descriptions in Chapter II, Section 2.6.2.

However, there are no overlapping identifiers between the two databases of the Nielsen Retail Scanner and Product Launch Analytics which necessitates additional pre-processing for merging. One option is to manually identify and connect the corresponding terms from the SKUs to the UPC Descriptions.

[9] "The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein."

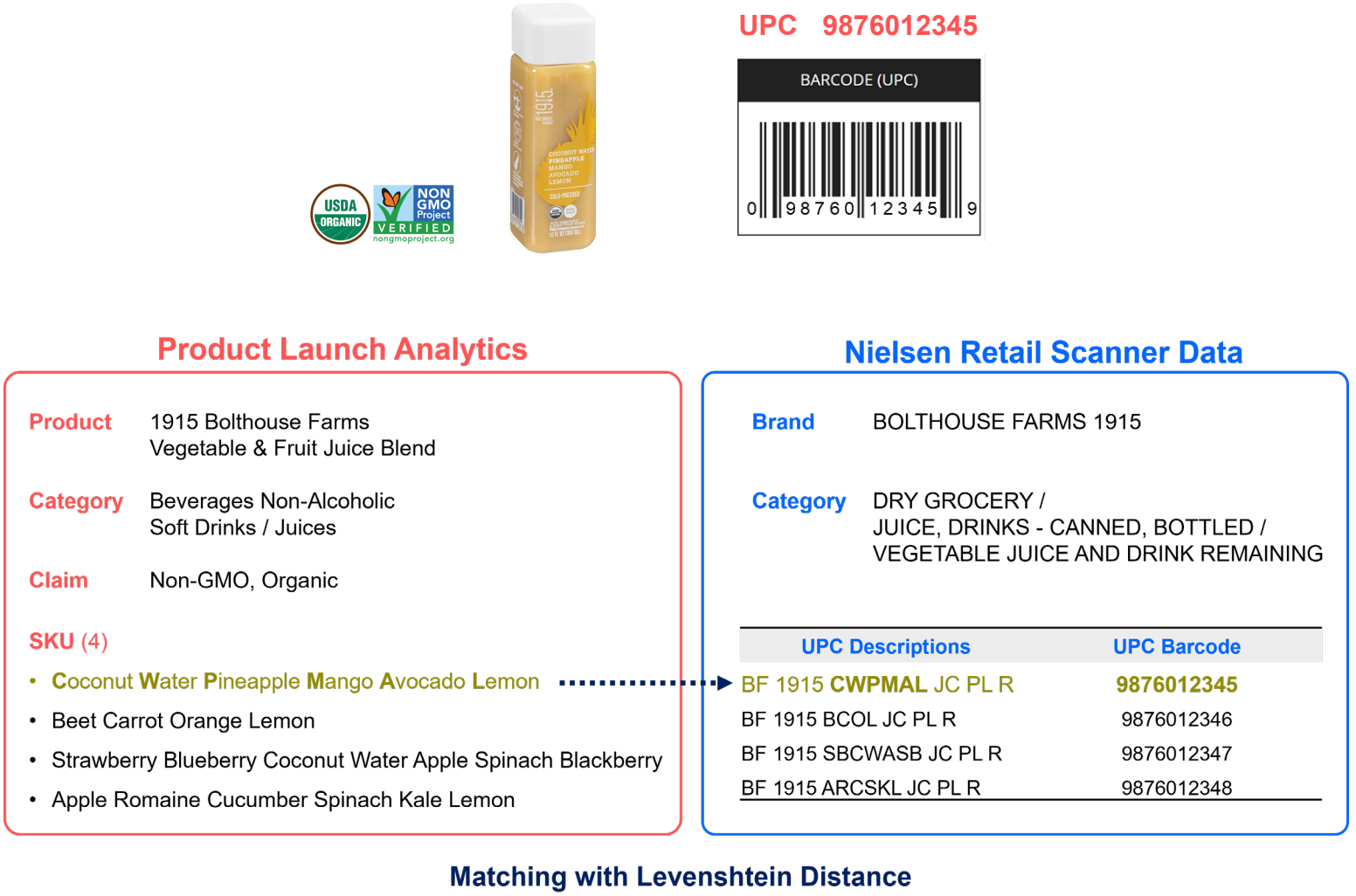


Figure 7. Overview of Data Merging Process

However, this task becomes impractical when faced with the challenge of matching approximately four million products that are scattered across 250,000 or so brands. Even with the initial filtering of products into certain brands, this process would be extremely daunting as there are tens or even thousands of products that are tied to each brand. Therefore, I utilize string matching techniques based on Levenshtein distance[10] to merge the two databases. This measure is based on the number of deletions, insertions, or substitutions required to transform a source into a target and is measured as the differences between these two strings. In our case, the string variables would be the SKU information from Product Launch Analytics and the UPC Descriptions from Nielsen Retail Scanner. Figure 7 provides an overview of the matching process with examples.

3.4.2 Empirical Setting

Using this combined dataset, I construct weekly data that includes the sales and the marketing mix variables for the periods of 2010–2017, or 418 weekly observations across this seven-year span. Specifically, I focus on the introduction of sustainable new products in the detergent industry. The focal brand I focus on is Tide, one of the sub-brands of the manufacturer P&G. Within P&G, there are other brands such as Cheer, ERA, Gain, Dawn, etc. Also, I observe the 186 competitor brands such as Oxi-clean, Arm & Hammer. Among these brands, I divide between sustainable and conventional products. Tide has launched three times over the span of seven years. This is to ensure that we have a large enough effect to gauge the influence of sustainable new products entering the market. Prior to the launch of its sustainable new products, Tide commanded about a 28% market share in the detergent category as the brand leader.

[10] I use the Token Set Ratio using FuzzyWuzzy in Python to compare strings and determine matches.

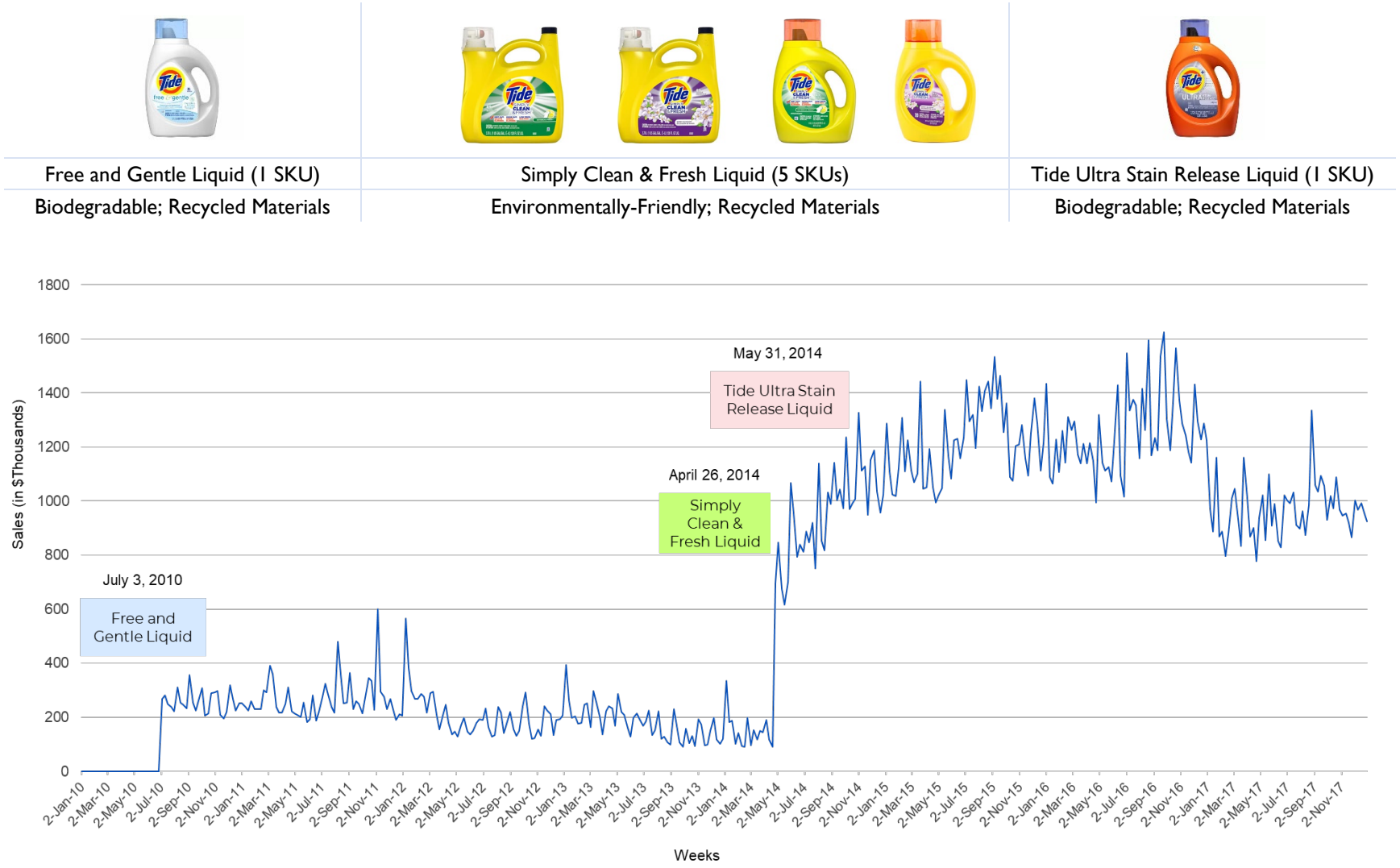


Figure 8. Sustainable New Products Launch and Sales of Tide

The launch of its sustainable new product on July 3rd of 2010 registered a market share of about 0.4%. Afterward, Tide again launched on April 26th and May 31st of 2014, which resulted in a market share of 1.4% for its sustainable new products while the total share for Tide was about 33%. Figure 8 indicates the launch dates and sales amounts for Tide's sustainable new products.

3.4.3 Key Measures

Sales. The focal variable we use to measure demand is based on weekly sales. I aggregate the weekly sales based on their brand and specification of sustainable or conventional. Following prior research (e.g., Simester, Tucker, and Yang 2019), I exclude items that survive fewer than 13 weeks (90 days) to avoid survival bias but also to avoid products explicitly introduced with a short-term purpose (e.g., Halloween or Christmas themed products).

Marketing mix. In addition to sustainable new products, I aggregate the weekly levels for each of the marketing mix variables of (1) Price, (2) Distribution, and (3) Promotion based on their brand and specification of sustainable or conventional. "Price" is the price of the product sold for that brand in all stores for that week including any fluctuations. "Distribution" is the total number of stores that carry the specific product of the brand in each respective designated market area (DMA). Lastly, "Promotion" is composed of two measures – (a) Feature (featured advertising) and (b) Display (product displayed) – and are dummy coded (0 or 1) for each construct if a product of the brand was featured and/or displayed in that store on that week. I use the summed values for Feature and Display for each of these variables.

Control variables. I control for time-invariant elements, in particular, Radical (1 or 0) for radical (versus incremental) innovations, Quality (1 or 0) for quality identifying claims (e.g., long-lasting, upscale, etc.), and Season (1 or 0) to account for seasonality for weeks that fall within major U.S. holidays.

3.5 METHODS

3.5.1 VAR-X Model

To understand the fundamentals of the demand decomposition approach, I need to implement a model that can capture the dynamic nature of new growth, cannibalization, and brand switching. Also, I want to incorporate marketing mix elements of price, place, promotion, and product type into the setup. Using a time-varying vector autoregressive model with exogenous variables, denoted by the "X" in VAR-X, allows me to decompose the base sales of sustainable product introductions into its constituent sources of sales – Tide conventional and sustainable, P&G conventional and sustainable excluding Tide, and Competitor conventional and sustainable. The VAR-X model has been widely used in the marketing context as it treats all variables as endogenous (e.g., Colicev et al. 2018; Eckert et al. 2021; Hewett et al. 2016).

First, I use the Schwartz Bayesian Information Criteria (BIC) to determine the lag length for the VAR-X model specification and conclude that a lag of L = 2 is optimal (see Table 12). In time-series modeling, BIC is a commonly used method to determine the lag length (Colicev et al. 2018; Eckert et al. 2021; Hewett et al. 2016). The benefits of BIC are that it is (1) the most accurate criterion for all realistic sample sizes (Ivanov and Kilian 2005) and (2) can asymptotically approximate the marginal density of the data used to construct the Bayes factor in Bayesian hypothesis testing (Allenby, Arora, and Ginter 1998).

Table 12. Lag Selection Diagnostics using Schwartz BIC

Lag	Tide Conventional	Tide Sustainable	P&G Conventional	P&G Sustainable	Competitor Conventional	Competitor Sustainable
0	–12.3503	–9.2980	–12.8132	–6.8146	–12.6925	–8.4611
1	–17.2759	–14.5827	–18.0308	–14.9233	–17.7132	–13.3168
2	**–17.3144***	–14.6241*	–18.1966*	–14.9389*	–17.8726*	–13.3395*
3	–17.0993	–14.4612	–18.0177	–14.7159	–17.6762	–13.0829
4	–17.1596	–14.4436	–18.0354	–14.6611	–17.7112	–12.9956
5	–16.9885	–14.2338	–17.8292	–14.4442	–17.5027	–12.8433
6	–16.7467	–13.9679	–17.6012	–14.1915	–17.2808	–12.5383
7	–16.4220	–13.6485	–17.3187	–13.8688	–16.9801	–12.2412
8	–16.1860	–13.3587	–17.0538	–13.5826	–16.7310	–11.9423

Second, I test if the variables are stationary or evolving using the augmented Dickey-Fuller (ADF) test. I first differenced the sales measures of all sustainable new products (Tide, P&G excluding Tide, and Competitors) along with store and price as they did not reject the null of a unit root ($p > .10$). For other variables (sales differences of conventional products, display, feature), they enter the model without first differencing as the ADF test rejects the null of a unit root ($p < .01$).

Third, I create measures for estimated sales ($ES_{b,m,t}$) for each product type (Tide conventional and sustainable, P&G conventional and sustainable excluding Tide, and Competitor conventional and sustainable) by using an AR(2) setup where I regress the sales of the product on time (t) by its time-lagged sales measure in time (t–1) and (t–2), two-week lags along with its price, store (distribution), and promotion (display and feature):

$$ES_{b,m,t} = \alpha_{b,m,t} + \beta_1(\text{Sales})_{b,m,t-1} + \beta_2(\text{Sales})_{b,m,t-2} + \beta_3(\text{Price})_{b,m,t} + \beta_4(\text{Store})_{b,m,t} + \beta_5(\text{Display})_{b,m,t} + \beta_6(\text{Feature})_{b,m,t} + \varepsilon_{b,m,t}. \quad (6)$$

where brands b = 1, … B, manufacturers m = 1, … M, and weeks t = 1, … T.

I then difference each of the measures for estimated sales ($ES_{b,m,t}$) with their actual sales for each product type to derive measures of sales differences ($\Delta S_{b,m,t}$).

Finally, I specify the VAR-X model with control variables using the following equation:

$$\begin{Bmatrix} \Delta \text{ Sales (Tide Con)}_t \\ \Delta \text{ Sales (Tide SNP)}_t \\ \Delta \text{ Sales (P\&G Con)}_t \\ \Delta \text{ Sales (P\&G SNP)}_t \\ \Delta \text{ Sales (Comp Con)}_t \\ \Delta \text{ Sales (Comp SNP)}_t \\ \text{Stores}_t \\ \text{Price}_t \\ \text{Feature}_t \\ \text{Display}_t \end{Bmatrix}$$

$$= \begin{Bmatrix} \Delta \text{ Sales (Tide Con)}_{t-1} \\ \Delta \text{ Sales (Tide SNP)}_{t-1} \\ \Delta \text{ Sales (P\&G Con)}_{t-1} \\ \Delta \text{ Sales (P\&G SNP)}_{t-1} \\ \Delta \text{ Sales (Comp Con)}_{t-1} \\ \Delta \text{ Sales (Comp SNP)}_{t-1} \\ \text{Stores}_{t-1} \\ \text{Price}_{t-1} \\ \text{Feature}_{t-1} \\ \text{Display}_{t-1} \end{Bmatrix} + \begin{Bmatrix} \Delta \text{ Sales (Tide Con)}_{t-2} \\ \Delta \text{ Sales (Tide SNP)}_{t-2} \\ \Delta \text{ Sales (P\&G Con)}_{t-2} \\ \Delta \text{ Sales (P\&G SNP)}_{t-2} \\ \Delta \text{ Sales (Comp Con)}_{t-2} \\ \Delta \text{ Sales (Comp SNP)}_{t-2} \\ \text{Stores}_{t-2} \\ \text{Price}_{t-2} \\ \text{Feature}_{t-2} \\ \text{Display}_{t-2} \end{Bmatrix} + \begin{Bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \\ \varepsilon_{4,t} \\ \varepsilon_{5,t} \\ \varepsilon_{6,t} \\ \varepsilon_{7,t} \\ \varepsilon_{8,t} \\ \varepsilon_{9,t} \\ \varepsilon_{10,t} \end{Bmatrix}, \quad (7)$$

where t = 1, …, T (= 418) weekly observations, from January 2010 to December 2017. Δ Sales (Tide Con): brand = b, manufacturer = m, SNP ≠ 1 refers to the difference between estimated sales and actual sales of Tide's conventional products. Δ Sales (Tide SNP): brand = b, manufacturer = m, SNP = 1 refers to Tide's sustainable products. Δ Sales (P&G Con): brand ≠ b, manufacturer = m, SNP ≠ 1 and Δ Sales (P&G SNP): brand ≠ b, manufacturer = m, SNP = 1 each

refer to P&G's conventional and sustainable products excluding Tide products, respectively. Δ Sales (Comp Con): brand ≠ b, manufacturer ≠ m, SNP ≠ 1 and Δ Sales (Comp SNP): brand ≠ b, manufacturer ≠ m, SNP = 1 each refer to the Competitor's conventional and sustainable products, respectively. I also include the exogenous variables of sustainable new product launch (1 or 0) for the launch of a Tide sustainable new product for that week and up to the 90-day period. Radical (1 or 0) for radical innovations, Quality (1 or 0) for quality identifying claims, and Season (1 or 0) to account for seasonality for weeks that fall within major U.S. holidays.

3.5.2 VAR-X Goodness of Fit Measures

To determine the stability of my model, I use the eigenvalues from the stability measures using unit root tests. Figure 9 indicates that the VAR model is stable with all eigenvalues or roots lying within the unit circle, thus satisfying the stability condition (Eckert et al. 2021).

Eigenvalue stability condition

Eigenvalue	Modulus
-.9144746	.914475
.9144746	.914475
-.8855509	.885551
.8855509	.885551
-.7711798	.77118
.7711798	.77118
.08123789 + .5205147i	.526816
.08123789 - .5205147i	.526816
-.08123789 + .5205147i	.526816
-.08123789 - .5205147i	.526816
-.3528082 + .02675496i	.353821
-.3528082 - .02675496i	.353821
.3528082 + .02675496i	.353821
.3528082 - .02675496i	.353821
-.1794762 + .2818188i	.334116
-.1794762 - .2818188i	.334116
.1794762 + .2818188i	.334116
.1794762 - .2818188i	.334116
-.2879083	.287908
.2879083	.287908

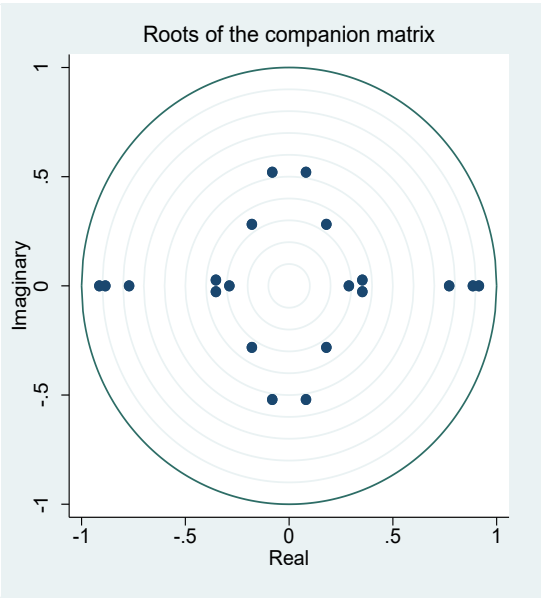


Figure 9. Unit Root and VAR Stability Condition Measures

3.6 RESULTS

3.6.1 Impulse Response Functions (IRF)

In VAR models, it is infeasible to interpret estimated coefficients directly (Sims 1980; Ecker et al. 2021). Instead, I present the results of the orthogonalized impulse response functions (OIRFs) that are calculated using the individual coefficients. Figure 10 captures the change in demand amounts while Table 13 provides the amount changes due to the shock of introducing Tide's sustainable new products into the market. Upon observing each of the shocks on the various product types, I see that these levels diminish after about 20–25 weeks.

Next, I focus on the sales amount fluctuations due to the shock of Tide's sustainable new products entering the market on all other product types from t+2, the optimal lag length period. First, the introduction of Tide's sustainable products leads to increases in the sales of Tide's conventional products. This increase is the most pronounced in comparison to all other products and suggests there is a complementing effect. Second, for P&G's sustainable products excluding Tide, they exhibit initial decreases but gradually recover from the influence of Tide's sustainable products suggesting cannibalization or substitution effects. P&G's conventional products excluding Tide are not so much affected by the launch of Tide's sustainable ones. Lastly, for competitor products, both show initial decreases in their sales. This decrease is more pronounced for competitor sustainable products which continue to be negative for up to about 20 weeks.

As a robustness check, I also observe the OIRFs using natural logarithms for all sales measures of the six product types, distribution, price, and promotion (display and feature) from Equation 6 to create elasticities (see Figure 11 and Table 14).

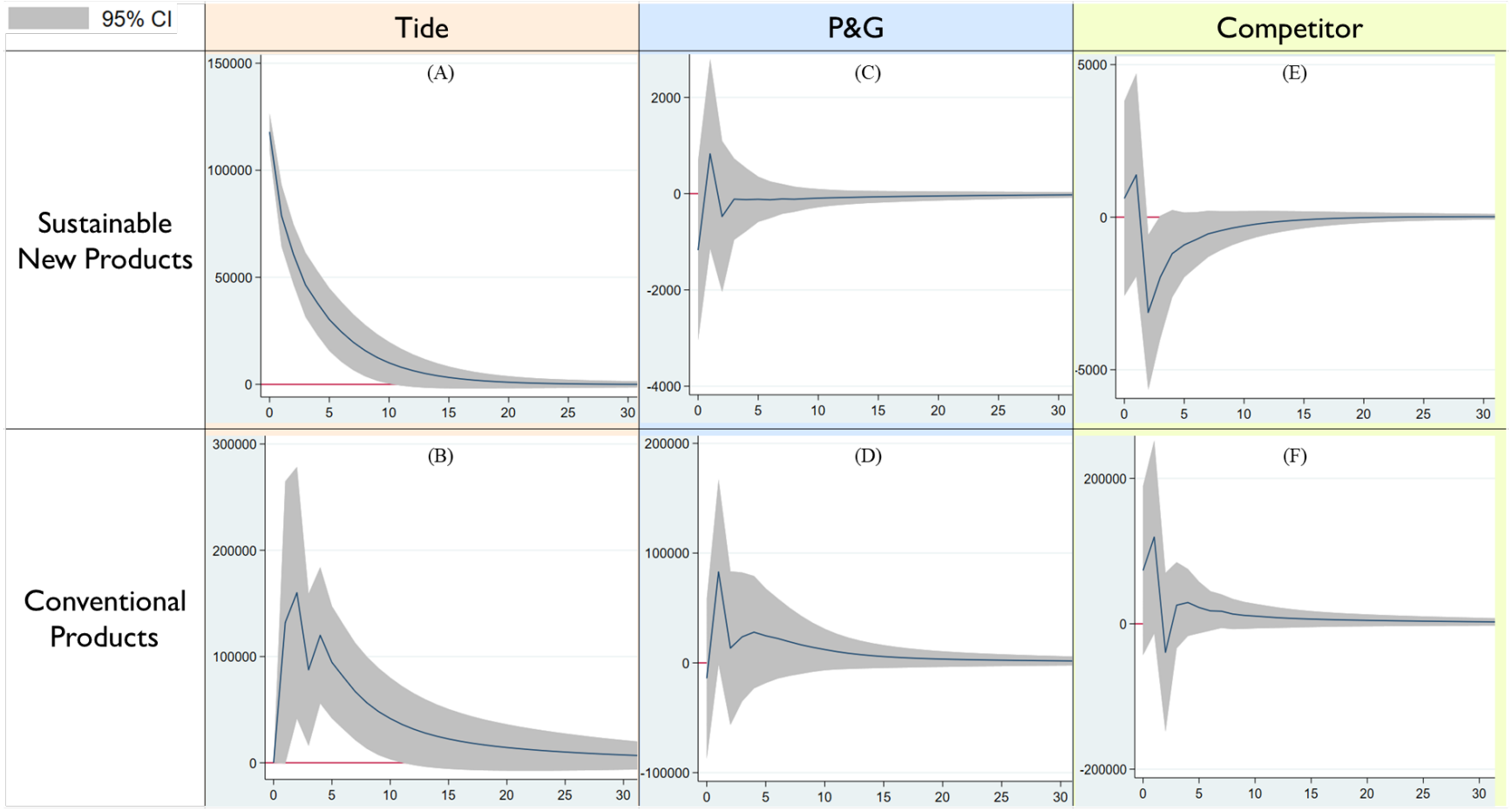


Figure 10. IRF of the Shock of Sustainable New Products

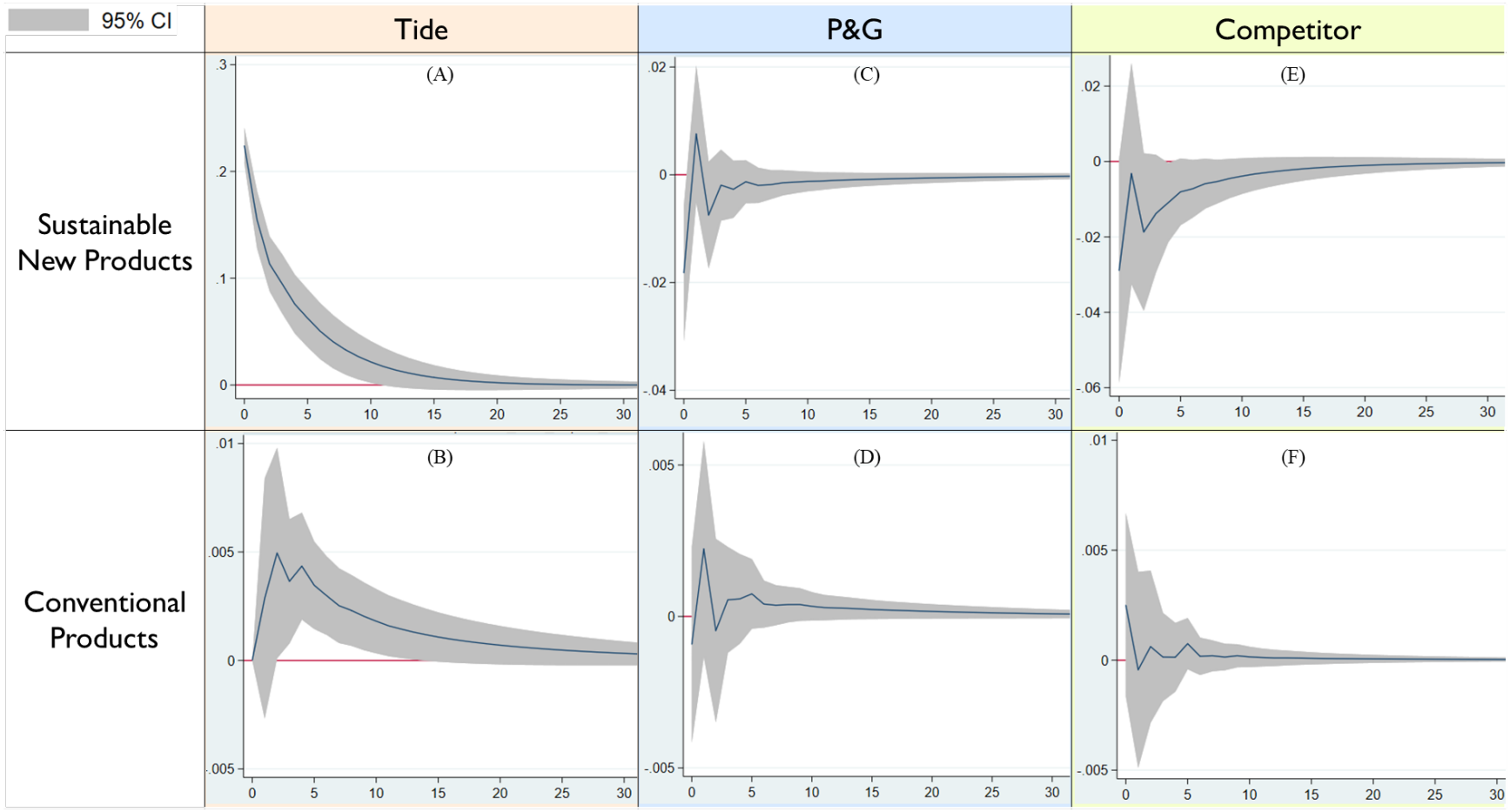


Figure 11. IRF of the Shock of Sustainable New Products using Elasticities

Table 13. IRFs of the Shock of Sustainable New Products

A. Sales

Lag	Tide Sustainable (A)	Tide Conventional (B)	P&G Sustainable (C)	P&G Conventional (D)	Competitor Sustainable (E)	Competitor Conventional (F)
0	117,933	0	–1,176	–14,200	614	73,258
1	78,770	132,058	828	82,891	1,386	119,407
2	60,709	160,074	–475	13,454	–3,122	–39,200
3	46,488	87,540	–115	23,714	–1,971	2,556
4	38,001	120,007	–124	27,986	–1,194	29,298
5	30,253	94,537	–117	24,691	–908	22,363
6	24,573	80,603	–128	22,265	–732	17,776
7	19,692	67,069	–110	19,276	–547	17,307
8	15,740	56,477	–116	16,445	–446	13,432
9	1,255	48,203	–103	14,147	–358	11,591
10	10,034	41,710	–93	12,157	–288	10,566
11	8,015	36,213	–86	10,300	–227	9,477
12	639	31,707	–81	8,758	–180	839
13	5,087	27,993	–75	7,544	–142	7,591
14	4,048	24,977	–70	6,566	–12	6,982
15	3,218	22,444	–65	5,755	–86	6,467
16	2,554	2,031	–61	5,090	–65	601
17	2,022	18,481	–58	4,552	–48	5,615
18	1,596	16,925	–54	4,114	–35	5,275
19	1,256	15,578	–51	376	–23	4,976
20	984	14,398	–48	3,446	–15	4,704

B. Elasticities

Lag	Tide Sustainable (A)	Tide Conventional (B)	P&G Sustainable (C)	P&G Conventional (D)	Competitor Sustainable (E)	Competitor Conventional (F)
0	22.4%	0.0%	–1.8%	–0.1%	–2.9%	0.3%
1	15.5%	0.3%	0.8%	0.2%	–0.3%	0.0%
2	11.3%	0.5%	–0.8%	0.0%	–1.9%	0.1%
3	9.5%	0.4%	–0.2%	0.1%	–1.4%	0.0%
4	7.6%	0.4%	–0.3%	0.1%	–1.1%	0.0%
5	6.3%	0.3%	–0.1%	0.1%	–0.8%	0.1%
6	5.0%	0.3%	–0.2%	0.0%	–0.7%	0.0%
7	4.1%	0.3%	–0.2%	0.0%	–0.6%	0.0%
8	3.3%	0.2%	–0.1%	0.0%	–0.5%	0.0%
9	2.7%	0.2%	–0.1%	0.0%	–0.4%	0.0%
10	2.2%	0.2%	–0.1%	0.0%	–0.4%	0.0%
11	1.7%	0.2%	–0.1%	0.0%	–0.3%	0.0%
12	1.4%	0.1%	–0.1%	0.0%	–0.3%	0.0%
13	1.1%	0.1%	–0.1%	0.0%	–0.3%	0.0%
14	0.9%	0.1%	–0.1%	0.0%	–0.2%	0.0%
15	0.7%	0.1%	–0.1%	0.0%	–0.2%	0.0%
16	0.6%	0.1%	–0.1%	0.0%	–0.2%	0.0%
17	0.4%	0.1%	–0.1%	0.0%	–0.1%	0.0%
18	0.4%	0.1%	–0.1%	0.0%	–0.1%	0.0%
19	0.3%	0.1%	–0.1%	0.0%	–0.1%	0.0%
20	0.2%	0.1%	–0.1%	0.0%	–0.1%	0.0%

3.6.2 Forecast-Error Variance Decomposition (FEVD)

I observe the results from Figure 12 and Table 15 for the periods of week 2 and week 16 as reference points for determining the time-varying demand decomposition using Cholesky FEVDs. Week 2 is the optimal lag period (L = 2) we previously selected based on the ADF tests. Week 16 indicates when the shock levels of Tide's sustainable new products start to level out and stabilize. The focus is on observing the changes in the variance due to the shock of sustainable Tide into the market for these periods.

For week 2, the launch of Tide's sustainable new product contributes to 91.5% of the shock on itself which indicates the level of its *new growth*. Next, I observe the levels of cannibalization which are derived by summing the total of three FEVD levels for Tide Conventional (1.0%), P&G conventional (1.1%), and P&G sustainable (0.6%). The total demand decomposition from *cannibalization* is 2.7%. Lastly, I observe the levels of *brand switching* that occur by summing competitor conventional (1.2%) and competitor sustainable (2%), for a total of 1.4%. Subsequently in Week 16, I see that the levels of new growth start to diminish and level out at 86.7% while cannibalization (Tide conventional + P&G conventional + P&G sustainable) and brand switching (competitor conventional + conventional sustainable) increase to 6.9% and 3.3%, respectively.

For the results using elasticities, I also start at week 2 but identify week 20 as when the trend starts to level out. At week 2, the primary demand for Tide's sustainable new products is 89.4% with cannibalization (Tide conventional + P&G conventional + P&G sustainable) summing to 3.1% and brand switching (competitor conventional + conventional sustainable) at 1.3%. This also changes at week 20 with new growth diminishing to 80.7%, cannibalization at 6.2%, and brand switching increasing to 2.4%.

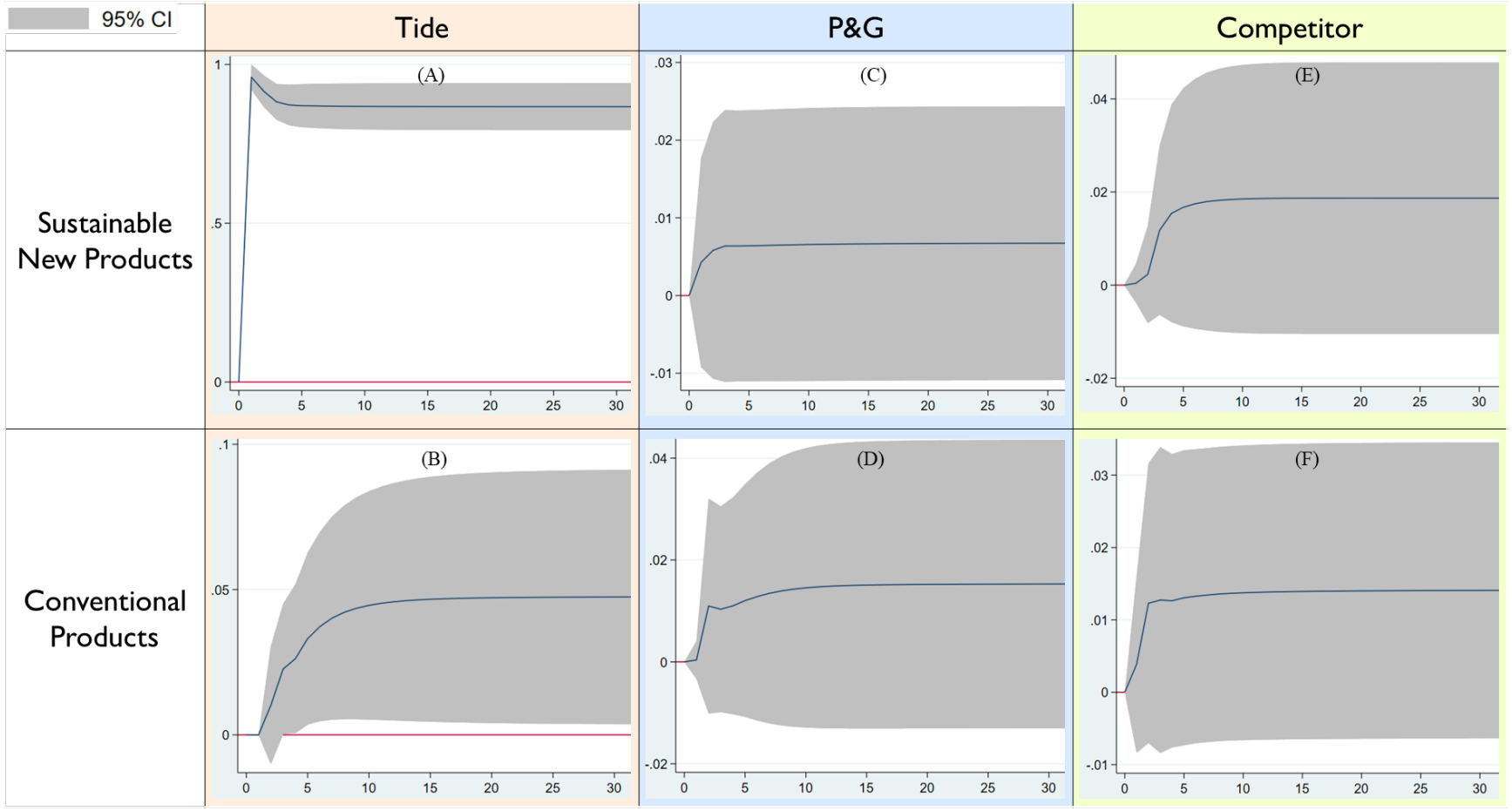


Figure 12. FEVD of the Shock of Sustainable New Products

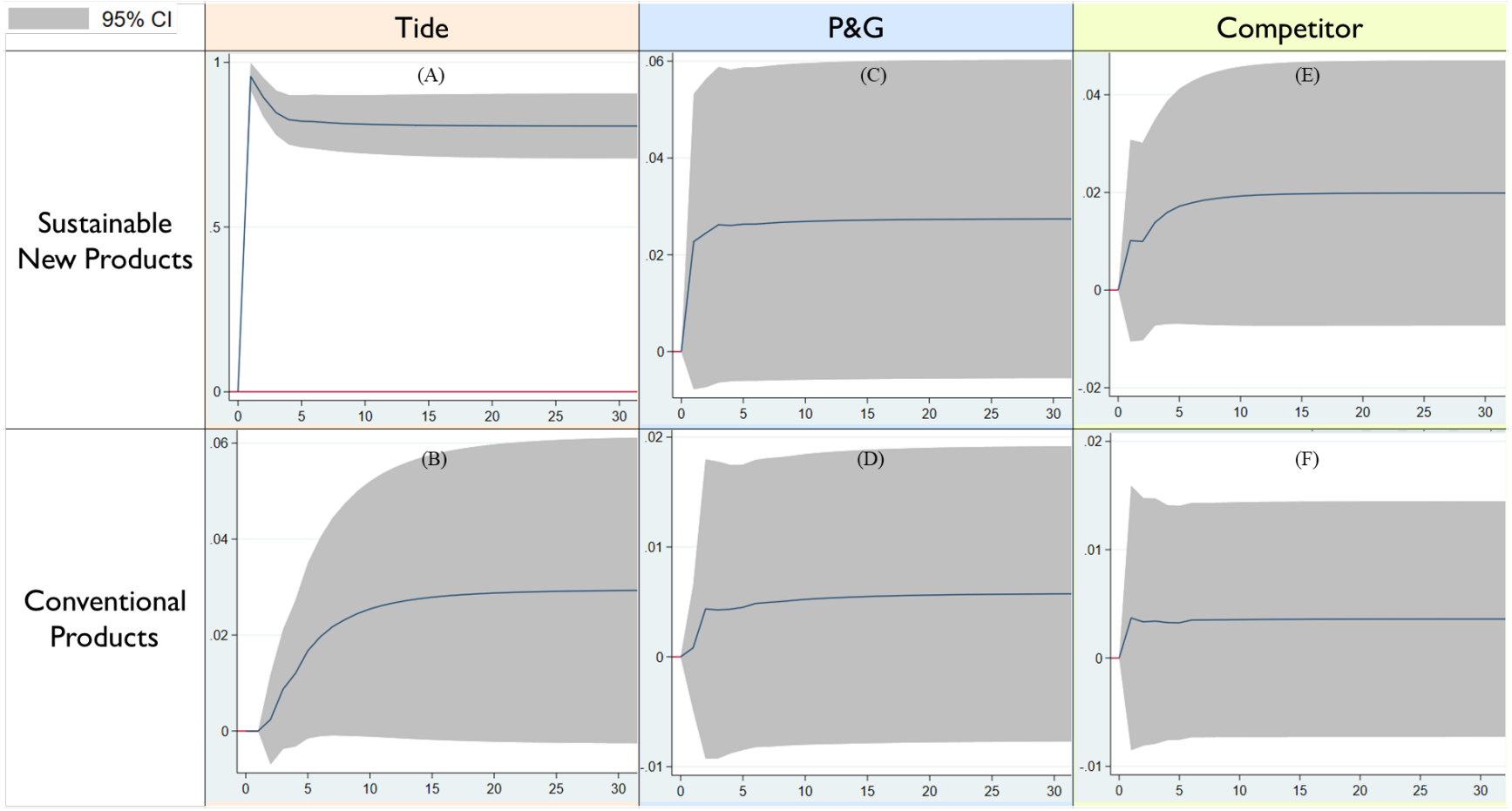


Figure 13. FEVD of the Shock of Sustainable New Products using Elasticities

Table 14. FEVD of the Shock of Tide SNPs

A. Sales

Lag	Tide Sustainable (A)	Tide Conventional (B)	P&G Sustainable (C)	P&G Conventional (D)	Competitor Sustainable (E)	Competitor Conventional (F)
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	96.0%	0.0%	0.4%	0.0%	0.0%	0.4%
2	**91.5%**	**1.0%**	**0.6%**	**1.1%**	**0.2%**	**1.2%**
3	88.2%	2.3%	0.6%	1.0%	1.2%	1.3%
4	87.2%	2.6%	0.6%	1.1%	1.5%	1.3%
5	87.0%	3.3%	0.6%	1.2%	1.7%	1.3%
6	87.0%	3.7%	0.6%	1.3%	1.7%	1.3%
7	86.9%	4.0%	0.6%	1.3%	1.8%	1.3%
8	86.8%	4.2%	0.7%	1.4%	1.8%	1.4%
9	86.8%	4.4%	0.7%	1.4%	1.8%	1.4%
10	86.8%	4.5%	0.7%	1.5%	1.8%	1.4%
11	86.8%	4.5%	0.7%	1.5%	1.9%	1.4%
12	86.8%	4.6%	0.7%	1.5%	1.9%	1.4%
13	86.8%	4.6%	0.7%	1.5%	1.9%	1.4%
14	86.8%	4.6%	0.7%	1.5%	1.9%	1.4%
15	86.8%	4.7%	0.7%	1.5%	1.9%	1.4%
16	**86.7%**	**4.7%**	**0.7%**	**1.5%**	**1.9%**	**1.4%**
17	86.7%	4.7%	0.7%	1.5%	1.9%	1.4%
18	86.7%	4.7%	0.7%	1.5%	1.9%	1.4%
19	86.7%	4.7%	0.7%	1.5%	1.9%	1.4%
20	86.7%	4.7%	0.7%	1.5%	1.9%	1.4%

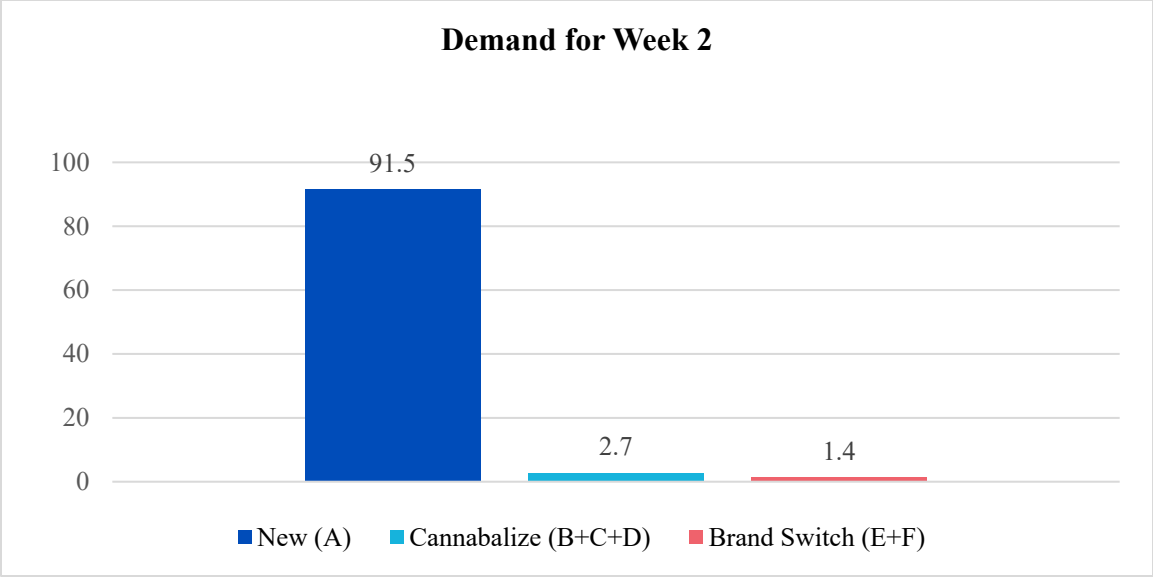
B. Elasticities

Lag	Tide Sustainable (A)	Tide Conventional (B)	P&G Sustainable (C)	P&G Conventional (D)	Competitor Sustainable (E)	Competitor Conventional (F)
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	95.7%	0.0%	2.3%	0.1%	1.0%	0.4%
2	**89.4%**	**0.2%**	**2.5%**	**0.4%**	**1.0%**	**0.3%**
3	84.7%	0.9%	2.6%	0.4%	1.4%	0.3%
4	82.6%	1.2%	2.6%	0.4%	1.6%	0.3%
5	82.1%	1.7%	2.6%	0.5%	1.7%	0.3%
6	82.0%	2.0%	2.6%	0.5%	1.8%	0.3%
7	81.7%	2.2%	2.7%	0.5%	1.8%	0.4%
8	81.5%	2.3%	2.7%	0.5%	1.9%	0.4%
9	81.3%	2.4%	2.7%	0.5%	1.9%	0.4%
10	81.2%	2.5%	2.7%	0.5%	1.9%	0.4%
11	81.1%	2.6%	2.7%	0.5%	1.9%	0.4%
12	81.0%	2.7%	2.7%	0.5%	2.0%	0.4%
13	81.0%	2.7%	2.7%	0.5%	2.0%	0.4%
14	80.9%	2.8%	2.7%	0.5%	2.0%	0.4%
15	80.9%	2.8%	2.7%	0.5%	2.0%	0.4%
16	80.8%	2.8%	2.7%	0.6%	2.0%	0.4%
17	80.8%	2.8%	2.7%	0.6%	2.0%	0.4%
18	80.8%	2.8%	2.7%	0.6%	2.0%	0.4%
19	80.8%	2.9%	2.7%	0.6%	2.0%	0.4%
20	**80.7%**	**2.9%**	**2.7%**	**0.6%**	**2.0%**	**0.4%**

3.7 DISCUSSION AND CONCLUSIONS

Using retail scanner data, I decompose the demand for sustainable new products to determine if they serve as sources of new (market expansion), competitive (substitution), or cannibalized growth. As summarized in Figure 14, the majority of the demand comes from new growth when a sustainable new product is launched into the market. The effect of this new growth is at about 92% at the time of its launch but gradually levels out at about 87% after 16 weeks. Although not as substantive, the effects of cannibalization and brand switching are noticeable. Cannibalization commands 2.7% and this slowly increases to 6.9% while brand switching is at 1.4% and also increases to 3.3% 20 weeks after the launch of a sustainable new product.

In addition, Table 15 provides the primary and secondary demand figures they were reported in prior empirical studies that deal with demand decomposition. The results of this essay closely resemble the magnitudes that previous studies have shown, especially for the detergent categories.



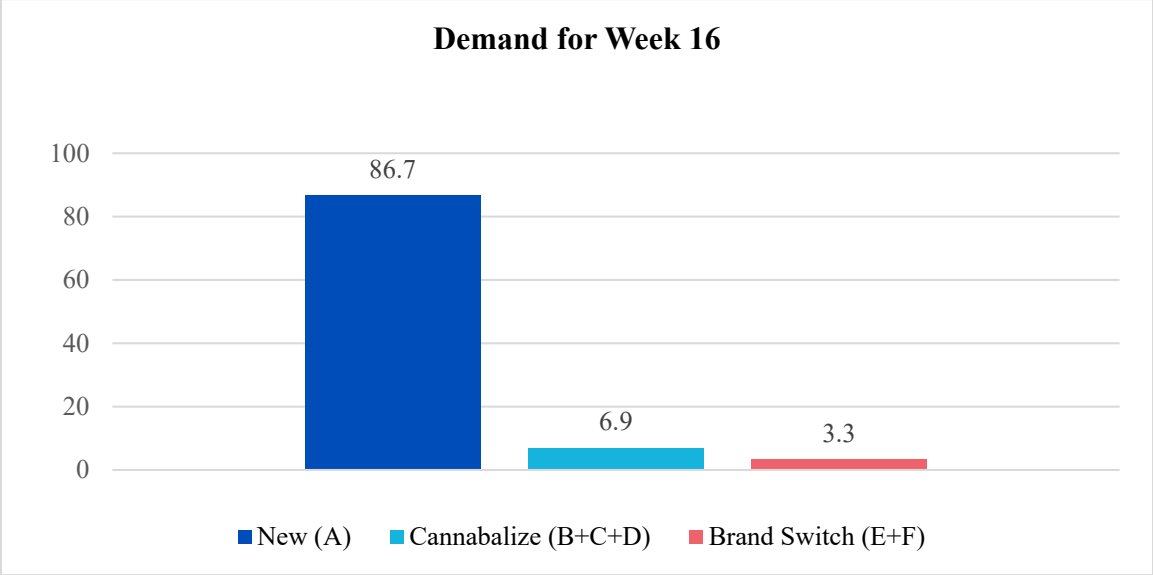


Figure 14. Summary of Demand Decomposition

Table 15. Comparison of Empirical Studies on Demand Decomposition

A. Elasticities

Study	Category	Secondary Demand (%)	Primary Demand (%)
Gupta (1988)	Coffee	84	16
Chiang (1991)	Coffee (feature)	81	19
	Coffee (display)	85	15
Chintagunta (1993)	Yogurt	40	60
Bucklin et al. (1998)	Yogurt	58	42
Bell et al. (1999)	Margarine	94	6
	Soft drinks	86	14
	Sugar	84	16
	Paper towels	83	17
	Bathroom tissue	81	19
	Dryer softeners	79	21
	Yogurt	78	22
	Ice cream	77	23
	Potato chips	72	28
	Bacon	72	28
	Liquid detergents	70	30
	Coffee	53	47
	Butter	49	51
Chib et al. (2004)	Cola (price)	78	22
	Cola (display)	68	32
	Cola (feature)	64	36
Van Heerde et al. (2003)	Sugar	65	35
	Yogurt	58	42
Nair et al. (2005)	Orange juice	65	35

B. Sales

Study	Category	Secondary Demand (%)	Primary Demand (%)
Pauwels et al. (2002)	Soup	11	89
	Yogurt	39	61
Van Heerde et al. (2003)	Sugar	45	55
	Yogurt	33	67
	Tuna	22	78
Sun et al. (2003)	Ketchup	56	44
Van Heerde et al. (2004)	Peanut butter	43	57
	Shampoo	31	69
	Tuna	31	69
	Bathroom tissue	21	79
Nair et al. (2005)	Orange juice	8	92
Sun (2005)	Tuna	42	58
	Yogurt	39	61
Chan et al. (2008)	Tuna	28	72
	Paper towels	14	86
Leeflang et al. (2008)	Bottled beer	18	82
	Canned beer	11	89
	Fabric softeners (concentrate)	13	87
	Fabric softeners (non)	29	71
	Dish detergents (concentrate)	4	96
	Dish detergents (non)	28	72
	Detergents	39	61
Van Heerde et al. (2010)	Automobiles	54	46
This Essay	**Sustainable New Products (Detergents)**	**13**	**87**

3.8 LIMITATIONS AND FURTHER RESEARCH

This essay comes with some limitations that can be investigated for future research. First, I would need to extend out to other categories to establish validity. Future research will investigate the demand effects in the other CPG categories such as various food categories, skincare/make-up, lotion, cleaning products, and so forth.

Second, a further deep dive into examining the marketing mix elements and their moderating effects would be of interest to both scholars and practitioners. In the process, it would be fruitful to consider other relevant product-level moderators such as convenience and certification. Certification of sustainable claims may serve to boost the various attractive demand elements (i.e., new growth and brand switching). For convenience, it would be interesting to observe if there are any trade-off effects between these two attributes.

Lastly, a future study that combines consumer-level panel data to capture the heterogeneity of individuals will provide a richer analysis and enable us to parse the effects between retailers and consumer choice. By observing household heterogeneity using techniques such as latent class (Chintagunta 1993, Wedel and Kamakura 2000) and Bayesian regression models (Smith, Rossi, and Allenby 2019), I anticipate to formally address the research question of how consumer demographics influence the product type-sales relationship.

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APPENDICES

APPENDIX A

Natural Language Processing and Text Classification Algorithm Performance

A1. Performance of Classification Algorithms using Product Claims

Classification Algorithm	Accuracy	Precision	Recall	F1 Score
Decision Tree	0.901	0.882	0.869	0.870
Random Forest	0.693	0.946	0.745	0.826
Gradient Boosted Classifier	0.850	0.803	0.850	0.806
SVM (Linear Kernel)	0.783	0.862	0.751	0.779
SVM (Gaussian Kernel)	0.643	0.916	0.533	0.615
K-Nearest Neighbor	0.469	0.699	0.485	0.503
Logistic Regression	0.378	0.575	0.245	0.337
Naive Bayes	0.208	0.782	0.110	0.171

Note: Results based on TF–IDF approach

A2. Performance of Classification Algorithms using Product Descriptions

Classification Algorithm	Accuracy	Precision	Recall	F1 Score
SVM (Linear Kernel)	0.373	0.854	0.414	0.528
Gradient Boosted Classifier	0.318	0.645	0.445	0.504
Decision Tree	0.480	0.411	0.502	0.421
Random Forest	0.171	0.946	0.291	0.420
K-Nearest Neighbor	0.306	0.457	0.305	0.304
SVM (Gaussian Kernel)	0.113	0.679	0.158	0.235
Logistic Regression	0.028	0.384	0.019	0.034
Naive Bayes	0.001	0.286	0.000	0.001

Note: Results based on TF–IDF approach

Accuracy = TP+TN/TP+FP+FN+TN; Precision = TP/TP+FP; Recall = TP/TP+FN; F1 Score = 2(Recall * Precision) / (Recall + Precision)*

TP: True Positives, TN: True Negatives, FP: False Positives, FN: False Negatives

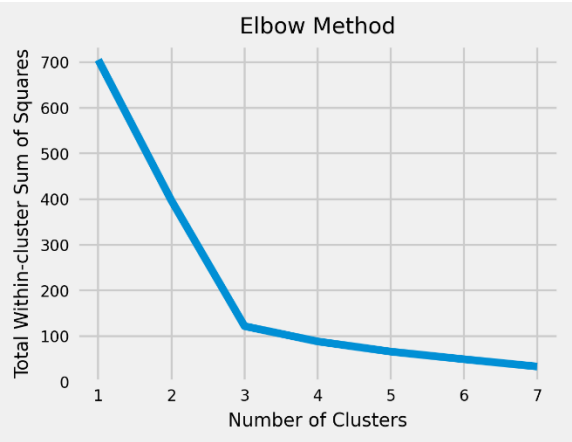
A3. Multi-label Classification

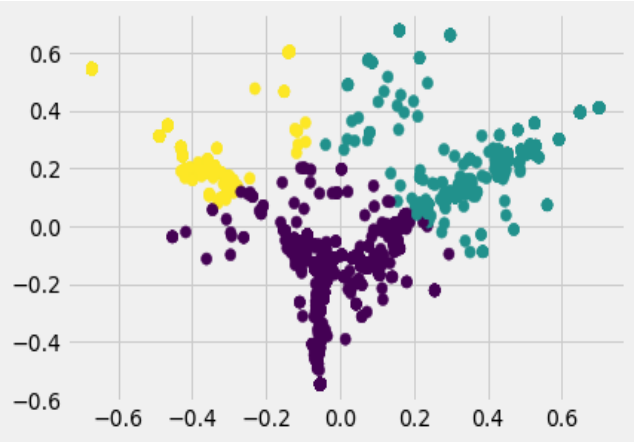
Classification using tree-based approaches (Decision Tree, Random Forest, Gradient Boosted Classifier) perform well due their conceptual simplicity ("white box") and process of examining word combinations in a piecewise fashion (Humphreys and Wang 2018). Support vector machine (SVM) algorithms also performed well, particularly SVM with linear kernels, with unstructured and semi-structured data, in the case of product descriptions. However, SVM is a binary classification method and cannot natively perform multi-class or multi-label classifications and does not perform well when classes are overlapping. It is also considered as somewhat of a "black box" algorithm as the exact learning process and calculations are conducted using vectors in hyperplanes (support vectors).

For performance measures, I use the F1 Score as it creates a balance between recall and precision by creating a harmonic mean of these two measures (Berger et al. 2020). Recall is the proportion of entities in the original text that the text-mining algorithm was able to successfully identify (it is defined by the ratio of true positives to the sum of true positives and false negatives). Precision is the proportion of correctly identified entities from all entities identified (it is defined by the ratio of true positives to the sum of true positives and false positives).

A4. K-means Clustering

K-means clustering is a type of unsupervised learning, which is used when you have unlabeled data (i.e., data without defined categories or groups). From the Product Launch Analytics database, I collect sustainable benefit claims and conduct clustering across the sequence and combination of these benefit claims to see their similarities and differences. First, I use principal component analysis (PCA) to vectorize the benefit claims to create center of clusters, or centroids. Next, I vary the number of clusters (K) – in this case, the number of categories – to find its optimal value. I use the elbow method that minimizes total intra-cluster variation (known as total within-cluster sum of squares). Below illustrates the number of clusters and the vectorized data points.





A5. Guided Latent Dirichlet Allocation (LDA) Topic Modeling

Topic models help unearth the main themes, topics, or categories that underlie unstructured documents. The most widely used application is the latent Dirichlet allocation (LDA) topic modeling approach (Blei 2012; Blei, Ng, and Jordan 2003; Tirunillai and Tellis 2014). In traditional LDA or in LSA, topics emerge strictly from the data and need to be labeled by the researcher (i.e., learning is unsupervised), which may be subject to certain biases and not in accordance with the underlying topical structure of the corpus (Jagarlamudi, Daume, and Udupa 2012). Therefore, I use an approach that is flexible enough to allow the definition of topics to be informed by theory or other sources of information, while allowing topics to emerge freely from the data and to capture other, unrelated constructs. In particular, this approach is based on the method proposed by Jagarlamudi, Daume, and Udupa (2012) and has been also used in prior marketing literature (Toubia et al. 2019).

Guided LDA is an extension of the LDA topic modeling approach with the basic setup of creating the corpus and extracting "topics" from text based on co-occurrence. Next, I "guide" the algorithm by defining a set of priors (i.e., seed words) that are associated for each topic. These seed words act as starting points but also weights by the algorithm to determine other words in the topics as needed. I derive the dictionary of seed words from the K-means Clustering Analysis conducted on sustainable product benefit claims in the previous section.

Example of Seed Words

1['ArtificialFlavor','Preservatives','ArtificialColor'],

2 ['Organic','Vegan','GeneticModification'],

3 ['Fresh','Paraben','Allergy','Recyclable', 'RecycledMaterials','Pure']

Topic 1		**Topic 2**		**Topic 3**	
artificialflavor	0.44	organic	0.77	fresh	0.13
preservatives	0.43	vegan	0.13	paraben	0.09
artificialcolor	0.28	geneticmodification	0.11	allergy	0.08
hfcs	0.08	vegetarian	0.05	recyclable	0.07
organic	0.05	fairtrade	0.03	recycledmaterials	0.07
artificialsweeteners	0.05	dairy	0.02	pure	0.07
geneticmodification	0.04	pure	0.02	animal	0.06
artificialingredients	0.02	preservatives	0.02	phosphates	0.06
addedhormones	0.02	artificialingredients	0.01	vegetarian	0.05
recyclable	0.01	pesticides	0.01	reusable	0.05
fresh	0.01	addedhormones	0.01	hfcs	0.04
pure	0.01	artificialflavor	0.01	biodegradable	0.04
dairy	0.01	recyclable	0.01	geneticmodification	0.04
vegan	0.01	reducedpackaging	0.01	vegan	0.04
vegetarian	0.01	hfcs	0.00	refill	0.04
fillers	0.01	recycledmaterials	0.00	environmentallyfriendly	0.03
bpa	0.01	environmentallyfriendly	0.00	artificialingredients	0.03
bisphenola	0.01	antibiotics	0.00	dairy	0.02
additives	0.01	paraben	0.00	artificialcolor	0.02
recycledmaterials	0.00	additives	0.00	petrochemicals	0.02
animal	0.00	biodegradable	0.00	addedhormones	0.02
pesticides	0.00	animal	0.00	formaldehyde	0.01
chemicals	0.00	allergy	0.00	preservatives	0.01
environmentallyfriendly	0.00	artificialcolor	0.00	chemicals	0.01
antibiotics	0.00	petrochemicals	0.00	antibiotics	0.01
allergy	0.00	toxic	0.00	artificialsweeteners	0.01
refill	0.00	artificialsweeteners	0.00	fairtrade	0.01
toxic	0.00	reusable	0.00	fluorocarbons	0.01
reusable	0.00	bisphenola	0.00	paba	0.01
paba	0.00	bpa	0.00	bpa	0.01

Additional References

Blei, David M, Andrew Y Ng, and Michael I Jordan (2003), "Latent Dirichlet Allocation," the *Journal of Machine Learning Research*, 3, 993–1022.

Jagarlamudi, Jagadeesh, Hal Daume, and Raghavendra Udupa (2012), "Incorporating Lexical Priors into Topic Models," in Proceedings of the 13th Conference of the European Chapter of the Association for Computational Linguistics. New York: Association for Computing Machinery.

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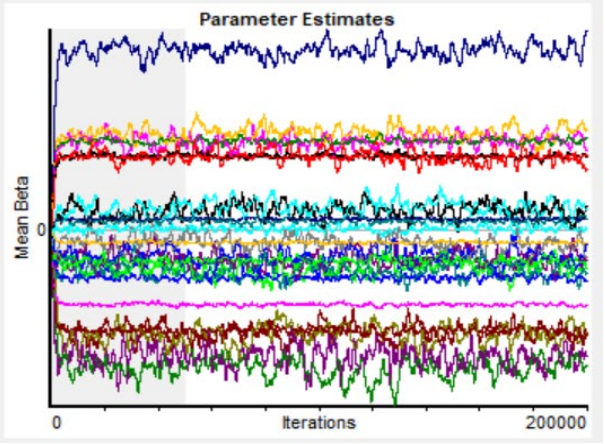
APPENDIX B

Model Specification and Estimation of Choice-Based Conjoint Analysis

B1. Model Estimation and Data Details

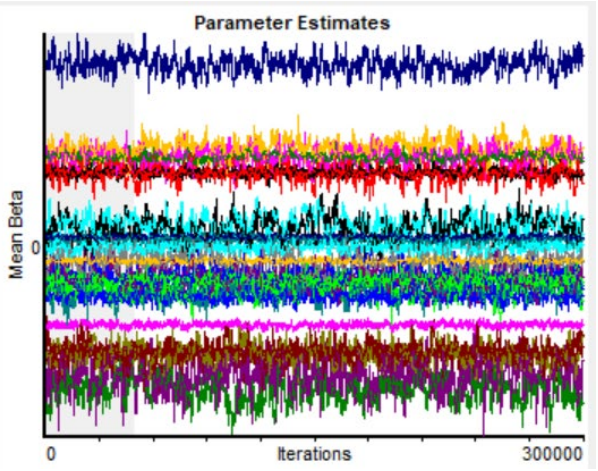
I used a Hierarchical Bayes (HB) approach using the Metropolis Hastings algorithm to estimate the utilities for the conjoint study on a sample of 604 respondents. I run a total of 200,000 posterior simulations. The first 50,000 draws are dropped as burn-in and thin the remaining simulations to every fifth draw. Visual inspection of trace plots and comparing the log-likelihoods indicated that the chains had converged.

Preliminary iterations		50000
Draws used per respondent		30000
Skip factor for draws used		5
Total iterations		200000
Number of respondents		604
Parameters per respondent		21
No covariates in use		
No constraints in use		
Saving random draws		
Iteration		200000
	Current	Average
Pct. Cert.	0.612	0.614
Fit statistic (RLH)	0.541	0.543
Avg Variance	2.819	2.793
Parameter RMS	1.788	1.788
Iterations/Sec		67.61
Time Elapsed		0:49:18
Time Remaining		0:00:00



As a robustness check, I ran 300,000 posterior simulations with 50,000 draws as burn-in, without any thinning. I obtain similar goodness-of-fit measures and utility estimate.

Previous Iterations		100000
Preliminary iterations		50000
Draws used per respondent		250000
Total iterations		300000
Number of respondents		604
Parameters per respondent		21
No covariates in use		
No constraints in use		
Random draws not saved		
Iteration		300000
	Current	Average
Pct. Cert.	0.616	0.610
Fit statistic (RLH)	0.544	0.540
Avg Variance	2.429	2.524
Parameter RMS	1.714	1.705
Iterations/Sec		14.42
Time Elapsed		5:46:41
Time Remaining		0:00:00



For conjoint tasks (cards), I had four options and a "Dual-Response None," superior to the conventional "None" option. This option provides a "safety net" allowing for estimation of the "None" parameter more efficiently, with less biased estimates of other parameters if the incidence of "None" usage is quite high (Brazell et al. 2006). Below, I include an example question and a table listing the attributes for the conjoint survey.

B2. Example Survey Question

(1 of 12)

If these were your only choices, which would you choose?

All are sold in single serving cup sizes.

Brand	Fage	Oikos	Fage	Chobani
Flavor	Fruit	Fruit	Plain	Plain
Fat	0% (non-fat)	2% (low-fat)	2% (low-fat)	0% (non-fat)
Label	Grade A Milk	No Artificial Ingredients No Genetic Modifications Grass-fed Cows	No Genetic Modifications	No Artificial Ingredients No Genetic Modifications Grass-fed Cows
Price	$0.99	$1.59	$1.29	$1.59
	Select	Select	Select	Select

Given what you know about the market, would you really buy the yogurt you chose above?

Yes | No

B3. Part-worth Plots by Product and Label Type Using Mean Values