



# Comparing Financial, Environmental, and Governance Outcomes of Product Stewardship Funding for Plastic Packaging in the US by Consumer-Packaged Goods Firms

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Comparing Financial, Environmental, and Governance Outcomes of Product Stewardship Funding  
for Plastic Packaging in the US by Consumer-Packaged Goods Firms

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A Thesis in the Field of Sustainability  
for the Degree of Master of Liberal Arts in Extension Studies

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## Abstract

The significant carbon footprint of the plastic lifecycle, rate of emissions of plastic pollutants, and proliferation of single-use plastic packaging for consumer-packaged goods threaten human health and essential Earth system processes. The consumer-packaged goods (CPG) industry is both a user and producer of plastic packaging and therefore has significant decision-making power over plastic packaging use. This study evaluated the effects of implementing product stewardship efforts for plastic packaging in the United States, where funding take-back and recycling programs, deposit and return schemes, and reusable and refillable packaging is, at present, voluntary.

Fifty-four consumer packaged goods firms were included in this study and categorized as engaging in product stewardship or not engaging in product stewardship for their plastic packaging in the United States. A dataset was built from sustainability reports, dashboards, disclosures, corporate websites, and publicly accessible financial performance data. Twenty-seven matched pairs of CPG firms were created from the sample to conduct the comparative analysis. Both a paired t-test and a Wilcoxon signed ranks test were used to comparatively assess the impacts of funding product stewardship on firms' plastic footprints and corporate financial performance and determine the correlation between product stewardship funding and circularity governance.

Contrary to my prediction, the comparative analysis revealed that firms funding product stewardship for plastic packaging in the United States did not demonstrate a

reduced total weight of plastic packaging or a greater share in reusable, recyclable, and/or compostable packaging compared to firms that do not fund product stewardship.

Similarly surprising, a comparison of accounting rates of return indicated there were no significant financial trade-offs in voluntarily engaging in these forms of product stewardship. Voluntary product stewardship funding, in fact, correlated with better corporate financial performance. Matched pair t-tests revealed significant differences in return-on-equity (ROE) ( $p = 0.014$ ), return-on-assets (ROA) ( $p = 0.015$ ), and number of global circular economy (CE) alliances supported ( $p = 0.024$ ); these results were corroborated by Wilcoxon signed rank tests.

This research underscored the need to incentivize high recycling rates and develop policy interventions to encourage circular design in addition to product stewardship funding. It reinforced that a cap on global plastic production is necessary. The findings also demonstrated the need for greater participation by CPG firms in global circular economy alliances and partnerships and greater plastic packaging transparency in the sector overall.

## Dedication

This thesis is dedicated to my grandparents Jack and Charlotte Roberts. I do not have the words to sufficiently express my gratitude for your support. Thank you for your wisdom, trust, encouragement, pride, and love—none of this would have been possible without you.

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I wish to extend my heartfelt gratitude to Dr. Mark Leighton for his time, expertise, and trust during this thesis process. Thank you for your guidance, patience, and wonderful sense of humor. It has been an honor and a pleasure to work with you, from the first statistics class, to Spannocchia, to the many Zoom calls that brought this project to life.

I cannot thank my family enough for making it possible for me to attend this program and complete this thesis. Thank you, forever and always, to my mother Jamie for being my best friend and celebrating every accomplishment, big and small. Thank you from the bottom of my heart to my father Richard for always believing in me and being my steadfast sounding board. Mom and Dad, I am so grateful for your support and unconditional love. Thank you to my grandparents Marshall and Carla Hunt for loving me, always being genuinely interested in my work and ideas, and offering wisdom and advice at every turn. To my parents, my four incredible grandparents, and my brother Jackson, thank you for instilling in me that I can do whatever I set my mind to—I owe you absolutely everything.

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## Table of Contents

Dedication .....	v
Acknowledgments.....	vi
List of Tables .....	x
List of Figures .....	xi
Chapter I. Introduction.....	1
Research Significance and Objectives .....	2
Background.....	3
The Plastic Crisis .....	4
The Plastic Lifecycle.....	7
Recycling Barriers .....	8
Plastic Packaging .....	11
Addressing the Plastic Crisis Through the Circular Economy .....	13
The Global Commitment .....	14
Product Stewardship .....	16
The State of Extended Producer Responsibility .....	19
EPR in the United States.....	23
Consumer-Packaged Goods Firms.....	24
Barriers to a Circular Economy for CPG Firms.....	26
Financial Risks and Outcomes of Product Stewardship for CPG Firms ...	27
CPG Firms and Plastic Transparency .....	29



Measuring CPG Firms' Plastic Performance and Circularity Governance .....	31
Research Questions, Hypotheses, and Specific Aims.....	36
Specific Aims.....	37
Chapter II. Methods .....	38
Plastic Footprint and Financial Performance Variables.....	40
Circularity Governance and Plastic Transparency Variables .....	41
Analysis of CPG Matched Pair Data .....	43
Chapter III. Results .....	46
Summary Statistics.....	46
Plastic Footprint .....	47
Corporate Financial Performance .....	48
Circularity Governance and Plastic Transparency .....	49
Matched Pair Analysis .....	51
Plastic Footprint .....	51
Corporate Financial Performance .....	52
Circularity Governance and Plastic Transparency .....	54
Chapter IV. Discussion .....	56
Research Limitations .....	57
Data Collection for Various CPG Firms.....	59
Research Outcomes.....	66
Plastic Footprint Outcomes.....	66
Circularity Governance and Plastic Transparency Outcomes .....	67

Corporate Financial Performance Outcomes .....	70
Recommendations for Key Stakeholders .....	71
CPG Firms .....	71
The Financial Sector .....	73
Policymakers .....	74
Future Research .....	75
Conclusions .....	76
Appendix 1. List of Companies .....	78
References .....	82

## List of Tables

Table 1. WWF-recommended performance indicator categories. ....	32
Table 2. WWF-recommended preparedness indicator categories. ....	35
Table 3. Summary statistics for all 54 CPG firms. ....	46
Table 4. Summary statistics for firms funding PS efforts.....	47
Table 5. Summary statistics for firms not funding PS efforts.....	47
Table 6. CPG firms included in the research .....	78

## List of Figures

Figure 1. Transgression of six of the nine planetary boundaries. ....	5
Figure 2. Product lifetime distributions for the eight industrial plastic packaging use sectors. ....	13

## Chapter I

### Introduction

*Nothing is more important to human beings than an ecologically functioning, life sustaining biosphere on the Earth... The Earth's biosphere seems almost magically suited to human beings and indeed it is, for we evolved through eons of intimate immersion within it. We cannot live long or well without a functioning biosphere, and so it is worth everything we have. — Joseph Guth*

The urgent need for a circular economy (CE) to solve the plastic packaging waste and pollution crisis has been recognized globally, underpinning Sustainable Development Goal (SDG) 12: “Ensure Sustainable Consumption and Production Patterns” (Gasper et al., 2019; UN, 2015). The biodiversity, human health, and economic impacts of the plastic crisis are profound and far-reaching. Consumer-packaged goods (CPG) firms are the top polluters (Break Free from Plastic, 2022). More profitable, yet hard-to-recycle packaging types are favored in the CPG space, contributing significantly to plastic packaging waste and pollution (Joltreau, 2022). Many major CPG firms implement product stewardship (PS) efforts, either voluntarily or through Extended Producer Responsibility (EPR) policy, funding the collection and recycling of their products and packaging at end-of-life, deposit return schemes, and reuse and refill systems. EPR is a type of mandatory product stewardship (Monroe, 2014). It is defined as “an environmental policy principle in which a producer’s responsibility is extended to the post-consumer stage of a product’s life” (Filho, et al., 2019, p. 552). While most OECD countries have EPR policies and programs in place, there is no federal policy in the United States; instead, state-by-state EPR legislation is emerging for plastic packaging.

There is a body of research analyzing the impacts of EPR schemes in a variety of industries and countries, yet the impacts of engaging in product stewardship for plastic packaging on CPG firms in the United States have not been assessed. Beyond this, there are limited explorations of sustainable packaging uptake and transitions in the CPG sector broadly (Phelan et al., 2022). The United States EPR landscape presents a unique opportunity; without federal legislation, CPG firms have voluntarily funded product stewardship efforts. Thus, firms that have funded deposit return systems, refill and reuse systems, and the collection and recycling of their plastic packaging at end-of-life can be compared with firms that have not funded PS efforts, providing essential insight into the corporate financial performance outcomes of product stewardship models and the organizational and financial requirements associated with EPR policy compliance.

### Research Significance and Objectives

My research examined historic and contemporary trends in plastic packaging production and usage and analyzed the current landscape of corporate circularity strategies and commitments in the CPG space in the United States. Specifically, I analyzed the impacts of funding product stewardship efforts for plastic packaging on firms' financial performance and plastic footprint. The results help assess if firms can be effectively equipped and incentivized to take on the financial and/or operational responsibility of deposit return systems, reuse and refill systems, and collecting and recycling plastic packaging at end-of-life. Further, analyzing firms' circularity governance provided insight into the effectiveness of participation in global circularity alliances and partnerships and the level of transparency of plastic metrics in the CPG space. This information can serve governments, policymakers, NGOs, and firms to

prepare the CPG industry for upcoming producer responsibility legislation in the United States, increase recycling rates, encourage greater transparency and reporting of plastic metrics, and incentivize innovation with new business models and packaging design to achieve the circular economy.

Therefore, my research objectives were:

- To analyze the impacts of funding product stewardship efforts on CPG firms' plastic footprints
- To comparatively assess firms funding product stewardship efforts and firms not funding product stewardship efforts for plastic packaging in the United States in the CPG space, using plastic footprint and financial performance metrics
- To assess circularity governance of CPG firms that both fund and do not fund product stewardship efforts
- To identify and assess financial risks posed by continued plastic packaging usage
- To make effective recommendations for key stakeholders (CPG firms, policymakers, and the financial sector) based on the analysis outcomes

## Background

Plastics and plastic pollution are ubiquitous. The plastiglomerate, a formation of plastic debris merged with organic matter and sediment, is a geological indicator of the Anthropocene (Corcoran & Jazvac, 2020). Modern lifestyles and plastic use are inextricable; plastic provides many benefits, including food packaging, drug delivery, and safety from communicable diseases (Kumar et al., 2021). Four hundred and fifty million tons of plastics are produced annually, and the rate of production will likely double by

2045 (Bergmann et al., 2022). Geyer et al. (2017) estimated that 8.3 billion tons of virgin plastics were produced from 1950 to 2015. Of these 8.3 billion tons of plastics produced, an estimated 4.9 billion were landfilled or entered the environment as externalities (Geyer et al., 2017). Indiscriminate use, ineffective recycling systems, and landfill deposits contribute significantly to plastic pollution (Kumar et al., 2021). Commonly used, petroleum-based plastics do not biodegrade and accumulate in landfills or the environment (Geyer et al., 2017). Even in optimistic forecasts of plastic waste reduction scenarios, emissions of plastic pollutants will increase (MacLeod et al., 2021). This constitutes a plastic crisis.

### The Plastic Crisis

Plastic pollution is found globally (MacLeod et al., 2021). MacLeod et al. (2021) consider plastic a “poorly reversible pollutant,” given emissions of plastic pollutants cannot be curtailed and pollutants reside in the environment for years on end. Ocean systems and freshwater habitats are contaminated with plastic debris (Geyer et al., 2017). Atmospheric microplastics fall as plastic rain (Brahney et al., 2020). Plastic pollutants accumulate in terrestrial soils and are transferred into the food chain (Kumar et al., 2021; MacLeod et al., 2021). Plastic pollutants, as well as the dyes and additives released as plastic ages, influence biophysical thresholds and alter the Earth system processes human life depends upon. In the planetary boundaries framework, plastic pollution is considered a novel entity (Figure 1). Novel entities are one of nine planetary boundaries within which humanity can continue to develop and thrive for future generations, in a “safe operating space.” Persson et al. (2022) posit that the safe operating space of the novel entities planetary boundary has been exceeded, as annual production of novel entities has



outpaced assessment and monitoring capacity globally (Bergmann et al., 2022; Persson et al., 2022; Richardson et al., 2022). Novel entities is among the six planetary boundaries that have been transgressed (Figure 1), which includes plastic pollution and the chemicals and dyes released from plastics as they age (Persson et al., 2022; Richardson et al., 2022).

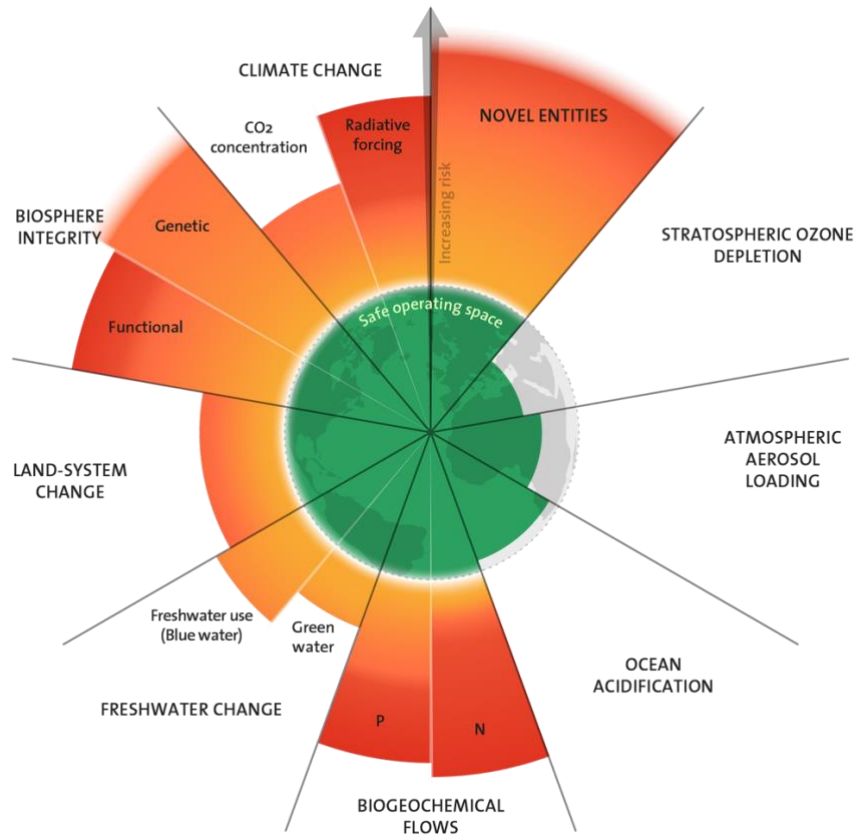


Figure 1. Transgression of six of the nine planetary boundaries (Richardson et al., 2022). Adapted from the Stockholm Resilience Centre and Richardson et al. (2022).

It is estimated that over 15 million tons of plastics enter the ocean alone per year (Aguilar et al., 2022). The growth of plastic contaminants in the ocean is unprecedented (Thushari & Senevirathna, 2020). Large-scale accumulation zones are growing (Villarrubia-Gómez et al., 2018) and plastic pollution on ocean surfaces is particularly

poorly reversible (MacLeod et al., 2021). Plastics are present in coastal and marine ecosystems in water, sediment, and biota (Thushari & Senevirathna, 2020). Habitat destruction, marine animal entanglement, and transportation of invasives impair ecosystem structure and function (Schmaltz et al., 2020). Pollutants such as plasticizers negatively impact the behavior patterns and endocrine and metabolic processes of marine organisms (Barnes, 2019).

Legacy plastics have broken down into microplastics and nanoplastics, a negative externality with a fundamental knowledge gap (Bergmann et al., 2022). A growing body of research is quantifying the impacts of microplastics and nanoplastics, especially on human health. Micro and nanoplastic particles have been found to enter the human body through ingestion and inhalation and have been detected in human blood, breast milk, and placenta. The impact of plasticizers, antioxidants, and lubricants that are contained in plastic on human health is a growing area of investigation (Rosellini et al., 2023). Their degradation and the subsequent release of toxic compounds represent what Rillig et al. (2021) refer to as the global plastic toxicity debt. Rosellini et al. (2023) analyzed several plastic-related compounds and the cytochrome CYP2C19 and found that plastic-related compounds affect several molecular pathways and can damage the human liver. In a study of human plaque tissue, Margella et al. (2024) found that microplastics and nanoplastics may be associated with cardiovascular disease and represent a risk factor for heart attack, stroke, and death. Micro and nanoplastic particles have been found in household dust and drinking water. Using a recently developed SRS approach to detect microplastics and nanoplastics at the single-particle level, Qian et al. (2024) found on

average, a liter of bottled water included 240,000 nanoplastics and microplastics, comprised of polyamide, PET, and other types of plastic.

As knowledge of the human health impacts of micro and nanoplastic particles is being expanded, so too are the climate and environmental impacts. Microplastics and plasticizers impact the carbon fixation process in the ocean, as plastic pollution reduces the rate of phytoplankton photosynthesis and the survival rate of zooplankton. This hinders both organisms' ability to capture carbon and transport it to the deep sea (Shen et al., 2020). The light-absorbing properties of microplastics have been found to alter the albedos of snow and ice surfaces in the cryosphere. This could potentially hasten the rate of melting and shrinkage of high-altitude regions and the Arctic and Antarctic (Zhang et al., 2022). These impacts, along with the immense carbon footprint of plastic, illustrate that the material presents not just a significant waste issue and threat to human health, but a climate threat as well.

### The Plastic Lifecycle

The plastic lifecycle has a substantial carbon footprint (Bergmann et al., 2022). Oil and gas are the primary feedstocks for contemporary plastic; thus, the upstream part of the plastic lifecycle produces significant emissions (Charles & Kimman, 2023; Walker-Franklin & Jambeck, 2023). Over 90% of plastics are produced by the petrochemical industry from virgin fossil feedstocks (Charles & Kimman, 2023; World Economic Forum, 2016). Monomers such as ethylene and propylene that are used to make plastics are derived from fossil hydrocarbons (Geyer et al., 2017). ExxonMobil, Shell, Chevron Phillips, INEOS, and Dow supply the majority of plastic resin and petrochemicals to packaging manufacturers for single-use plastic (Charles & Kimman,

2023; Break Free From Plastic, 2022). According to Masnadi et al. (2018), plastic industrials contribute to the quickest-growing source of industrial GHG emissions. Roughly 17 million tons of CO<sub>2</sub>e were emitted in 2014 by 72 plastic manufacturing facilities in the United States during the plastic manufacturing process (Geyer et al., 2017). Royer et al. (2018) demonstrated that GHGs, though in small amounts, are even released during plastic degradation. Beyond this, waste incineration of plastic packaging has significant climate impacts. An estimated 16 million tons of net emissions were attributed to plastic packaging incineration in 2015 (Shen et al., 2020).

Thus, there are GHG emissions at every phase of the plastic lifecycle, from extraction and manufacturing to degradation and incineration. In 2022, the lifecycle of plastic accounted for 4.5% of greenhouse gas emissions. With production set to double by 2045, the emissions footprint will increase (Bergmann, et al., 2022). Ultimately, the plastic sector will likely account for 20% of total oil consumption and 15% of the annual carbon budget in the coming decades (World Economic Forum, 2016).

### Recycling Barriers

Policy efforts like extended producer responsibility (EPR) and single-use bans are gaining traction as the externalities of the plastic crisis become too dire to ignore. Yet barriers to recycling, which is touted as a solution, remain in place. Governments do not have the capacity to fully calculate the externalities and risks or enact policies to control the issue (Bergmann, et al., 2022). Stakeholders across the fast-moving consumer goods industry, retailers, and waste management professionals experience several psychological, systemic, and pragmatic recycling barriers (Roy et al., 2023). Beliefs and attitudes of stakeholders include lack of motivation and sufficient knowledge, a sense of

disempowerment and lost opportunities, and reliance on legislation for solutions and opportunities (Roy et al., 2023). Consumer scapegoating is also pervasive (Roy et al., 2023).

A gap exists between consumer intentions to recycle and recycling behavior (Roy et al., 2022). Soares et al. (2021) found that, in general, people are aware of plastic pollution impacts and that plastic pollution threatens the bio-ecological sector most acutely. However, plastic recycling behavior by consumers can be hindered by several factors. Consumer confusion and ambiguity about the recyclability of plastic products are the most important barriers (Fogt Jacobsen et al., 2022; Roy et al., 2022). Additionally, plastic recycling is not a priority in consumers' day-to-day lives (Roy et al., 2022). Lack of opportunity and inconvenience exacerbate barriers (Fogt Jacobsen et al., 2022). Finally, consumers perceive the responsibility for effective plastic recycling to be that of local governments and manufacturers (Roy et al., 2022).

Beyond this, the plastic recycling sector, in the EU for example, has been hindered primarily by “the low demand of recycled plastics, low commodity prices, and uncertainties about market outlets” for types of low-value waste (Filho, et al., 2019, p. 551). Filho et al. point out that compared to glass, paper, and metals, plastic recycling rates remain low in the EU broadly due to the low cost of producing types of plastic packaging combined with the wide availability of these materials. This disincentivizes plastic recycling. The plastic recycling sector in the EU manages plastic waste based on the type of plastic materials. Levels of recycling depend largely on the value and ease of recyclability of plastic waste, as well as whether it falls under the obligation of producer responsibility or another entity (Filho, et al., 2019).

In the US, a large quantity of plastic waste is not recycled, resulting in a significant loss of market and energy value. In an assessment of plastic waste by resin type at state, county, and local levels in the United States, the Department of Energy's National Renewable Energy Laboratory found that only 5% of the estimated 44 million metric tons of plastic waste managed domestically was recycled in 2019 (Milbrandt et al., 2022). 86% of plastic waste was left in landfills, while the rest was incinerated as waste-to-energy. Milbrandt et al. (2022) also calculated that the landfilled plastic waste represented \$7.2 billion in market value lost in 2019 to the US economy. It also represented the loss of 3.4 exojoules of total embodied energy (Milbrandt et al., 2022). Ultimately, a progressive market with high demand for recycled feedstocks is necessary to scale recycling and increase recycling capacity (Charles & Kimman, 2023).

Like the EU, the plastic recycling sector in the US suffers from a weak market, yet recycling infrastructure in the country is also poor and outdated. China's 2018 waste import ban, called Operation National Sword, restricted the import of recyclables that exceeded a contamination rate of over 0.5%. Prior to this ban, the US had exported a large portion of its waste to China for recycling, along with other countries, due to infrastructure that has been unable to evolve alongside changing packaging streams (Bourtsalas, 2024; Nilson, 2021).

The US has no federal recycling program, rather states individually enforce rules and regulations around recycling and bear the burden of educating consumers about recyclability. Some counties in the US do not have access to any recycling systems. There are some exceptions to the inability to improve domestic recycling rates in the US, namely in urban areas where public-private partnerships have been implemented and

curbside collection and recycling is accessible to residents. Yet, only plastics comprised of PET and high-density polyethylene are broadly recycled in the US. Most other types of plastics, or plastics without resin codes one and two, are sent to landfill, illustrating the extent of recycling barriers (Bourtsalas, 2024; Nilson, 2021).

### Plastic Packaging

Despite the immense negative externalities of plastic and the shortcomings of plastic recycling, the global plastic packaging sector has experienced strong and sustained growth (World Economic Forum, 2016). Since 1950, the packaging sector has been the most significant user of plastic (Walker-Franklin & Jambeck, 2023). This has been driven by an increasingly globalized world, the use of plastic packaging for food distribution and goods protection, convenience, and, broadly, the shift from reusable to single-use containers (Geyer et al., 2019; Walker-Franklin & Jambeck, 2023; World Economic Forum, 2016).

Plastics are widely used and preferred as packaging materials given their low cost, versatility, and light weight (World Economic Forum, 2016). Characteristics such as durability, corrosion resistance, and high thermal and electrical insulation properties have contributed to their proliferation (Soares et al., 2021). For food packaging in particular, plastic has a significant economic advantage. Plastic packaging allows for more effective marketing, prevents loss from store shelves, and reduces transportation costs due to its light weight (Walker-Franklin & Jambeck, 2023). Thus, in the consumer-packaged goods (CPG) space, packaging type is a core differentiation variable for firms (Joltreau, 2022). Often, using attractive yet hard-to-recycle packaging to preserve a product, such as

flexible sachets and films, appeals to consumers and increases profitability (Ellen MacArthur Foundation, 2022b; Joltreau, 2022).

While plastic packaging is preferred by CPG firms, it is largely single-use, inherently contributing to the plastic crisis (World Economic Forum, 2016). The natural capital cost of consumer goods plastic is an expression of the environmental and social impacts on a monetary scale. The natural capital, or environmental, cost of plastic in the consumer goods industry was estimated at \$75 billion in 2014, with an estimated \$40 billion attributed to plastic packaging (UNEP, 2014; World Economic Forum, 2016). This reflects the scale of damage caused by plastic packaging, illustrating that the widely considered “cheap” material is, in fact, costly. Vanaerschot and Plaisier (2021, p. 4) refer to plastic packaging as “the most harmful and visible form of plastic pollution.”

After the first use, 95% of the material value (\$80-120 billion annually) of plastic packaging is lost (World Economic Forum, 2016). Compared to the seven other industrial use sectors for plastic (consumer and institutional products, textiles, electrical and electronic, transportation, industrial machinery, and building and construction), Geyer et al. (2017) found that most plastic packaging leaves use in the same year as its production (Figure 2). Only 14% of plastic packaging is collected for recycling, and sorting and processing result in additional loss of material value; another 14% of plastic packaging is incinerated. Thus, 72% of plastic packaging is not recovered. Rather, it is landfilled or “leaks” out of the collection system (World Economic Forum, 2016).



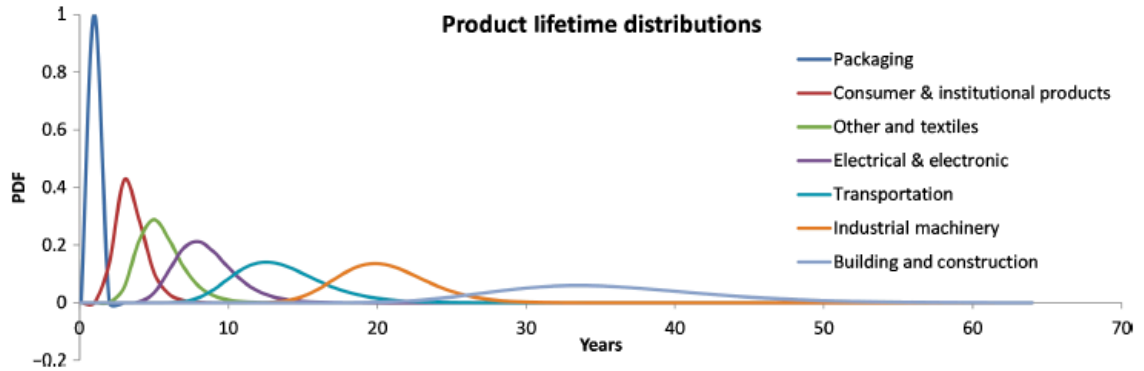


Figure 2. Product lifetime distributions for the eight industrial plastic packaging use sectors (Geyer et al., 2017).

In addition to its single-use nature, plastic packaging is also notably hard to recycle. The same qualities that make plastic a desirable form of packaging (its malleability and the variety of applications) make plastic packaging, in turn, highly difficult to manage after disposal (Walker-Franklin & Jambeck, 2023). Thus, it is considered the largest contributor to natural system degradation. The small size and low residual value of plastic packaging mean it is highly susceptible to leakage (World Economic Forum, 2016). Leakage is defined by the International Union for Conservation of Nature and Natural Resources (IUCN) as the “potential amount of macro and microplastics that are not kept in a circular loop or properly managed at their end-of-life” and, as a result, enter the environment (IUCN, 2023).

### Addressing the Plastic Crisis Through the Circular Economy

To address the plastic crisis, much attention is being paid to the circular economy (CE) as a credible term, framework, and solution to several other sustainability challenges, among them waste generation, resource scarcity, and sustainable economic

growth (Geisendorf & Pietrulla, 2018; Geissdoerfer et al., 2017; Lieder & Rashid, 2016). First popularized in China in the 1990s, the circular economy has been introduced into governance agendas and policies (Jensen, 2023; Winans et al., 2016). An increasing body of research argues for implementing CE processes that reduce resource inputs, reduce waste and energy costs, create opportunities for new value creation and business growth, and result in fewer emissions compared to linear production processes (Geissdoerfer et al., 2017; Lieder & Rashid, 2016; Phelan et al., 2022; Tura et al., 2018). There has been an increase in both scholarship and practical propositions on the CE (Geisendorf & Pietrulla, 2018). Lieder & Rashid (2016) have completed a summarization of CE concepts. While there are different understandings of what a CE entails, a circular economy can be defined as an environmentally and economically regenerative economy that restoratively uses resources (Geisendorf & Pietrulla, 2018; Lieder & Rashid, 2016; Weetman, 2016).

### The Global Commitment

The European Commission has committed to a circular agenda and the Ellen MacArthur Foundation has led promotion of the CE (Ellen MacArthur Foundation, 2022b; Jensen, 2023; Winans et al., 2016). The New Plastics Economy Global Commitment (hereafter referred to as “the Global Commitment”) is a “common vision of a circular economy for plastic, in which it never becomes waste,” launched by the United Nations Environment Programme (UNEP) and the Ellen MacArthur Foundation in 2018. It developed key targets and voluntary reporting standards for the more than 1,000 businesses, governments, and other organizations that are signatories (Ellen MacArthur Foundation, 2022b; Phelan, 2022). This is a significant achievement, as practical

implementation of the CE in business processes, which are typically linear, has been modest (Tura et al., 2018). The Global Commitment signatories represent over 20% of the plastic packaging market and have publicly committed to key 2025 CE targets (Ellen MacArthur Foundation, 2022b). The key voluntary commitments made by major consumer-packaged goods (CPG) firms include:

- Make 100% of packaging recyclable, reusable, or compostable by 2025
- Reduce virgin plastic use
- Include more recycled content in packaging

“Recyclable” is defined in the context of the Global Commitment as packaging that is being recycled in practice and at scale within existing recycling systems of substantial geographical areas that comprise at least 400 million inhabitants. The threshold for recyclable or compostable packaging is a 30% recycling and/or composting rate. Incineration and waste-to-energy are not counted as recycling solutions (Ellen MacArthur Foundation, 2022b; Ellen MacArthur Foundation, 2023a; Phelan et al., 2022). These commitments have formed the basis of many CPG firms’ corporate responses to the plastic crisis and consumer pressure to address it (Break Free From Plastic, 2022). Notably, however, while it provides an essential framework for firms, there is no requirement for firms to invest in product stewardship efforts aimed at capturing “at least as much waste as companies produce” (MacKerron et al., 2020; Phelan et al., 2022).

These firms are rethinking packaging, products, and business models and increasingly investing in designing packaging to be technically recyclable (Ellen MacArthur Foundation, 2022b). The Ellen MacArthur Foundation reports a slight increase (+1.7%) from 2021 to 2022 in the share of reusable, recyclable, or compostable

plastic packaging (Ellen MacArthur Foundation, 2022b). However, while signatories of the Global Commitment individually decreased virgin plastic use, the collective virgin plastic use of signatories returned to 2018 levels (Ellen MacArthur Foundation, 2022b). This signals that even as companies increase their progress on integrating recycled content into their supply chains, for example, significant increases in total plastic packaging use (+4.3%) negate progress (Ellen MacArthur Foundation, 2022b). To date, significant plastic reduction by signatories has not been achieved (Break Free From Plastic, 2022).

Thus, firms must improve strategic actions in the areas of reuse, flexible packaging, and divorcing business growth from plastic packaging. Both an increase in recycled plastic use and the slowing of total plastic packaging use are highly necessary. These can be achieved through redesigning packaging, transforming business models to diminish the need for single-use packaging, and engaging in forms of product stewardship (Ellen MacArthur Foundation, 2022b). The collective increase in virgin plastic use by Global Commitment signatories indicates policy intervention, namely extended producer responsibility legislation, is needed to increase recycling rates and recycled plastic use, and slow total plastic packaging use by CPG firms altogether.

### Product Stewardship

Product stewardship (PS) and extended producer responsibility (EPR) are both policy approaches that are applied in the context of the circular economy and sustainable packaging. The goal of the two policy approaches is broadly to mandate or encourage producers to address and mitigate negative impacts of their products and packaging from the beginning to the end of the product or packaging lifecycle (Monroe, 2014). PS can be

voluntary or mandatory, and many firms have decided to invest in voluntary initiatives (OECD, 2014; World Bank, 2022). Product stewardship is defined by the Product

Stewardship Institute (2024) as:

the act of minimizing health, safety, environmental, and social impacts of a product and its packaging throughout all lifecycle stages, while also maximizing economic benefits. The manufacturer, or producer, of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role. Stewardship can be either voluntary or required by law.

EPR is defined (Product Stewardship Institute, 2024), on the other hand, as:

a mandatory type of product stewardship required by law. It includes, at a minimum, the requirement that the manufacturer's responsibility for its product extends to post-consumer management of that product and its packaging.

While there is some disagreement in the literature regarding the precise categorization of efforts, programs, or initiatives as PS or EPR, the voluntary efforts funded by CPG firms in the US to meet circularity targets and address plastic pollution are referred to as product stewardship (Monroe, 2014). These include funding take-back programs, deposit return systems, and reuse and/or refill systems funded by firms. Take-back schemes for plastic packaging occur at the post-consumer stage and facilitate the collection of packaging by producers or retailers (OECD, 2014). Firms partner with and pay companies such as TerraCycle and Pact Collective to establish the logistics for take-back schemes for their brands' plastic packaging (Pact Collective, 2024; TerraCycle, 2024). Deposit return systems or schemes place an additional charge at point-of-sale on a specific product, packaging, or material, for example plastic bottles. When consumers recycle the product, packaging, or material the deposit return system is designed for, they

receive their initial deposit back, incentivizing recycling (Dempster et al., 2021).

However, recycling is not viewed as sufficient.

Providing consumers with reusable or refillable packaging and alternative delivery models are considered effective plastic reduction strategies, complementary to recycling. Yet Phelan et al. (2022) found in an analysis of over 60 corporate sustainability reports that companies overwhelmingly refer to recycling in response to the plastic crisis in reports. Activities that are focused on system change, such as the PS efforts established in this paper, are less prominently mentioned in sustainability reports. These corporate communications are aligned with the literature, which suggests that firms prefer recycling over all other solutions to the plastic crisis (Klemeš et al., 2020; Phelan et al., 2022).

Reuse of packaging, or “reusable packaging,” refers to packaging that completes more than a single use or trip and includes return and reuse systems either at consumers’ home or on the go. When CPG firms implement reuse models, by launching product lines with reuse models or reuse pilots, for example, a product or packaging is “circulated as a whole” (Phelan et al., 2022). Reuse is considered an especially effective PS strategy to address plastic packaging waste, as it can significantly reduce virgin plastic use; material use reductions of up to 70 to 90% in some case studies have been reported (Ellen MacArthur Foundation, 2023b). The Ellen MacArthur Foundation (2023b) estimated that implementing reuse models for plastic packaging could provide a reduction of plastic leakage per year of over 20% by 2040. Reuse has not been widely adopted, yet there are potential applications for the delivery model across a variety of products. Reuse offers the opportunity to save GHG emissions, reduce water usage, and reduce both material use and waste generation (Ellen MacArthur Foundation, 2023b).

## The State of Extended Producer Responsibility

Producer responsibility is paramount for a circular plastics economy (Filho et al., 2019). In both OECD and emerging economies, Extended Producer Responsibility (EPR) policies are being implemented (OECD, 2014). The OECD (2014) defined four broad categories of EPR instruments:

- Take-back requirements mandate the collection of products by the producer or retailer at the post-consumer stage.
- Economic and market-based instruments include deposit-refund schemes, Advanced Disposal Fees (ADF), material taxes, and other combinations of upstream taxes or subsidies to incentivize firm compliance with EPR policy.
- Regulations and performance standards include minimum recycling content standards.
- Accompanying information-based instruments aim to raise public awareness, supporting EPR efforts indirectly by implementing reporting requirements, labeling practices, and consumer communication about producer responsibility on producers (OECD, 2014).

Globally, small consumer electronics are the product most covered by EPR policy; packaging is the second most covered (OECD, 2014). EPR schemes have been implemented in Chile, Mexico, Brazil, Argentina, and Colombia. Japan and the Republic of Korea have established EPR schemes and regulations, with effective monitoring and enforcement frameworks. In South Africa, EPR programs have been initiated largely by industry leaders (OECD, 2014). EPR legislation has been introduced in India for plastic waste and e-waste. Large appliances and other electronic products are under EPR

legislation in China and Vietnam. Similarly, EPR systems in Malaysia and Thailand prioritize e-waste, but legislation is being applied to plastic packaging as well (Johannes, et al., 2021).

EPR is a main policy instrument in the EU. There is momentum in the EU, fueled by governmental and public attention, to develop a CE. The European Strategy for Plastic in a Circular Economy has prioritized 2030 targets to make all plastic packaging recyclable on the EU market and mitigate single-use plastic consumption (Filho, et al., 2019). All member states have implemented EPR schemes across packaging, batteries, end-of-life vehicles, and electrical and electronic equipment waste streams. Schemes have also been established to address additional waste streams, such as tires and oil (OECD, 2014). With this context, EPR, which was employed in the EU as early as the 1990s, is viewed as a strategy to support the circular plastics economy transformation (Filho, et al., 2019).

Financial responsibility and organizational obligations under EPR are absorbed by producers, who establish and manage take-back systems through fees (Filho, et al., 2019). This acknowledges that producers are the ideal stakeholders to directly minimize their products' impacts. EPR does not apply to exported products; rather, it applies to products consumed in the national market (Joltreau, 2022). EPR is considered best implemented amidst a variety of other policy interventions and cannot alone achieve the CE (Larrain, et al., 2022). EPR is optimal when associated with bonus and penalty systems (Arnaud, 2017).

In individual EPR schemes, each producer is required to pay for the end-of-life of its own products. Yet, in practice, EPR-based policies have been implemented in most



cases to correspond to collective EPR systems. Collective systems are most common due to economies of scale and the difficulties of implementing individual systems liable to face prohibitive costs (Joltreau, 2022). Administrative costs include identifying individual brands in household bins, for example. Thus, in collective EPR systems, the advance disposal fee (ADF) is the most frequently used instrument.

ADFs are typically determined by packaging weight and material when products are put on the market. ADFs are imposed on importers and producers of difficult-to-recycle and hazardous products in South Korea (OECD, 2014). ADFs reflect the average cost of end-of-life management of the packaging material. In EPR systems, producer responsibility organizations (PROs) take on the legal responsibility of firms. PROs finance and organize the collection, sorting, and recycling of waste generated by the activities of member firms. They act as intermediaries and can be public or owned by recycling operators, setting and collecting fees from producers while also being under public control (Joltreau, 2022).

Examples of this include the EPR schemes in Belgium for industrial packaging and in the UK for ePRNs. Producers also assume financial responsibility by setting up direct reimbursement contracts with municipalities. This model has been employed in the Czech Republic, Denmark, and France to enable recycling. Organizational responsibility includes the orchestration of mechanisms to collect and recycle packaging waste, which has been executed in Austria and Denmark (Filho, et al., 2019).

EPR schemes are ultimately designed to support incentive creation for reuse and more efficient design (Filho, et al., 2019). In some cases, producers pay per ton of packaging placed on the market. This encourages firms to decrease packaging use. Firms

are also encouraged to minimize waste management costs through packaging design, often through waste prevention. This, for example, would mean less packaging for a given product. Firms may also be encouraged by EPR schemes, which are associated with reuse and recycling objectives, to design packaging into recyclability, thus decreasing recycling costs through material substitution. Switching to “more recyclable” materials may also be incentivized if the ADF reflects packaging recyclability (Joltreau, 2022). Thus, metrics such as percentage of reusable, recyclable, or compostable plastic packaging and total weight of plastic packaging can effectively measure the impact of producer responsibility schemes.

EPR can also provide incentives for firms to consider alternative business approaches to achieve a circular economy. New circular business models and initiatives such as reuse schemes, repair and product-service schemes, and sharing platforms can be developed (Filho et al., 2019). Yet, the lack of binding mechanisms and incentives globally for firms has stalled the implementation of EPR schemes on a global scale for plastic packaging; waste streams and value chains, particularly for single-use plastic packaging, remain overwhelmingly linear (Filho et al., 2019; Phelan et al., 2022).

Furthermore, it is unclear if EPR policy has contributed to increased collection and recycling of plastic waste to date. Larrain et al. (2022) noted that while EPR and other types of command and control interventions decouple the recycling industry from the oil market, for example, interventions cannot increase recycling rates alone. EPR policy has contributed to increased collection and recycling rates, but it has not yet achieved very high collection and recycling rates (Filho et al., 2019). Rather, EPR policy has been shown to increase the separate collection of plastic waste (Larrain et al., 2022).

Joltreau (2022) empirically tested whether EPR costs of compliance have contributed to packaging waste reduction and packaging material substitution and found that very little (though statistically significant) packaging reduction resulted from EPR financial incentives. Similarly, Filho et al. (2019) report that, in the EU, EPR policy has not yet encouraged improved circular design of plastic packaging. Additionally, no systematic substitution effects between packaging materials have emerged from EPR financial incentives to date (Joltreau, 2022).

### EPR in the United States

EPR programs are designed and implemented at the sub-national level in the United States by states. There is no federal law governing EPR and producers have implemented voluntary producer responsibility programs to fund the collection and recycling of their products. From 1991 to 2011, over 70 EPR laws were enacted by states. These laws were broadly focused on manufacturers (OECD, 2014). At present, EPR policy for packaging has been passed in Maine, Oregon, Colorado, and California (Flanagan, 2023).

Yet only one-third of executives who participated in a PMMI survey in 2023 reported that their firm was considering the impact of EPR legislation on their packaging (Izquierdo & Feldman, 2023). This may be, in part, because there is still a limited understanding of EPR and product stewardship impacts for individual firms. While research has been conducted to assess the outcomes of EPR policy on circular design of plastic packaging, packaging waste reduction and material substitution, and collection and recycling rates (Filho et al., 2019; Joltreau, 2022; Larrain et al., 2022), surprisingly

few publications have assessed the outcomes of producer responsibility at the company level. Additionally, few studies have considered the impact of funding product stewardship on ESG criteria, which are increasingly important to companies and financial institutions. There has also been limited research on how the CPG industry is addressing the plastic crisis (Phelan et al., 2022). Finally, there are no reports that appear to assess voluntary product stewardship efforts in detail. The patchwork nature of EPR legislation in the United States and the small number of executives considering the impact of EPR legislation on their packaging emphasizes the knowledge and research gaps identified.

### Consumer-Packaged Goods Firms

Fast-moving consumer-packaged goods, defined by high-throughput volumes, low cost per unit, and high purchase frequency, are used regularly by almost everyone (Phelan et al., 2022; Taqi et al., 2022). They include a diverse range of products, including food, cosmetics, cigarettes, beverages, wine and spirits, cleaning supplies, apparel, and many more (Taqi et al., 2022). The consumer-packaged goods (CPG) industry is growing at the top of the market and is characterized by Taqi et al. (2022) as “massive and fiercely competitive.” The industry is both a user and producer of fast-moving, single-use plastic packaging, and as both a producer and brand product owner, CPG firms have disproportionate decision-making power over plastic packaging use. Thus, the industry plays a critical role in the broader transition toward circular and sustainable packaging (Monroe, 2014; Phelan et al., 2022).

Many signatories of the Global Commitment are CPG firms and have, in recent years, expressed public support for the circular economy. However, the top polluters recorded across 78 countries are CPG firms (Break Free From Plastic, 2022; Phelan et al.,

2022). Over two thousand global brand audits of leaked plastic conducted by Break Free From Plastic from 2018 to 2022 revealed these top polluters: The Coca-Cola Company, PepsiCo, Nestlé, Unilever, Mondelēz International, Mars, Inc., Procter & Gamble, Philip Morris International, Danone, and Ferrero Group. The Coca-Cola Company was found to be the top global plastic polluter across the five-year period of global brand audits. Food and beverage wrappers, bottles, and sachets were the top category recorded from 2018 to 2022 (Break Free From Plastic, 2022).

These top-polluting CPG firms are under strong public pressure and scrutiny due to their high level of plastic production and visibility. In response to this pressure, an increasing number of CPG companies are voluntarily contributing to the CE transition through producer responsibility and incorporating plastic strategies into their sustainability reports (Rhein & Sträter, 2021). Mars, Inc., Nestlé, PepsiCo, Danone, and The Coca Cola Company are Global Commitment signatories and have committed to 100% recyclable packaging (Ellen MacArthur Foundation, 2022b; Phelan et al., 2022). Additionally, CPG companies are disclosing packaging lifecycle management metrics through SASB. The SASB Standards are a set of 77 sustainability accounting standards that include industry-specific disclosure topics and metrics. For the CPG space, industry-specific SASB disclosure topics describe sustainability-related risks or opportunities associated with the industry's activities. SASB Standards for the Consumer Goods: Household & Personal Products category include a packaging lifecycle management disclosure topic. The quantitative metrics are total weight of packaging in metric tons, percentage made from recycled and/or renewable materials, and percentage that is recyclable, reusable, and/or compostable (SASB, 2023a).

Carter et al. (2021) noted the importance of environmentally friendly and socially responsible reputations for firms. Progressively, consumers are demanding goods with a lower environmental impact that are produced using environmentally friendly and socially responsible practices (Taqi et al., 2022). CPG firms are thus participating in voluntary efforts such as product stewardship in the United States, but are also engaging in industry coalitions, industry-led alliances, and other “regional business-government-citizen networks” globally (Phelan et al., 2022). Product stewardship efforts and participation in a circular economy transition may serve as an effort to bolster firms’ reputations. However, despite participation in global CE alliances and partnerships, disclosures through SASB, the funding of PS efforts, and sustainability reporting, it is projected that CPG firms’ key Global Commitment targets will be missed (Ellen MacArthur Foundation, 2022b).

#### Barriers to a Circular Economy for CPG Firms

While there are incentives to fund product stewardship efforts and engage in a circular economy for plastic packaging, there are significant barriers to corporate intervention that contribute to firms failing to meet Global Commitment targets. These include external factors such as inconsistent legislation in the countries multinational firms operate in or the absence of legislation entirely, and inadequate and costly infrastructure needed to address the plastic crisis. This is compounded by a patchwork of regulations and policies within regions, states, and countries, and between countries that impacts CPG firms’ abilities to effectively respond to legislation. Yet several internal and governance factors also contribute significantly to barriers to participating in the circular

economy transition. Such internal barriers include a lack of circularity and plastic leadership from senior management and minimal collaboration (Grafström & Asama, 2021; Ma et al., 2020; Phelan et al., 2022).

Practically, the expense associated with transitioning to alternative packaging delivery models such as reuse and refill systems and the functionality of such systems presents significant barriers. According to the Ellen MacArthur Foundation (2023b), vast economies of scale that are not achievable by a single company are required to establish environmentally and economically beneficial return models and reuse applications. Innovations removing packaging entirely, or “package-less” innovations, are finite, as the number of consumer-packaged goods that can be delivered without packaging is limited. Beyond this, there are negative carbon implications and potentially unknown negative externalities associated with plastic alternative materials. Finally, demand from consumers for convenience and low cost complicates CPG firms’ transition to alternative delivery models that may be costly to the consumer or perceived as inconvenient (Grafström & Asama, 2021; Ma et al., 2020; Phelan et al., 2022).

#### Financial Risks and Outcomes of Product Stewardship for CPG Firms

Given firms engaging in product stewardship internalize the cost of collecting and recycling packaging at end of life and the R&D and implementation of expensive alternative packaging delivery models, corporate financial performance must be assessed. Eccles et al. (2014) tracked corporate performance for “high sustainability” companies, or firms that have adopted a substantial number of environmental and social policies. Accounting rates of return, return-on-equity (ROE), measured by net income divided by

equity, and return-on-assets (ROA), measured by net income divided by total assets, were considered (Eccles et al., 2014; Sandberg et al., 2022). Accounting rates of return demonstrate the profitability of a firm in relation to its equity and assets. Corporate financial performance is measured by ROE and ROA, especially in studies analyzing the relationship between corporate responsibility and corporate financial performance (Lee et al., 2016; Raza et al., 2014; Sadeghi et al., 2016; Sandberg et al., 2022; Siminica et al., 2019; Yang et al., 2010). Thus, accounting rates of return can be used to assess the corporate financial performance of firms that have funded product stewardship efforts for plastic packaging.

CPG firms must weigh the investment required and outcomes of product stewardship against the risk of continued use of plastic packaging in a business-as-usual scenario. While there is a gap in knowledge of how product stewardship efforts for plastic packaging impact corporate financial performance, plastic packaging use poses significant financial and reputational risks (Rheinbay et al., 2021). New regulations and policies, such as EPR, that target plastic pollution pose the risk that firms with large plastic footprints will have to make significant investments in short periods of time to comply. Furthermore, even as plastic industry investment continues to grow, plastics are materially devalued by overproduction and price fluctuations. The growing demand for alternatives itself poses a risk. The CPG space, and the food and beverage sector specifically, is highly vulnerable to potential price shocks due to its significant dependence on plastic for consumer packaging. The vulnerability of the petrochemical industry to financial shocks compounds this risk. Pew Research Center posits that an



annual risk of \$86 billion is associated with investments in the plastic industry (Vanaerschot & Plaisier, 2021).

Continued plastic packaging usage poses reputational risks, and therefore financial risks, as well. In 2023, lawsuits, accusations, and campaigns have been levied upon Danone and Unilever by environmental activist groups and upon PepsiCo by the state of New York for failing to address plastic pollution and follow through on single-use plastic reduction commitments (Hummel, 2023; Horton, 2023; Mindock & Stempel, 2023).

#### CPG Firms and Plastic Transparency

Transparency from CPG firms around packaging data is crucial to inform external stakeholders on both the impact of companies' activities and companies' progress towards the transition to sustainable packaging. These data are relevant to consumers, investors, industry alliances, governments, NGOs, and many more stakeholders. Such parties have a stake in being informed on corporate strategies and practices that are addressing and affecting the plastic crisis. Companies should disclose volumes of plastic packaging used in addition to goals for reductions in overall plastic usage (MacKerron et al., 2022; Phelan et al., 2022). This fuller picture of plastic packaging data is also essential for CPG firms to internally inform strategies and long-term sustainability planning (Ellen MacArthur Foundation, 2023b).

Phelan et al. (2022) found in a review of 68 corporate sustainability reports from firms in the food and beverage sector that most reporting falls short in addressing plastic pollution. Food and beverage companies were found to report on collection and recycling

efforts rather than more robust packaging solutions. Despite the growth of EPR legislation for plastic packaging, sustainability reports reflect insufficient efforts to reduce and respond to plastic packaging waste, namely in emerging economies with insufficient waste management systems (Phelan et al., 2022).

Phelan et al. (2022) found that most food and beverage CPG firms' corporate sustainability reports avoid "negative" words such as "waste" and "pollution." Companies instead indirectly address the plastic crisis through statements about reducing post-consumer plastic waste and recycling. Statements about reducing plastic packaging were found to be brand- or product-line-specific, rather than at the conglomerate level (Phelan et al., 2022). Many references to plastic pollution also include mentions of "collective responsibility" for the plastic crisis. The six companies out of the 68 Phelan et al. (2022) analyzed that displayed strong recognition and strong responsiveness in addressing plastic packaging in corporate sustainability reporting are all Global Commitment signatories: PepsiCo, Mars, Danone, Unilever, Nestlé, and The Coca-Cola Company.

The most significant finding by Phelan et al. (2022) was that commitments are mentioned more prominently than actions in sustainability reporting on plastic (Phelan et al., 2022). This is consistent with other literature (MacKerron et al., 2020) and reinforces a body of research suggesting that without enforcing compliance, voluntary commitments are insignificant (Aragón-Correa & Rubio-Lopez, 2007; Basu & Palazzo, 2008). In the context of the plastic crisis, no legal frameworks exist that enforce compliance or penalize firms that do not meet their reported voluntary commitments (Monroe, 2014; Phelan et al., 2022).

## Measuring CPG Firms' Plastic Performance and Circularity Governance

The importance of plastic transparency from CPG firms cannot be overstated. Without the disclosure of plastic-related metrics, the plastic footprint and environmental performance of firms in the CPG space engaging in producer responsibility cannot be assessed. While both “plastic footprint” and “ESG performance” are ambiguous concepts, McCafferty-Harvey et al. (2021) define a company’s plastic footprint as:

how much plastic a company uses (both in its products and incidental to operations), what portion of that plastic is made from virgin feedstocks as opposed to recycled or plant-based plastic, the type of plastic used (important, for example, as it impacts products’ long-term biodegradability or recyclability), and where that plastic ends up at the end of its useful life.

ESG, or “environmental, social, and governance,” criteria are increasingly important to financial institutions, companies, and ESG D&I (data and insights) providers (Rheinbay et al., 2021). ESG D&I providers have been found by Rheinbay et al., (2021) to recognize the “material financial impact connected to plastics.” McCafferty-Harvey et al. (2021) argue that plastic management incorporation into ESG criteria can attract capital and grow firms’ share price or valuation. Investors are increasingly considering plastic pollution (Phelan et al., 2022). Yet, robust plastics evaluation is not included in many frameworks and there is no standard for measuring or reporting the plastics impact of firms (Rheinbay et al., 2021).

A set of indicators that assess firms’ performance on current plastic action and preparedness was developed by the World Wildlife Fund (WWF) in their report *Integration of Plastics Impact Evaluation into ESG Assessments* (Rheinbay et al., 2021). These indicators were developed to make corporate action on plastics management

transparent and to more accurately capture a firm’s efforts to address the plastic crisis (Rheinbay et al., 2021).

Table 1. WWF-recommended performance indicator categories.

	Indicator category	Example metric
Plastic in portfolio	Total plastic footprint; problematic plastic in portfolio; recyclable or compostable plastic in portfolio	% of revenue from products containing plastics; % of revenue from products containing problematic plastics; % volume of packaging material that is recyclable
Plastic from process	Waste generated in operations; responsible disposal of waste from operations	% of plastic waste in total manufacturing waste; % of plastic waste sent for recycling
Plastic waste recovery	Use of recycled content in portfolio; action on waste recovery of own products at end of life; initiatives on infrastructure and beyond own supply chain	% of recycled content by volume in plastic inputs; \$ and/or % of revenue EPR expenditure to take responsibility for impact of plastic at end of life of product; % EPR expenditure for infrastructure/# of cleanup activities undertaken

*The WWF-recommended performance indicator categories correspond to environmental plastic-related performance, or “plastic footprint” (Rheinbay et al., 2021).*

Unfortunately, these indicators have not been adopted, and very few of the metrics that correspond to these indicators are reported by major CPG firms. Per the WWF recommendations, plastic performance can be evaluated by both performance and

preparedness indicators. Performance indicators include plastic in portfolio, plastic from process, and plastic waste recovery (Table 1) (Rheinbay et al., 2021).

Performance indicators correspond most closely with environmental criteria and preparedness indicators correspond most closely with governance criteria. The WWF recyclable or compostable plastic in portfolio indicator category provides insight into the amount of plastic a company adds to the value chain with its products (Rheinbay et al., 2021). Notably, defining recyclability presents a challenge. This is true for both SASB disclosures of packaging lifecycle management and Global Commitment signatory reporting on reusable, recyclable, or compostable plastic packaging and is elaborated upon in the Discussion chapter (Ellen MacArthur Foundation, 2022b; SASB, 2023a). The final application of plastic in a firm's portfolio and the design of plastics to be recyclable within the recycling infrastructure products are sold in determines the "recyclability" (Rheinbay et al., 2021). An example metric for environmental performance assessment is volume of packaging material that is recyclable (%) (Rheinbay et al., 2021).

The Ellen MacArthur Foundation measures the Global Commitment signatories' progress toward the 2025 targets via plastic packaging weight (in metric tons) and reusable, recyclable, or compostable plastic packaging (%), and post-consumer recycled content (%) (Ellen MacArthur Foundation, 2022b). Global Commitment signatory reporting standards are designed to drive greater transparency and consistency in plastic data reporting, much like the WWF-recommended performance indicator categories. Firms that report as Global Commitment signatories share data against a common set of commitments and use the same definitions (Ellen MacArthur Foundation, 2023a). Environmental performance metrics for plastic performance such as recyclable or

compostable plastic portfolio (% volume of packaging material that is recyclable) also correspond with SASB disclosure metrics for CPG firms (Rheinbay et al., 2021).

The SASB Index “packaging lifecycle management” accounting metric is a quantitative metric with common units of measure for “total weight of packaging” and “percentage that is recyclable, reusable, and/or compostable” in metric tons and percentage. SASB Index registrants disclosing total weight of packaging are provided with the following definition: “packaging includes any material containing the registrant’s product or otherwise accompanying the product, as well as secondary materials used by the registrant for shipping and distribution of products.” Primary packaging is described as packaging that comes into direct contact with products, while secondary packaging is “designed to contain one or more primary packages with any protective materials, where required.” SASB Index registrants disclosing the percentage of packaging that is recyclable, reusable, and/or compostable calculate the percentage as the total weight of recyclable and/or compostable packaging divided by the total weight of all packaging (SASB, 2023a).

Finally, preparedness indicators were developed to capture firms’ efforts to reduce plastic footprints (Table 2) (Rheinbay et al., 2021). Preparedness indicators such as strategy and targets, actions, milestones, collaboration, and internal governance and transparency The WWF indicator categories of measurement reporting and communication and actions, milestones, and collaboration (Table 2) are most readily available in CPG firms’ annual sustainability reports, with some explicitly available in Global Commitment signatory reports. The number of global alliances supported is a useful metric to measure actions and partnerships and, therefore, assess a firm’s

circularity governance performance (Rheinbay et al., 2021). The global alliances and partnerships examined should be CE alliances and partnerships. Measurement reporting and communication are essential components of a firm’s internal governance and transparency when it comes to plastic as well (Rheinbay et al., 2021). This reflects a

Table 2. WWF-recommended preparedness indicator categories.

	Indicator category	Example metric
Strategy and targets	Commitment to phasing out problematic plastic; commitment to addressing existing plastic waste	Target on elimination of single-use plastics; commitment to efforts on improving waste management systems
Actions, milestones, and collaboration	Actions and partnerships; reporting on milestones and progress	# of global alliances supported; performance on interim milestones
Internal governance and transparency	Roles and responsibilities; policies and incentives; measurement reporting and communication	% of total full-time employees assigned to work on developing substitutes for problematic plastics; # of metrics disclosed

*The WWF-recommended preparedness indicator categories correspond to governance plastic-related performance, or “circularity governance” (Rheinbay et al., 2011).*

company’s transparency and disclosure practices. Thus, given consistencies amongst WWF indicator categories, SASB packaging lifecycle management accounting metrics, and Global Commitment signatory disclosure requirements, plastic packaging weight and percentage of reusable, recyclable, or compostable plastic packaging are sufficient and comprehensive indicators to assess firms’ plastic-related environmental performance. The

number of plastic-related metrics disclosed, global CE alliances and partnerships supported, reuse pilots launched globally, and product lines with reuse models globally also serve as valuable metrics for evaluating plastic-related governance performance (Rheinbay et al., 2021; SASB, 2023a).

### Research Questions, Hypotheses, and Specific Aims

My research addressed two questions: 1) Can consumer-packaged goods (CPG) firms improve both plastic footprint and corporate financial performance by funding product stewardship efforts for plastic packaging? 2) Does funding PS efforts for plastic packaging in the US correlate with strong circularity governance?

In answering these questions, I examined the hypotheses that, compared to CPG firms without product stewardship (PS) efforts, CPG firms with PS efforts for plastic packaging in the US have:

- Shown significantly reduced plastic packaging weight
- Achieved a greater percentage of reusable, recyclable, or compostable packaging
- Demonstrated poorer return-on-equity (ROE)
- Demonstrated poorer return-on-assets (ROA)
- Disclosed a greater number of plastic-related metrics
- Supported a greater number of global circular economy alliances and partnerships
- Launched a greater number of reuse pilots
- Achieved a greater number of product lines with reuse models



## Specific Aims

To test these hypotheses, my specific aims were to:

1. Identify firms in the CPG space that are either funding or not funding product stewardship efforts, initiatives, or programs for their plastic packaging in the United States that have sustainability reports, SASB disclosures, and financial performance data from 2021 to 2023 publicly available.
2. Define a sample of paired CPG firms (one funding PS efforts in the United States, one not) that have the same profile (i.e., revenue, plastic packaging types, CPG sector or type, Global Commitment signatory status, similarity in geographic footprint, etc.).
3. Collect data on plastic footprint, corporate financial performance, and circularity governance and plastic transparency of the matched pairs of CPG firms.
4. Develop criteria on impactful and credible circular economy (CE) alliances and partnerships and collect data on these variables.
5. Utilize summary statistics and statistical hypothesis tests to comparatively assess the impacts of PS funding on CPG firms' plastic footprint and corporate financial performance and determine the correlation between PS efforts and circularity governance.

## Chapter II

### Methods

To analyze the plastic footprint and financial performance outcomes of product stewardship, I first identified the largest global multinational consumer packaged goods (CPG) firms using Consumer Goods Technology's list of Top 100 Consumer Goods Companies of 2022 (2022), based on their annual revenue. This identified a sample of 54 CPG firms that sell packaged products directly to consumers and/or retailers across a range of types of products sold in plastic packaging, including household goods, cosmetics and personal care, food and beverage, over-the-counter (OTC) pharma, alcoholic beverages, and clothing and apparel (Phelan et al., 2022; Top 100 Consumer Goods Companies of 2022, 2022). The Top 100 Consumer Goods Companies of 2022 list included the annual revenue of public CPG firms, thus I added well-known private firms I was familiar with, such as Mars Inc. and Ferrero, as their disclosures indicated they were also signatories of the Global Commitment. Although Weleda and Oatly were not identified from searched lists of the top CPG firms, I included them in the sample as I knew they made some metrics publicly available through their corporate websites and sustainability reporting. The full list of companies included in the research is available in the Appendix.

Firms were categorized as engaging in product stewardship (PS) or not engaging in PS for their plastic packaging in the United States. Reported efforts and initiatives on CPG firms' corporate websites, publicly accessible sustainability reports, and Ellen

MacArthur Foundation New Plastics Economy Global Commitment signatory reports from 2021 to 2023 were used to determine whether firms funded or did not fund product stewardship efforts, or were “engaging” or “not engaging.” PS efforts were defined as funding take-back programs, deposit return systems, and reuse and/or refill systems funded by firms. If no evidence of product stewardship funding was identified from cross-referencing corporate websites, sustainability reports, signatory reports, and SASB disclosures from 2021 and 2022, a firm was classified as not engaging in PS for plastic packaging in the United States.

Sustainability reports and corporate websites were also used to determine the brands that fund reuse and take-back programs; for example, Burt’s Bees, which is a subsidiary of Clorox Co., funds a take-back collection and recycling program with US-based recycling company TerraCycle for plastic packaging (TerraCycle, 2024). Another example of PS efforts identified is L’Oréal’s investment in a take-back collection and recycling program for cosmetics packaging with US-based recycling company Pact Collective and the development of circular refill and reuse packaging systems for personal care brands Kérastase and Kiehl’s in the United States. This information was sourced from L’Oréal’s corporate website, sustainability reporting, and Ellen MacArthur Foundation Global Commitment signatory reports from the years 2021 and 2022 (Ellen MacArthur Foundation, 2021; Ellen MacArthur Foundation, 2022a; L’Oréal, 2022a; L’Oréal 2022b; Pact Collective, 2024). L’Oréal was classified as “engaging in product stewardship.” The full list of companies categorized by CPG type and PS classification is in the Appendix.

Sustainability reports were typically available for the timeframe of the study. They were obtained directly from corporate websites and were used to build the dataset, as they contain firms' plastic packaging data, commitments, targets, and similar metrics reported (Rhein & Sträter, 2021). Corporate sustainability reports are used by firms to share information regarding sustainability strategies and practices with external stakeholders and are considered a "direct expression" of policy and strategy regarding ESG topics (Comas Martí & Seifert, 2013; Landrum & Ohsowski, 2018; Phelan et al., 2022). Sustainability reports have been used in the literature to assess sustainability messaging, strategies, and outcomes at the corporate level (Meckenstock et al., 2016; Phelan et al., 2022, Stewart & Niero, 2018). However, using corporate sustainability reports presents research limitations, considered in the Discussion chapter.

#### Plastic Footprint and Financial Performance Variables

A dataset was built from publicly accessible sustainability reports published by CPG firms, the Ellen MacArthur Foundation Global Commitment signatory reports dashboards, SASB Index disclosures, corporate websites, and publicly accessible financial performance data from the years 2021, 2022, and 2023. The data collected were organized in an Excel spreadsheet with the following variables as columns: plastic packaging weight in 2021, plastic packaging weight in 2022, percentage of reusable, recyclable, or compostable plastic packaging in 2021, percentage of reusable, recyclable, or compostable plastic packaging in 2022, return-on-equity as of November 2023, return-on-assets as of November 2023, number of circular economy global alliances and partnerships supported as of November 2023, number of plastics-related metrics

disclosed as of November 2023, number of reuse pilots launched globally in 2022, and number of product lines with reuse models globally in 2022.

The difference in plastic packaging weight and percent difference in reusable, recyclable, or compostable plastic packaging were calculated based on the change from 2021 to 2022. For each firm with the data available, the plastic packaging weight in 2021 was subtracted from the plastic packaging weight in 2022. Therefore, positive numbers indicated an increase in metric tons of plastic packaging. L'Oréal, for example, reported a total plastic packaging weight of 137,609 metric tons in 2021. In 2022, the cosmetics and personal care firm's total plastic packaging weight increased to 144,430 metric tons.

Accounting rates of return, ROE and ROA, were used to assess CPG firms' corporate financial performance. ROE and ROA as of November 2023 for all public firms included in the analysis were collected using Yahoo Finance Plus in USD. The annual ROE and ROA of Amorepacific were available only in Korean won and the firm and its match, Natura & Co., were excluded from the analysis for ROE and ROA. Additionally, the accounting rates of return could not be collected for private CPG firms, including Bel Group, Mars, Weleda, SC Johnson, Ferrara, Ferrero, Driscoll's, and Land O'Lakes.

#### Circularity Governance and Plastic Transparency Variables

To assess whether strong circularity governance correlates with a reduced plastic footprint, I obtained data on the number of circular economy (CE) global alliances and partnerships firms in the analysis supported as of November 2023, the number of plastics-related metrics disclosed as of November 2023, the number of reuse pilots launched in 2022, and the number of product lines with reuse models funded in 2022. The number of

reuse pilots launched globally and the number of product lines with reuse models globally were only available for firms that are signatories of the Ellen MacArthur Foundation Global Commitment and disclosed these specific metrics in annual signatory reports. Thus, these two metrics were available only for 2022. The number of CE global alliances and partnerships supported and the number of plastics-related metrics disclosed were collected based on the World Wildlife Fund (WWF) Institute 2021 *Integration of Plastics Impact Evaluation into ESG Assessments* report as discussed in the Background chapter (Rheinbay et al., 2021). These were collated in the WWF report by searching both corporate websites and sustainability reports for each individual firm. To assess partnerships and alliances supported by CPG firms and as suggested in the WWF report, criteria were defined for the kind of alliances that are considered impactful and credible (Rheinbay et al., 2021). Credible circular economy alliance and partnership requirements included:

- Multi-stakeholder platforms facilitating collaboration across public and private spheres
- Setting standards, creating incentives, and/or providing financing and capacity-building opportunities related to the circular economy for entities involved (Nelson, 2017)
- Comprised of multi-national organizations and partners (business, government, academia) widely considered to be major and impactful players in the circular economy
- Focused on circular economy impact at the global level

- Dedicated to scaling up plastic action and/or addressing root causes of plastic pollution

Global circular economy partnerships and alliances that counted towards firms' total number included the Ellen MacArthur Foundation, Alliance to End Plastic Waste, Consumer Goods Forum, World Economic Forum Global Plastic Action Partnership (GPAP), Business Coalition for a Global Plastics Treaty, Clean Currents Coalition (Benioff Ocean Science Laboratory), Association of Plastic Recyclers, UN Global Compact, World Economic Forum Global Plastic Action Partnership, Bioplastic Feedstock Alliance, the Ocean Conservancy Trash Free Seas Alliances, Sustainable Packaging Initiative for Cosmetics (SPICE), Plastics Pact Network, and NextGen Consortium.

#### Analysis of CPG Matched Pair Data

After corporate financial performance, plastic footprint, and circularity governance data were collected for each of the firms, 27 matched pairs of two CPG firms with similar profiles were created from the sample. A firm that invested in product stewardship (PS) and a firm that did not invest in PS for plastic packaging in the US were paired using the following criteria in order of priority: CPG type (or products sold in plastic packaging), 2022 revenue, plastic packaging types used, geographic footprint, and Global Commitment signatory status (Machek et al., 2016). CPG type was the highest priority criterion to define a match and a match could not be considered “high-quality” if the CPG type was not aligned. Some CPG firms were categorized into multiple types. CPG types were defined by the types of products sold in plastic packaging and included but were not limited to:

- Household goods
- Cosmetics and personal care
- Over the counter (OTC) pharmaceuticals
- Food and beverage
- Clothing and apparel
- Alcoholic beverages

The quality of the match was defined along the following:

- High-quality match: 4 to 6 criteria aligned, including CPG type
- Moderate-quality match: 2 to 3 criteria aligned
- Low-quality match: Only 1 criterion aligned

In total, 8 high-quality matches, 16 moderate-quality matches, and 3 low-quality matches were identified from the sample of 27 pairs of CPG firms. A number was assigned to each matched pair, with high-quality matches receiving numbers 1, 2, 3, and so on, and a match ratio was calculated per pair. Finally, to complete the matched-pair analysis, an Excel sheet was created including product stewardship classification, brands and documented product stewardship efforts, matching criteria and data, matched pair number, match ratio, and all collected corporate financial performance, plastic footprint, and circularity governance data.

The difference in plastic packaging weight and the difference in the percentage of reusable, recyclable, or compostable plastic packaging from 2021 to 2022 were calculated for firms with available data. I calculated summary statistics for all firms included in the analysis. I also separately calculated summary statistics for firms



engaging in product stewardship and those without product stewardship efforts for comparison.

I utilized both a paired t-test and a Wilcoxon signed ranks test for the two dependent samples to comparatively assess the impacts of funding product stewardship on CPG firms' plastic footprints and corporate financial performance and determine the correlation between PS funding and circularity governance. To preserve the scale of differences when conducting the paired t-test, log transformation of the data was required to better normalize the distributions of the two samples. Additionally, to address zeroes in the data set, a constant of 1 was added to conduct the paired t-test. I conducted the Wilcoxon signed ranks test as the non-parametric counterpart to the paired t-test test. The statistical significance of mean differences and rank total differences of the following indicators for the 2020-2023 period was determined:

- Difference in plastic packaging weight from 2021 to 2022 (metric tons)
- Difference in share of reusable, recyclable, or compostable packaging from 2021 to 2022 (%)
- Return on equity in USD as of November 2023
- Return on assets in USD as of November 2023
- Number of product lines with reuse models globally in 2022
- Number of reuse pilots launched globally in 2022
- Number of CE global alliances and partnerships supported as of November 2023
- Number of plastics-related metrics disclosed on corporate website and in sustainability reporting as of November 2023

## Chapter III

### Results

The aims of my analysis were to determine the impacts of funding product stewardship (PS) efforts on CPG firms' plastic footprints and corporate financial performance and to assess the circularity governance and plastic transparency of CPG firms that both fund and do not fund PS efforts.

#### Summary Statistics

Summary statistics were calculated for each of the nine metrics for all 54 firms included in the analysis (Table 3), the 27 firms that fund PS efforts (Table 4), and the 27 firms that do not fund PS efforts (Table 5).

Table 3. Summary statistics for all 54 CPG firms.

<b>Results</b>			
	Mean	Median	Mode
Difference in plastic packaging weight	-2,709	1,018	N/A
% difference in reusable, recyclable, or compostable packaging	3	0	N/A
ROE	27%	14%	12%
ROA	17%	7%	7%
# global CE alliances	4	3	1
# plastic metrics disclosed	7	8	11
# reuse pilots launched	4	4	2
# product lines with reuse models	14	6	4

Table 4. Summary statistics for firms funding PS efforts.

<b>Results</b>			
	Mean	Median	Mode
Difference in plastic packaging weight	3,970	1,881	N/A
% difference in reusable, recyclable, or compostable packaging	3	1	N/A
ROE	43%	24%	N/A
ROA	9%	8%	7%
# global CE alliances	4	5	5
# plastic metrics disclosed	7	9	11
# reuse pilots launched	5	4	4
# product lines with reuse models	3,970	1,881	N/A

Table 5. Summary statistics for firms not funding PS efforts.

<b>Results</b>			
	Mean	Median	Mode
Difference in plastic packaging weight	-8,608	1,142	N/A
% difference in reusable, recyclable, or compostable packaging	3	-2	N/A
ROE	10%	12%	12%
ROA	29%	6%	N/A
# global CE alliances	3	3	1
# plastic metrics disclosed	7	8	9
# reuse pilots launched	3	2	1
# product lines with reuse models	15	6	N/A

## Plastic Footprint

The 54 CPG firms included in the analysis reduced their total plastic packaging weight by an average of 2,709 metric tons from 2021 to 2022 (Table 3). The companies

that funded PS efforts for plastic packaging in the US, either through deposit return systems, take-back programs, or refill and reuse programs, showed a mean increase in plastic packaging weight from 2021 to 2022 of 3,970 metric tons (Table 4). Companies without PS efforts for plastic packaging in the US, on the other hand, show an average decrease in plastic packaging weight over the year-long period of 8,608 metric tons (Table 5). The median value was an increase of 1,881 metric tons for firms funding PS and an increase of 1,142 metric tons for firms not funding PS for plastic packaging in the US. The median value for all firms in the sample was an increase of 1,018 metric tons. These results did not support the hypothesis that CPG firms with PS efforts for plastic packaging in the US have shown significantly reduced plastic packaging weight compared to firms that do not invest in PS efforts.

From 2021 to 2022, there was an increase of 3% in the percentage of reusable, recyclable, or compostable packaging for the 54 CPG firms included in the analysis. There was also an increase of 3% for both the firms that fund and do not fund PS efforts for plastic packaging in the United States (Tables 4 & 5). The median value was an increase of 1% for firms funding PS and a decrease of 2% for firms not funding PS for plastic packaging in the US. These results did not support the hypothesis that firms funding PS for plastic packaging in the US have achieved a greater percentage of reusable, recyclable, or compostable packaging than firms without PS efforts.

#### Corporate Financial Performance

As of November 2023, the 54 firms included in the analysis averaged a 27% return on equity (ROE) (Table 3). Firms funding PS averaged a 43% ROE (Table 4), while the average for firms not funding PS was 10% (Table 5). The median value was

24% for firms funding PS and 12% for firms not funding PS for plastic packaging in the US. The median value for all firms in the sample was 14%. On the other hand, the 54 firms included in the analysis averaged a 17% return on assets (ROA). Firms funding PS averaged a 9% return on assets, while firms not funding PS averaged a 29% ROA. The median value was 8% for firms funding PS and 6% for firms not funding PS for plastic packaging in the US. The median value and mode for all firms in the sample was 7%.

Thus, firms funding PS showed greater mean ROE and poorer mean ROA than firms not funding PS, which did not support the ROE hypothesis, yet supported the ROA hypothesis. Notably, the difference is not marginal; ROE was much higher for firms funding PS for plastic packaging. ROA was much higher for firms not funding PS.

#### Circularity Governance and Plastic Transparency

The total number of global circular economy (CE) alliances and partnerships supported was counted for each of the 54 CPG firms included in the analysis. Coca-Cola Co., which invests in product stewardship efforts for plastic packaging in the US, supports 12 total global CE alliances and partnerships, the largest value in the sample. Overall, firms support an average of four CE alliances and partnerships; the median value for the sample was three alliances and partnerships supported. Firms not funding PS efforts supported an average of three alliances and partnerships, while firms funding PS supported an average of four alliances and partnerships. Median values, respectively, were three and five CE alliances and partnerships supported. The results aligned with the hypothesis that firms funding PS efforts for their plastic packaging in the US support a greater number of global CE alliances and partnerships.

Similarly, the total number of plastic metrics disclosed was counted for each of the 54 CPG firms included in the analysis. The mode for the sample was 11 plastic metrics disclosed. L'Oréal, Coca-Cola Co., Nestlé, Unilever, Henkel, Colgate-Palmolive Co., Mars, Clorox Co., and Pernod Ricard all disclosed 11 plastic metrics. Walmart disclosed 13 total plastic metrics, which was the largest value in the sample. Overall, firms disclosed, on average, seven plastic metrics; the median was eight plastic metrics disclosed. Both firms not funding PS efforts and funding PS efforts also disclosed an average of seven plastic metrics. Median values, respectively, are eight and nine plastic metrics disclosed. The results therefore do not support the hypothesis that firms funding PS efforts for their plastic packaging in the US have disclosed a greater number of plastic-related metrics.

The total number of reuse pilots launched globally in 2022 was only available from firms in the sample that are signatories of the Ellen MacArthur Foundation Global Commitment. Twenty-two firms reported their total number of reuse pilots launched. The average number of reuse pilots launched and the median value was four. The mode value for all 54 firms included in the analysis was two reuse pilots launched. For firms that have funded PS efforts in the United States, the average is slightly higher at five reuse pilots launched globally. Firms without investment in PS efforts for plastic packaging in the US launched an average of three reuse pilots. The median value for firms funding PS efforts was four, while the median for firms that have not funded PS efforts was two. The results supported the hypothesis that firms funding PS efforts for their plastic packaging in the US have launched a greater number of reuse pilots globally.

The number of product lines globally with reuse models was also only available from the 24 firms in the sample that are signatories of the Ellen MacArthur Foundation Global Commitment. Natura & Co. reported 75 product lines with reuse models globally, the highest value in the sample. The average number of product lines with reuse models for the sample was 14. For firms without PS efforts, the average number of product lines with reuse models was 15, while it was 13 for firms that funded PS efforts. The median value for all firms included in the analysis, firms that have funded PS efforts, and firms that have not funded PS efforts, was six product lines with reuse models. The results did not support the hypothesis that firms funding PS efforts for their plastic packaging in the US have achieved a greater number of product lines with reuse models globally.

#### Matched Pair Analysis

Pairing firms that have funded PS efforts with firms that have not funded PS efforts controlled for some extraneous variables, providing a stronger analysis to test for differences in the two types of consumer-packaged goods (CPG) firms. The results from paired t-tests are reported along with the nonparametric Wilcoxon signed-rank tests for robust comparisons.

#### Plastic Footprint

A total of 36 firms and 18 matched pairs were included in the analysis to compare the difference in plastic packaging weight in metric tons from 2021 to 2022 in no product stewardship (PS) funding and PS funding CPG firms. The paired t-test revealed no significant difference in plastic packaging weight for firms with PS (mean = 0.468) or without PS funding (mean = 0.933) ( $t(17) = -0.33$ , one-tailed  $p = 0.373$ ). The Wilcoxon

signed ranks test also revealed no significant difference in plastic packaging weight between firms not funding PS and firms funding PS (ns/r = 18,  $z = -0.23$ ,  $p = 0.409$ ). These results suggest that there was no effect of PS funding on plastic packaging weight and that funding product stewardship does not result in a decrease in metric tons of plastic packaging for CPG firms. This disproves the hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have shown significantly reduced plastic packaging weight.

A total of 42 firms and 21 matched pairs were included in the analysis to compare the difference in the percent of reusable, recyclable, or compostable packaging from 2021 to 2022 in no product stewardship (PS) funding and PS funding consumer-packaged goods firms. The paired t-test revealed no significant difference for no PS funding (mean = -0.121) and PS funding (mean = 0.184) ( $t(20) = -0.89$ , one-tailed  $p = 0.192$ ). The Wilcoxon signed ranks test similarly revealed no significant difference in difference in the percent of reusable, recyclable, or compostable packaging from 2021 to 2022 between firms not funding PS and firms funding PS (ns/r = 21,  $z = -0.5$ ,  $p = 0.308$ ). These results suggest that funding product stewardship does not result in an increase in the percentage of reusable, recyclable, or compostable packaging for CPG firms. This disproves the hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have achieved a greater percentage of reusable, recyclable, or compostable packaging.

#### Corporate Financial Performance

A total of 32 firms and 16 matched pairs were included in the analysis to compare the return-on-equity (ROE) as of November 2023 in no product stewardship (PS) funding



and PS funding consumer-packaged goods firms. The paired t-test revealed a significant difference in return-on-equity as of November 2023 for no PS funding (mean = 0.056) and PS funding (mean = 0.148) ( $t(15) = -2.44$ , one-tailed  $p = 0.014$ ). The Wilcoxon signed ranks test revealed a significant difference in return-on-equity (ROE) as of November 2023 between firms not funding PS and firms funding PS ( $ns/r = 16$ ,  $z = -2.42$ ,  $p = 0.008$ ). These results suggest that there is an effect of PS funding on return-on-equity and that funding product stewardship does result in greater ROE for CPG firms. This refutes the hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have demonstrated poorer ROE.

A total of 36 firms and 18 matched pairs were included in the analysis to compare the return-on-assets (ROA) as of November 2023 in no product stewardship (PS) funding and PS funding consumer-packaged goods firms. The paired t-test revealed a significant difference in return-on-assets as of November 2023 for no PS funding (mean = 0.026) and PS funding (mean = 0.039) ( $t(17) = -2.37$ , one-tailed  $p = 0.015$ ). The Wilcoxon signed ranks test revealed a significant difference in return-on-assets (ROA) as of November 2023 between firms not funding PS and firms funding PS ( $ns/r = 18$ ,  $z = -2.04$ ,  $p = 0.021$ ). These results suggest that there is an effect of PS funding on return-on-assets and that funding product stewardship does result in greater ROA for CPG firms. This disproves the hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the United States have demonstrated poorer ROA.

## Circularity Governance and Plastic Transparency

All 54 firms and 27 matched pairs were included in the analysis to compare the number of global circular economy alliances and partnerships supported as of November 2023 in no product stewardship (PS) funding and PS funding consumer-packaged goods firms. The paired t-test revealed a significant difference in the number of global circular economy alliances and partnerships supported as of November 2023 for no PS funding (mean = 0.524) and PS funding (mean = 0.630) ( $t(26) = -2.06$ , one-tailed  $p = 0.024$ ). The Wilcoxon signed ranks revealed a significant difference in the number of global circular economy alliances and partnerships supported as of November 2023 between firms not funding PS and firms funding PS ( $ns/r = 20$ ,  $z = -2.29$ ,  $p = 0.011$ ). These results suggest that there is an effect of PS funding on support for global circular economy alliances and partnerships. This supports the hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have supported a greater number of global circular economy alliances and partnerships.

All 54 firms and 27 matched pairs were also included in the analysis to compare the number of plastic metrics disclosed as of November 2023 in no product stewardship (PS) funding and PS funding consumer-packaged goods firms. The paired t-test revealed no significant difference in the number of plastic metrics disclosed as of November 2023 for no PS funding (mean = 0.854) and PS funding (mean = 0.828) ( $t(26) = +0.38$ , one-tailed  $p = 0.353$ ). The Wilcoxon signed ranks test also revealed no significant difference in the number of plastic metrics disclosed as of November 2023 between firms not funding PS and firms funding PS ( $ns/r = 24$ ,  $z = 0.31$ ,  $p = 0.3783$ ). These results suggest that there is no effect of PS funding on plastic metrics disclosure. This refutes the

hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have disclosed a greater number of plastics-related metrics, reflecting greater plastic transparency.

Only 10 firms and five matched pairs were included in the analysis to compare the number of reuse pilots launched globally in 2022 in no product stewardship (PS) funding and PS funding consumer-packaged goods firms. The paired t-test revealed a nearly significant difference in the number of reuse pilots launched globally in 2022 for no PS funding (mean = 0.384) and PS funding (mean = 0.664) ( $t(4) = -1.92$ , one-tailed  $p = 0.064$ ). Due to the number of matched pairs, the Wilcoxon signed ranks test was unable to yield a significant result. These results cannot confirm the effect of PS funding on the launch of reuse pilots, at least with this small sample. The hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have launched a greater number of reuse pilots, is not supported.

Finally, only eight firms and four matched pairs were included in the analysis to compare the number of product lines with reuse models in 2022 in no product stewardship (PS) funding and PS funding consumer-packaged goods firms. The paired t-test revealed no significant difference in the number of product lines with reuse models in 2022 for no PS funding (mean = 0.764) and PS funding (mean = 1.040) ( $t(3) = -0.65$ , one-tailed  $p = 0.353$ ). Due to the small sample, the Wilcoxon signed ranks test was unable to yield a significant result. These results suggest that there is no effect of PS funding on product lines with reuse models. This disproves the hypothesis that, compared to firms without product stewardship efforts, CPG firms with PS efforts for plastic packaging in the US have achieved a greater number of product lines with reuse models.

## Chapter IV

### Discussion

The results of the summary statistics calculations, paired t-tests, and Wilcoxon signed ranks tests yielded the following results for the tested hypotheses: comparing U.S. CPG firms without product stewardship (PS) efforts to CPG firms with PS efforts for plastic packaging:

- There is no effect of PS funding on difference in plastic packaging weight
- There is no effect of PS funding on difference in reusable, recyclable, or compostable packaging share
- There is an effect of PS funding on return-on-equity
- There is an effect of PS funding on return-on-assets
- There is an effect of PS funding on support for global circular economy alliances and partnerships
- There is no effect of PS funding on plastic metrics disclosure

Wilcoxon signed ranks tests could not be performed for the number of product lines globally with reuse models in 2022 and the number of reuse pilots launched globally in 2022 due to the number of matched pairs. The paired t-test suggests there is no effect of PS funding for plastic packaging in the United States on the launch of reuse pilots and product lines with reuse models globally.

The summary statistics were aligned with the hypothesized differences in packaging weight, difference in reusable, recyclable, or compostable packaging share,

return-on-equity, support for global CE alliances and partnerships, and plastic metrics disclosure. ROA was the exception; the summary statistics results demonstrated that ROA is much higher for firms not funding product stewardship. Additionally, the summary statistics results were aligned with the paired t-test on the launch of reuse pilots globally but suggested that PS funding does not correlate with a greater number of product lines with reuse models globally.

### Research Limitations

My research was limited by the quality of data obtained and the fact that select data points were not available for each matched pair. Phelan et al. (2022) noted that the total units of plastic packaging used per year is reported by very few firms in the food and beverage category of the CPG sector. While sustainability reports, SASB disclosures, and Global Commitment reporting are important sources of data, and similar measurements are used within the CPG industry, there is no measurement standard for plastic footprint. As discussed in the Methods chapter, I consulted SASB Index disclosures, sustainability reporting, and corporate websites to collect data for the 23 firms that are not signatories of the Global Commitment. Each firm's definition of "reusable," "recyclable," and "compostable" may vary and this was unknown as the methodology for calculation was seldom explicitly stated. The definition of "recyclable" is highly subjective in the United States, with recyclability claims often not reflecting the practical recyclability of plastic packaging within companies' portfolios.

In the literature, corporate sustainability reports are considered to lack consistency and contain information that is difficult to cross-check (Landrum & Ohsowski, 2018; Lock & Seele, 2016; Meckenstock et al., 2016; Phelan et al., 2022; Roca & Searcy, 2012;

Stewart & Niero, 2018). It is also likely that, due to reputational risks, companies have chosen to disclose or omit specific information (Phelan et al., 2022; Roca & Searcy, 2012). Therefore, given that corporate sustainability reports were used to build the dataset, the results of this research should be considered in light of the fact that reported total plastic packaging weight in metric tons, percentage of reusable, recyclable, or compostable packaging, number of global CE alliances and partnerships supported, number of product lines with reuse models, and number of reuse pilots launched are voluntary, measured in different ways by firms, and remain at each firm's discretion (Phelan et al., 2022).

SASB disclosure guidelines provide definitions to registrants for “recyclable” and “reusable” that are consistent with definitions established in ISO 14021:1999 “Environmental labels and declarations—Self declared environmental claims (Type II environmental labelling).” In the context of the packaging lifecycle management accounting metric, recyclable is defined (SASB, 2023a) as

a product or packaging that can be diverted from the waste stream through available processes and programs and can be collected, processed, and returned to use in the form of raw materials or products.

Reusable is defined (SASB, 2023a) as

a product or packaging that has been conceived and designed to accomplish, within its lifecycle, a certain number of trips, rotations, or uses for the same purpose for which it was conceived.

Finally, the definition of “compostable” for registrants' reporting purposes is consistent with the definition in ASTM Standard D6400, 2004, “Standard Specification for Compostable Plastics.” Compostable is defined (SASB, 2023a) as

how that which undergoes degradation by biological processes during composting to yield CO<sub>2</sub>, water, inorganic compounds, and biomass at a

rate consistent with other known compostable materials and that leaves no visible, distinguishable, or toxic residue.

Notably, the SASB “packaging lifecycle management” accounting metric does not explicitly refer to plastic packaging (SASB, 2023a).

Many of the firms that disclose through SASB that were included in the analysis reported numbers on packaging, not plastic packaging specifically. This is the case as well for some of the firms whose data I sourced from sustainability reporting and corporate websites, while each firm that reported plastic footprint data through Global Commitment signatory reporting explicitly reported plastic packaging metrics. Thus, percentage of reusable, recyclable, or compostable packaging in the context of this research is referred to as only “packaging.” For the purposes of this research, this indicator referred to “packaging,” “consumer packaging” and “plastic packaging.” Plastic packaging weight, however, in the context of this research is referred to as “plastic packaging,” yet includes both “packaging” and “plastic packaging.” Given the high volumes of plastic packaging utilized by the CPG sector, these definitions are sufficient to measure “plastic footprint.” Recognizing the data collected were voluntary, measured in different ways by firms, and remain at each firm’s discretion, the specifics of data collected for each firm that is not a Global Commitment signatory is detailed below (Phelan et al., 2022).

#### Data Collection for Various CPG Firms

Saputo was categorized as a firm that does not engage in PS for plastic packaging in the US and is a SASB Index registrant included in both tests for share of reusable, recyclable, or compostable packaging and plastic packaging weight from 2021 to 2022.

Saputo is a food and beverage CPG firm that does not fund deposit return systems, take-back programs, or refill and reuse programs for its plastic packaging in the United States. Using the SASB Index packaging lifecycle accounting metric, Saputo disclosed “total weight of packaging” and “percentage of plastic packaging that is recyclable, reusable, and/or compostable” (Saputo, 2023; SASB, 2023b). Saputo data were considered sufficient to measure the firm’s plastic footprint.

Conagra Brands is a SASB Index registrant categorized as not engaging in PS for plastic packaging in the United States. Data from the food and beverage CPG firm was sourced from both SASB disclosures and Conagra Brands’ 2021 and 2022 sustainability reports. Conagra Brands published its total weight of packaging in metric tons and an estimated percentage of packaging made from recyclable, reusable, and/or compostable materials. These metrics were folded into a discussion on Conagra’s publicized goal of achieving “100% of current plastic packaging renewable, recyclable, or compostable by 2025” (Conagra Brands, 2021; Conagra Brands, 2022; SASB, 2023b). Conagra Brands data were considered sufficient to measure the firm’s plastic footprint.

Church & Dwight was categorized as a household goods CPG firm engaging in PS for its investment in TerraCycle and Loop take-back and reuse platforms for its Arm & Hammer and OxiClean brands’ plastic packaging in the United States. It is a SASB Index registrant and was included in both tests for percent difference in reusable, recyclable, or compostable packaging and difference in plastic packaging weight from 2021 to 2022. While Church & Dwight’s *2022 Sustainability Report* states that the firm’s products are packaged in paper and plastic packaging, the data sourced, which do not specify plastic packaging and thus account for both paper and plastic packaging, were



considered sufficient for inclusion in the plastic footprint analysis (Church & Dwight, 2022; SASB, 2023b).

Yum! Brands is a SASB Index registrant and was categorized as engaging in product stewardship for funding a TerraCycle take-back program for its Taco Bell brand plastic packaging. Both the food and beverage firm's reported plastic packaging weight and share of reusable, recyclable, or compostable packaging were included in the analysis. The firm reported estimated totals of fiber plastic-based packaging and customer service wares in metric tons in 2021 and 2022. Yum! Brands also reported the percentage of recyclable plastics used in consumer packaging. These data points were reported as directional estimates, with future refinements in data collection expected by the firm in subsequent years. Yum! Brands was included in the analysis given that plastics-specific data were supplied in the SASB disclosure and thus were considered representative of the firm's plastic footprint (SASB, 2023b).

J.M. Smucker Co. was included in the analysis for the percent difference in reusable, recyclable, or compostable plastic packaging. J.M. Smucker Co. is a food and beverage firm and SASB registrant; data was sourced from the firm's *2023 Corporate Impact Report*. The firm disclosed the percentage of recyclable, reusable, and/or compostable packaging materials by weight. The publication outlined definitions and standards for each of the three terms. The firm's report cites that packaging is "recyclable" if it can be collected or recovered from the waste stream and recycled through an "established program." "Compostable" undergoes composting through a managed process that controls the decomposition and transformation of biodegradable materials. "Reusable" is packaging returned for cleaning and refilling with new product

multiple times (J.M. Smucker Co., 2023; SASB, 2023b). J.M. Smucker Co. data were considered sufficient for inclusion in the plastic footprint analysis.

Estée Lauder is a cosmetics and personal care CPG firm categorized as engaging in PS. The firm's efforts include their Back 2 Mac take-back and recycling program for Mac brand plastic packaging. Estée Lauder is a SASB registrant and the firm's data was included in the analysis of plastic packaging weight and percent difference in reusable, recyclable, or compostable plastic packaging. Estée Lauder only reports packaging metrics for percentage of reusable, recyclable, or compostable packaging and the total weight in metric tons of "non-renewable" packaging. Non-renewable packaging includes plastic packaging. The firm defines "renewable," on the other hand, as packaging made from biomass from a living source and "replenished at a rate equal to or greater than the rate of depletion" (Estée Lauder, 2023; SASB, 2023b). Thus, Estée Lauder data were considered sufficient for inclusion in the plastic footprint analysis.

e.l.f Beauty is a SASB registrant and cosmetics and personal care CPG firm. The firm was categorized as not engaging in PS for their plastic packaging in the US. e.l.f. Beauty was included in the analysis of difference in plastic packaging weight from 2021 to 2022. The firm reported the total weight of packaging in metric tons in 2021 and 2022 in their *Fiscal 2022 Impact Report*. In e.l.f. Beauty's SASB disclosure, the firm does not report the percentage of its packaging that is recyclable, reusable, and/or compostable and states that it does not currently track this metric (e.l.f Beauty 2022; SASB, 2023b). The total weight of packaging data disclosed by e.l.f Beauty were considered sufficient for inclusion in the plastic footprint analysis.

LVMH Moët Hennessy Louis Vuitton is a clothing, apparel, cosmetics, and personal care CPG firm. It was categorized as engaging in PS for funding both a take-back and recycling program with Pact Collective and refill and reuse systems for Fenty brand cosmetics plastic packaging in the US. LVMH reported plastic packaging weights in 2021 and 2022. The data were pulled from LVMH's 2022 sustainability report. LVMH discloses metric tons of virgin, fossil-based plastic in consumer packaging and states "packaging used for shipment during transportation is excluded from this indicator" (LVMH, 2022). Thus, the data from LVMH's sustainability report were considered sufficient for inclusion in the plastic footprint analysis.

Data from food and beverage CPG firm Kraft Heinz were included in both tests for difference in percentage of reusable, recyclable, or compostable packaging and difference in plastic packaging weight from 2021 to 2022. Kraft Heinz was categorized as not engaging in plastic packaging product stewardship in the US. Kraft Heinz discloses its percentage of reusable, recyclable, and/or compostable packaging. The firm's sustainability report noted that the data disclosed for this metric includes "widely recyclable" materials and the calculation covers both global packaging and "select external manufacturing data." It also did not include data from Primal Kitchen, one of the firm's many food and beverage brands. The firm also reports "total weight of all plastic packaging" in metric tons for 2021 and 2022 in its 2023 sustainability report; the data were considered sufficient for inclusion in the plastic footprint analysis (Kraft Heinz, 2023).

Procter & Gamble (P&G) is a household goods and personal care CPG firm. P&G was categorized as engaging in PS in the US due to funding multiple take-back and

recycling programs with TerraCycle for their Tide, Gillette, and Venus brands' plastic packaging. P&G reported the percent difference in reusable, recyclable, or compostable consumer packaging from 2021 to 2022, which was included in the analysis. In its *2022 Citizenship Report*, the firm defines "recyclable" as packaging that can be collected, sorted, and processed at scale, in which there are "end markets for the material in at least one geography." The firm does not consider waste-to-energy as a viable end market for "recyclable" packaging. Thus, the percent recyclable, reusable, and/or compostable data from 2021 and 2022 were considered sufficient for inclusion in the analysis. While P&G disclosed its metric tons of plastic packaging, this was not included in the plastic footprint analysis because it was for the 2021/2022 fiscal year (Procter & Gamble, 2022).

Kimberly Clark is a SASB registrant and household goods and personal care CPG firm. Kimberly Clark was categorized as engaging in PS for plastic stewardship by funding a take-back and recycling program with TerraCycle for its Kimberly Clark brand products and packaging. Kimberly Clark did not disclose the percentage of recyclable, reusable, or compostable packaging in its portfolio, but disclosed metric tons of plastic packaging for 2021 and 2022 in its *2022 Global Sustainability Report* (Kimberly Clark, 2022; SASB, 2023b). Kimberly Clark data were considered sufficient to measure the firm's plastic footprint.

Kroger funds a take-back and recycling program for its own brand, Our Brands, and was categorized as engaging in PS for plastic packaging in the US. It is a food and beverage CPG retailer and distributor; Kroger is a SASB registrant. The data from Kroger's *2023 ESG Performance Table* was included in the tests for percent difference of reusable, recyclable, and/or compostable plastic packaging as it specified plastic

packaging for its own brand. Kroger disclosed that the data represent a “baseline” for Our Brands products and does not include general merchandise products (Kroger, 2023; SASB, 2023b). The data were considered representative of the retailer’s own brand’s plastic footprint, which it funds PS efforts for, and therefore sufficient for inclusion in the analysis.

Bel Group is a food and beverage CPG firm that was categorized as engaging in PS for funding a take-back and recycling program with TerraCycle for its brand Babybel’s plastic packaging in the US. Bel Group was included in the tests of percent difference in reusable, recyclable, or compostable plastic packaging. Bel Group disclosed “recyclable-ready and/or home-compostable packaging, excluding wax” in 2021 and 2022 in the firm’s published *2022 CSR Scorecard* (Bel Group, 2022). The data disclosed by Bel Group were considered sufficient for inclusion in the plastic footprint analysis.

Hershey Co. is a SASB registrant and the firm’s data were included in both tests for percent difference in reusable, recyclable, or compostable packaging and difference in plastic packaging weight from 2021 to 2022. It was categorized as not engaging in PS for plastic packaging in the US. The *Hershey Goodness Inside 2022 ESG Report* disclosed the firm’s percent of plastic packaging that is recyclable, reusable, and/or compostable and the total weight of the firm’s packaging (Hershey Co., 2022; SASB, 2023b). Thus, the percent recyclable, reusable, and/or compostable and packaging weight data from 2021 and 2022 were considered representative of the food and beverage CPG firm’s plastic footprint and sufficient for inclusion in the analysis.

Land O’ Lakes is a food and beverage CPG firm. Land O’ Lakes was included in the analysis of percent difference in reusable, recyclable, or compostable packaging and

was categorized as not engaging in PS for plastic packaging in the US. The firm reported its percent of reusable, recyclable, or compostable packaging in 2021 and 2022. In the *Land O' Lakes Community Impact Report*, it is specifically referred to as “consumer packaging” and was thus considered sufficient for inclusion in the plastic footprint analysis (Land O' Lakes, 2022).

### Research Outcomes

In conducting this research, I comparatively analyzed the plastic footprint impacts of CPG firms that fund PS for their plastic packaging in the United States and those that do not. This analysis provided insight into the impacts of funding product stewardship efforts for firms' total plastic packaging weight and the percentage of firms' packaging portfolio that is recyclable, reusable, or compostable.

### Plastic Footprint Outcomes

By assessing plastic footprint outcomes using the definitions discussed in the previous section, I determined that funding deposit return systems, refill and reuse systems, and collection and recycling schemes for plastic packaging does not correlate to a reduced total weight of plastic packaging or a greater share in reusable, recyclable, or compostable plastic packaging year over year. Ultimately, this suggests that voluntary product stewardship is not an effective strategy for CPG firms to employ to reduce the adverse impacts of plastic packaging and minimize their total plastic footprint.

Greater transparency into efforts undertaken at the corporate level to reduce plastic packaging would better inform this research. The progress demonstrated by summary statistics results may be explained by firms downgauging and lightweighting

their plastic packaging. For example, Hershey claimed in its sustainability report to have removed four million pounds of packaging material in 2022 alone by downgauging, eliminating, and redesigning packaging but does not disclose the degree to which each of the three strategies contributed to this reduction (Hershey Co., 2022). The summary statistics demonstrated that all 54 CPG firms included in the analysis reduced their total plastic packaging weight by an average of 2,709 metric tons from 2021 to 2022. The review of CPG firms' sustainability reports reflected that lightweighting and downgauging are common strategies to address packaging sustainability. This begs the question: To what degree is product stewardship or lightweighting and downgauging attributable to this outcome?

Had firms funding PS for plastic packaging shown reduced plastic footprints, the research would have suggested the funding of voluntary take-back schemes for plastic packaging or the funding of reuse and refill systems, for example, may be employed by CPG firms as a strategy to improve overall firm sustainability performance. However, given firms funding PS efforts do not show reduced plastic footprints compared to CPG companies without investment in product stewardship efforts, the research supports the literature that there is a need to incentivize high recycling rates and economic interventions such as packaging taxes to encourage circular design in addition to PS funding.

#### Circularity Governance and Plastic Transparency Outcomes

By assessing circularity and plastic transparency, I determined that while there is an effect of PS funding on support for global circular economy alliances and partnerships, there is no effect of PS funding on plastic metrics disclosure. This research was

conducted to determine whether greater participation in CE alliances, organizations, and partnerships and greater transparency around plastic-related metrics and performance correlated with funding product stewardship efforts for plastic packaging in the US. The comparative analysis outcomes suggest that when compared to firms that do not fund PS efforts, firms that do fund PS efforts for plastic packaging demonstrate strong circularity governance, showing greater participation in CE alliances, organizations, and partnerships. When comparing the number of plastic related metrics disclosed, however, firms that do not fund PS efforts demonstrate greater plastic transparency by reporting a larger number of plastic metrics in sustainability reports, disclosures, and on corporate websites.

Analyzing whether greater numbers of reuse pilots launched globally and product lines with reuse models globally correlate with product stewardship funding for plastic packaging in the United States also applied a global lens to the research, inviting the following question: Does voluntarily funding PS for plastic packaging in the US reflect greater commitment to circularity abroad in the form of reuse pilots and product lines with reuse models? The answer to this question was somewhat inconclusive, given Wilcoxon signed ranks tests could not be performed for the number of product lines globally with reuse models in 2022 and the number of reuse pilots launched globally in 2022. Yet, the paired t-test suggested product stewardship funding in the United States does not correlate with a greater number of reuse pilots launched and product lines with reuse models abroad. This implies that just because a given CPG firm voluntarily funds product stewardship efforts in the United States for plastic packaging, this does not mean



the same CPG firm necessarily shows a strong commitment to funding reuse pilots and product lines with reuse models for plastic packaging globally.

The research outcome that product stewardship funding correlates with participation in a greater number of CE alliances and partnerships indicates greater involvement in such initiatives is needed. Phelan et al. (2022) found that over half of the food and beverage CPG firms' corporate sustainability reports they analyzed were involved in at least one voluntary initiative, partnership, or industry association focused on plastic packaging and/or recycling. While participation in at least one partnership or association may be common, stronger circularity governance is clearly needed as involvement in alliances and partnerships may in turn encourage firms to fund more circularity initiatives, perhaps due to public commitments or inter-industry collaboration facilitated by partnerships. In agreement with the literature, I found that participation in global alliances and partnerships can catalyze efforts to address plastic pollution and implement circular economy principles. However, the plastic footprint findings of this research are also aligned with Phelan et al. (2022), who noted that participation is still limited and uptake in the CPG space is low. While there is limited transparency from the industry overall, my results reflect that even being a circularity "leader" in funding voluntary PS does not guarantee transparency.

Additionally, in alignment with Phelan et al. (2022) and the WWF Report (Rheinbay et al., 2021), I searched for the following preparedness indicators that reflect circularity governance to include in this analysis: reported expenditures dedicated to supporting plastic reduction and disposal solutions, number of employees dedicated to working on plastic solutions, and proportion of sales revenue spent on plastic reduction

activities. I was unable to locate these indicators. The literature reflected that they are not disclosed by firms in the CPG space. Total expenditures on circularity solutions for plastic and the proportion of revenue spent on plastic reduction activities were not made public in sustainability reporting or other sustainability disclosures. Externally quantifying the number of employees working on packaging sustainability was not possible. This, and the findings of this research, reinforce the need for greater plastic transparency from CPG firms.

#### Corporate Financial Performance Outcomes

Finally, the correlation between PS funding for plastic packaging in the United States and increased ROE and ROA is consistent with the literature that engagement in ESG issues is associated with improved financial performance. The correlation between voluntarily funding PS efforts for plastic packaging and improved corporate financial performance could be explained by the literature that sustainably producing, accessing, and re-using goods both captures value and improves firms' competitive position (Geissdoerfer et al., 2018; Phelan et al., 2022). Noting that firms funding product stewardship efforts internalize the cost of collecting and recycling their packaging at end of life via take-back systems and developing and establishing circular and reusable packaging systems, I hypothesized that firms not voluntarily funding PS efforts in the US would show stronger corporate financial performance.

However, firms funding PS in the United States for plastic packaging demonstrated stronger corporate financial performance compared to firms not funding PS. This research outcome did not indicate that there are significant trade-offs in voluntarily engaging in these forms of product stewardship. A goal of this study was to

quantify the financial risk of plastic packaging usage and, therefore, compliance with EPR policy. The corporate financial performance impacts of voluntarily funding PS at this time do not reflect significant financial risks associated with EPR compliance. However, this does not account for the scale at which firms may be required to fund take-back and recycling, deposit return, and reuse and refill schemes under EPR legislation for packaging.

### Recommendations for Key Stakeholders

The findings of this study and general reflections on the plastic crisis suggest recommendations for several key stakeholders: CPG firms, the financial sector, and policymakers. Overall, these stakeholders have been doing too little, too slowly to address the adverse impacts of rampant plastic packaging production and consumption.

#### CPG Firms

With the plastic crisis compounding, a transition to the circular economy led by CPG firms cannot occur quickly enough. CPG firms should begin to heavily invest in circular systems for plastic packaging to both mitigate the financial risks associated with forthcoming regulations and the risks that plastic packaging dependence poses to businesses. Firms that invest early in circular systems, especially as competitors in the CPG, clothing and apparel, or household goods sectors fall behind, may reap the rewards of a competitive advantage from being a first mover. Bio-based or compostable plastic packaging should be enthusiastically piloted. Low- to zero-waste reusable packaging systems and product delivery methods should be prioritized and firms should channel R&D funds necessary to support such developments. Beyond this, CPG firms should

establish long-term contracts for recycled plastic with manufacturers to create a healthy market for and guarantee continued investment in recycled plastic (Charles & Kimman, 2023).

Firms must immediately begin to phase out virgin, toxic plastic and associated chemicals altogether, a process that will likely take a significant amount of time. All products and packaging must be designed and redesigned to ensure maximum recycled content and practical recyclability. Notoriously hard-to-recycle packaging that most consumers do not have a recycling solution for should be eliminated completely. Flexible packaging should be replaced with low- to zero-waste product delivery systems and no new product lines should be developed with sachets and other forms of flexible plastic packaging (MacKerron et al., 2020; Reddy et al., 2020).

Based on my research findings, greater plastic transparency, strong support for EPR legislation, and involvement in global circular economy alliances, partnerships, and initiatives is paramount. Firms cannot fall short in both complying with forthcoming EPR policy and proactively endorsing legislative action. CPG firms should also support the global community in establishing a mandatory global cap on plastic production and developing a Global Plastic Treaty by the end of 2024, the negotiations for which began in early 2022 when the UN Environmental Assembly adopted a landmark resolution to develop a global and legally binding plastic pollution treaty (Bergmann et al., 2022; Break Free From Plastic, 2023; Fillion, 2023).

All CPG firms should disclose volumes of plastic packaging used, types of plastic packaging used, and chemicals in plastic packaging at a minimum (Break Free From Plastic, 2023). Firms should set targets and report on the number of new reuse models

developed that replace single-use plastic packaging units. Finally, independent from corporate circularity programs and initiatives, a percentage of CPG firms' annual revenue should be directly routed to fund recycling systems (MacKerron et al., 2020; Reddy et al., 2020).

The strategies recommended will require significant spending and paradigm shifts in business models. Since the inception of plastic, the ecological and human health costs associated with the material have been externalized by CPG firms. Plastic packaging will no longer be cheap once the true costs of producing, using, and disposing of it are accounted for. Thus, reducing plastic production by directly eliminating it, catalyzing consumer reuse options, and creating new delivery models must be prioritized by corporate leadership and circularity governance must be embedded with concerted effort throughout each organization to create meaningful progress.

### The Financial Sector

Financing and investment policies should also be established by banks around the plastic lifecycle. Banks and investors should require significant transparency from CPG firms and other sectors that rely on plastic packaging. This should be done to fully assess each firm's vulnerability to plastic-related financial risk and, therefore, the risk of the investment. Clear exclusion criteria must also be developed by banks for single-use plastics. Finally, CPG firms with public commitments to reduce their plastic footprints that have demonstrated progress should receive continued financial support from banks contingent on meeting circularity targets and deadlines. Failure to meet circularity targets and plastic footprint reduction targets should result in the termination of relationships (Vanaerschot & Plaisier, 2021).

Investors and financial institutions should incorporate the risks associated with plastic in financial and ESG assessments. Investors should push CPG firms to incorporate plastic management into ESG criteria and set rigorous, science-based, and time-bound targets for recycled plastic feedstock. Capital should be directed to emerging circularity projects and the new value chain associated with a circular economy should be heavily invested in. Finally, a massive shift away from global investment in the plastic industry is needed, with capital investment routed to new delivery models, plastic alternatives and substitutes, and recycling infrastructure (Charles & Kimman, 2023; McCafferty-Harvey et al., 2021; Reddy et al., 2020).

#### Policymakers

Governments at all levels must establish incentives and regulations to scale the changes in policy, business models, infrastructure, and funding mechanisms urgently needed to address the negative impacts of plastic packaging (Reddy et al., 2020). Governments should ensure major banks develop ambitious plastic strategies and incentivize financing the circular economy (Vanaerschot & Plaisier, 2021). The 175 countries that endorsed the Global Plastic Treaty must provide continuous and unequivocal support for it (Fillion, 2023). In order to encourage the proliferation of recycled plastic on the market, governments must set robust minimum recycled content standards, especially for single-use plastics.

As a part of the Global Plastic Treaty, the US must support a mandatory global cap on plastic production, rather than push for national goals and plastic recycling (Fillion, 2023). The U.S. Secretary of State should take a strong stance on calling for solutions to the plastic crisis, including reducing plastic production and pollution

domestically. A polymer premium should be levied on fossil-based plastic polymer production and consumption. Funds from such a levy should be routed to bolster recycling infrastructure and scale plastic collection in the United States (Charles & Kimman, 2023). The US must decrease plastic consumption, implement federal EPR policy for plastic packaging, impose a federal ban on toxic, virgin plastics, and significantly invest in increasing recycling rates and overhauling the waste management industry at every level of government (Reddy et al., 2020).

### Future Research

Additional research is needed to better understand why the correlations discussed in this chapter were found. The lack of plastic transparency in the CPG sector leaves much to be desired and further mapping and/or quantifying the level of plastic transparency in the industry could be illuminating. Further investigation into embedding circularity in corporate governance is needed. Given the corporate financial performance demonstrated in this research, the following questions arise: Once firms begin funding PS efforts for plastic packaging, how long does it take for this to catalyze improved financial performance? Does funding PS efforts for plastic packaging reflect stronger sustainability performance/ESG ratings as a whole, and therefore improved corporate financial performance? How do public expectations for improved sustainability performance interplay with the fundamental difficulties with financing and establishing product stewardship programs and initiatives?

Beyond this, the results of the plastic footprint analysis pose additional questions. Further research is needed into the degree to which PS efforts for plastic packaging are implemented at the corporate level. Understanding, for example, the total number of

product lines with PS efforts implemented relative to a firm's total number of product lines could reveal that perhaps PS efforts have not, so far, reduced plastic footprint due to the scale of implementation. The plastic footprint outcome poses the following questions: To what degree do PS efforts for plastic packaging need to be implemented to begin affecting a firm's total plastic footprint? A thorough assessment of lightweighting and downgauging as a plastic footprint reduction strategy is also needed to unpack and understand reported trends in progress. Finally, further research into effective business strategies to reduce plastic packaging is urgently needed.

### Conclusions

CPG firms contribute to plastic packaging pollution and use virgin plastic at significant rates. To keep pace with expectations from consumers, governments, investors, and many other stakeholders around sustainability performance, firms in this industry must engage in ambitious efforts to mitigate the adverse impacts of the plastic crisis. Key players in the industry, perhaps in anticipation of EPR legislation, have voluntarily funded product stewardship efforts for plastic packaging in the US and set targets in the coming five to ten years. Yet, there has been little research into the efficacy of these efforts and their correlation to circularity governance, plastic footprint, and corporate financial performance. This research sought to fill that gap.

My findings showed that ultimately, funding deposit return systems, refill and reuse systems, and the collection and recycling at end-of-life for plastic packaging does not sufficiently address plastic footprint impacts, nor achieve progress towards circularity and sustainability goals established by CPG firms. As the plastic crisis intensifies and risk builds for firms that continue to rely heavily on plastic packaging, it is evident that the



product stewardship efforts funded by CPG firms to date are falling short, especially when it comes to reuse. Voluntarily funding PS is correlated with improved corporate financial performance and stronger circularity governance, but it does not reflect greater plastic transparency. While there is a financial incentive to invest in product stewardship initiatives, funding PS is not enough to mitigate the negative externalities associated with plastic packaging use in the CPG sector. Federal EPR legislation in the US, along with other types of robust policy intervention such as packaging taxes, is required to mandate collection and recycling of plastic packaging at end-of-life and encourage new business models for product delivery, as well as packaging redesign.

This research could be used by CPG firms to inform plastic pollution mitigation and corporate plastic footprint reduction strategies. It could encourage firms to further explore the effectiveness of certain product stewardship strategies, invest in new business models to reduce their plastic footprint, or perhaps encourage further investigation into reuse models for product delivery. The research findings could also be used by non-governmental organizations (NGOs), institutions in the circularity space, and CPG industry groups to promote participation in global circular economy alliances and partnerships. Finally, it could be used to encourage greater transparency from the industry, as this study unwaveringly demonstrated the need for greater disclosure of plastic metrics from firms in the CPG industry and enhanced visibility.

## Appendix I

### List of Companies

Table 6. CPG firms included in the research

Consumer packaged goods (CPG) firm	Product stewardship (PS) classification	CPG type (products sold in plastic packaging)	Global Commitment signatory?
Abbott – Nutrition	Does not engage in PS	Pharmaceutical & medical goods	No
AmorePacific	Engages in PS	Cosmetics & personal care	Yes
ASOS	Does not engage in PS	Clothing & apparel	Yes
Beiersdorf AG	Does not engage in PS	Cosmetics & personal care, pharmaceutical & medical goods	Yes
Bel Group	Engages in PS	Food & beverage	No
Campbell Soup Co.	Engages in PS	Food & beverage	Yes
Church & Dwight	Engages in PS	Household goods	No
Clorox Co.	Engages in PS	Household goods, cosmetics & personal care, food & beverage	Yes
Coca-Cola Co.	Engages in PS	Food & beverage	Yes
Colgate-Palmolive Co.	Engages in PS	Household goods, cosmetics & personal care, pharmaceutical & medical goods	Yes
Conagra Brands	Does not engage in PS	Food & beverage	No
Danone	Does not engage in PS	Food & beverage	Yes
Diageo	Does not engage in PS	Alcoholic beverages	Yes
Driscoll's	Does not engage in PS	Food & beverage	Yes
e.l.f. Beauty	Does not engage in PS	Cosmetics & personal care	No

Essity AB	Does not engage in PS	Household goods, pharmaceutical & medical goods	Yes
Estée Lauder Companies	Engages in PS	Cosmetics & personal care	Yes
Ferrara	Does not engage in PS	Food & beverage	Yes
Ferrero	Does not engage in PS	Food & beverage, toys	Yes
Henkel AG	Engages in PS	Household goods, cosmetics & personal care	Yes
Hennes & Mauritz AB (H&M Group)	Does not engage in PS	Clothing & apparel, cosmetics & personal care	Yes
Hershey Co.	Does not engage in PS	Food & beverage	No
J.M. Smucker Co.	Does not engage in PS	Food & beverage	No
Johnson & Johnson Consumer Health	Engages in PS	Cosmetics & personal care, pharmaceutical & medical goods	Yes
Kao	Engages in PS	Cosmetics & personal care	No
Kellogg Co.	Does not engage in PS	Food & beverage	Yes
Keurig Dr. Pepper	Does not engage in PS	Food & beverage	Yes
Kimberly-Clark Corp.	Engages in PS	Household goods	No
Kraft Heinz	Does not engage in PS	Food & beverage	No
Kroger	Engages in PS	Food & beverage	Yes
L'Occitane Group	Engages in PS	Cosmetics & personal care	Yes
L'Oréal	Engages in PS	Cosmetics & personal care	Yes
Land O' Lakes	Does not engage in PS	Food & beverage	No
LVMH Moët Hennessy Louis Vuitton	Engages in PS	Cosmetics & personal care, clothing & apparel, alcoholic beverages	No

Mars, Inc.	Engages in PS	Household goods, food & beverage, toys	Yes
McCormick & Co.	Engages in PS	Food & beverage	Yes
MolsonCoors Brewing Co.	Does not engage in PS	Alcoholic beverages	Yes
Mondelez International	Does not engage in PS	Food & beverage	Yes
Natura & Co.	Does not engage in PS	Household goods, clothing & apparel, cosmetics & personal care	No
Nestlé SA	Engages in PS	Food & beverage	Yes
Oatly	Does not engage in PS	Food & beverage	No
PepsiCo	Engages in PS	Food & beverage	Yes
Pernod Ricard	Does not engage in PS	Alcoholic beverages	Yes
Procter & Gamble (P&G)	Engages in PS	Household goods	No
Reckitt Benckiser Group	Engages in PS	Household goods, cosmetics & personal care, pharmaceutical & medical goods, food & beverage	Yes
Sanofi	Engages in PS	Pharmaceutical & medical goods, cosmetics & personal care	No
Saputo, Inc.	Does not engage in PS	Food & beverage	No
SC Johnson	Engages in PS	Household goods, cosmetics & personal care	Yes
Starbucks Coffee Company	Does not engage in PS	Food & beverage, household goods	Yes
Target Corporation	Does not engage in PS	Household goods, cosmetics & personal care, food & beverage	Yes
Unilever N.V.	Engages in PS	Household goods, cosmetics & personal care, food & beverage	Yes

Walmart, Inc.	Does not engage in PS	Household goods, cosmetics & personal care, food & beverage	No
Weleda	Engages in PS	Cosmetics & personal care	No
Yum! Brands	Engages in PS	Food & beverage	No

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