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# The circular economy rebound effect

## Reconceptualizing rebound approaches and mitigation opportunities from an ordonomic perspective

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### Abstract

Recent scholarship has advocated a conceptual investigation of rebound effect theory in the circular economy (CE) context. While the available body of knowledge on a circular economy rebound (CER) is rather scant, this forum article proposes a conceptual view of existing CER approaches. Our analysis reveals that the CER literature has largely bypassed an appreciation of how firm behavior is embedded in and canalized by governance arrangements. This forum article contributes to the literature by reconceptualizing the challenges of mitigating CERs. It proposes to re-focus the CER debate toward: (i) the innovation need of functional collective commitments for CE to address free-rider-problems; (ii) the criticality of effective management of decoupling through innovative circular governance; (iii) the critical reflection of calls for degrowth and “non-optimization” behavior; and (iv) the recognition of optimization behavior and circular governance frameworks as complementary rather than substitute approaches for facilitating CER mitigation.

### KEYWORDS

circular economy, circular economy rebound, governance, industrial ecology, ordonomics, rebound effect

## 1 | INTRODUCTION

Scholars have recently highlighted the necessity of applying rebound effect (RE) theory to the circular economy (CE) concept to explore unintended consequences of implementing circularity on micro, meso, and macro levels (e.g., Castro et al., 2022; Figge & Thorpe, 2019; Font Vivanco et al., 2022; Metic & Pigosso, 2022; Zerbino, 2022a, 2022b). A variety of tensions have emerged in the literature on circular economy rebound (CER) effects regarding the ambiguous role of optimization and economic incentivization (e.g., Siderius & Poldner, 2021; Zink & Geyer, 2017) and the competitive logics of a market-oriented system (e.g., Kjaer et al., 2019): (i) Some scholars have advocated the idea of *decoupling* to reduce absolute resource consumption by simultaneously improving economic prosperity, ultimately realizing “*green growth*” (e.g., Castro et al., 2022; Kjaer et al., 2019; Zerbino, 2022a, 2022b). (ii) However, there exists doubt from other scholars on whether and how CERs can be effectively managed and eventually overcome in a growth-driven economic system (e.g., Schröder et al., 2019; Siderius & Poldner, 2021; Zink & Geyer, 2017), ultimately calling for abandoning growth and optimization concepts, thus promoting *degrowth* (post-growth) circularity ideas.

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There has only been little research into this crucial phenomenon, prompting scholars to advocate for additional research on CERs (e.g., Bakker et al., 2021; Goyal et al., 2021). Recently, scholarship has noted that “there is still a limited understanding regarding the occurrence of rebound effects within a CE context” (Metic & Pigosso, 2022, p. 1). In a similar vein, some scholars have contemplated that “[o]ne unresolved issue for the circular economy is the potential rebound effect” (Schröder et al., 2019, p. 191; see also Corvellec et al., 2022). Thus, recent scholarship has proposed to expand the knowledge on the nature of REs in a CE context from a conceptual view to reveal the prospects for the emergence of viable instruments to mitigate CERs, addressing the urgent need for innovative conceptual deliberations (e.g., Castro et al., 2022; Figge & Thorpe, 2019; Zerbino, 2022b).

This forum article aims to conceptually stimulate the debate on whether degrowth or decoupling trajectories are effective in mitigating CERs by applying an ordonomic approach, that is, a recent development in the field of business ethics, that seeks to systematically explore the interplay between *semantics (order of ideas)* and *governance (order of incentives)* (Pies, 2016; Pies et al., 2009, 2010). The key interest of the ordonomic approach is the analysis of the potential discrepancy between moral categories and institutional imperatives. This discrepancy often leads to perceived conflicts between self-interest and public interest. We argue that the debate about CER effects constitutes an example of such a discrepancy and discuss structural solutions. Hence, we contribute to answering the crucial question of *how* CERs can be deliberately overcome.

This article continues with situating our study in the literature streams in Section 2. We delineate our research method in Section 3. We then present our re-conceptualization of the CER debate in Section 4. Finally, we present the discussion and concluding remarks in Section 5.

## 2 | THEORETICAL BACKGROUND

### 2.1 | Rebound effect theory

Historically, the RE was first discussed by Jevons (1865). While various definitions for the term RE can be found within the energy economics literature, they fundamentally center on the disparity between the potential and realized energy and environmental benefits of specific efficiency improvements (Greening et al., 2000; Jenkins et al., 2011; Khazzoom, 1980; Sorrell, 2007, 2009). The theoretical literature on REs already examined changes in broader framings, including carbon emissions (e.g., Brookes, 1990; Saunders, 1992) or life cycle assessments (Font Vivanco & van der Voet, 2014), with a tendency to focus on specific effects distinguishing between direct, indirect, and economy-wide REs (Greening et al., 2000; Saunders, 2000; Sorrell & Dimitropoulos, 2008). As a case in point, Wei (2010), expanding on findings from Wei (2007), empirically applied a general equilibrium model to the global economy to examine economy-wide REs. This study highlighted: (i) the importance of the supply side to REs, (ii) that substitution between energy and other resources has only a limited impact on the short-term rebound, and (iii) that super-conservation can happen. These insights give a first hint that backfire effects (rebounds exceeding 100%) are relatively unlikely to occur on a global scale. In a similar vein, Sorrell's (2007) findings indicated that although it was improbable for backfire effects to occur as a result of energy efficiency enhancements, they are, however, likely to manifest in the initial adoption phases of “general-purpose technologies” like electricity and mechanization. The theoretical literature on REs evolved from application in energy economics to resources in general (Giampietro & Mayumi, 2018), examining non-energy rebounds (Font Vivanco et al., 2018), and thus gained prominence in the field of sustainability science (e.g., Font Vivanco et al., 2022).

### 2.2 | The circular economy concept

The CE concept instigates slowing down (via repair, reuse, remanufacture) or closing (via recycling and recovery) resource loops to preserve material and product value (Bocken et al., 2017; Morsetto, 2020). Such transformation is a large-scale systemic task that requires paradigmatic mindset shifts (Blomsma et al., 2023) and holistic innovation activities on the micro, meso, and macro levels (Kirchherr et al., 2017; Korhonen, Nuur, et al., 2018; Korhonen, Honkasalo, et al., 2018; Prieto-Sandoval et al., 2018). Attempts at transitioning toward a CE are unrealistic unless they move beyond incremental adaptation, as such approaches may deter the required transformation process (Velenturf & Purnell, 2021). However, a radical and disruptive approach presents significant challenges due to potential REs resulting from systemic innovation activities (Corvellec et al., 2022; Font Vivanco et al., 2022; Siderius & Poldner, 2021; Zink & Geyer, 2017). Therefore, scholars have increasingly paid attention to an in-depth understanding of REs in a CE context and the development of mitigation strategies to address these challenges more effectively (e.g., Castro et al., 2022; Metic & Pigosso, 2022).

### 2.3 | Circular economy rebound effect: State of the art

Recently, scholarship has connected RE theory to the CE concept with the aim of investigating the unintended consequences of innovation activities in the context of circularity (e.g., Castro et al., 2022; Figge & Thorpe, 2019; Metic & Pigosso, 2022; Siderius & Poldner, 2021; Zink & Geyer,

2017). The relevant literature has defined the CER as a situation in which the improved efficiency of a production and consumption system is (over-)compensated by increased levels of production and/or consumption (Zink & Geyer, 2017). When the resource reduction from an improvement is less than expected due to systemic or behavioral responses (Kjaer et al., 2019), the amplitude of CER may range from relatively small to enormous drawbacks, that is, “backfire” (Wüst et al., 2022). Zink and Geyer’s (2017) definition refers to the most critical case of “backfire” REs, that is, CER effects exceeding 100% (see also Makov & Font Vivanco, 2018; Font Vivanco et al., 2022).

The literature has identified two main CER “mechanisms” (Makov & Font Vivanco, 2018; Siderius & Poldner, 2021; Zink & Geyer, 2017): (a) *Imperfect and/or insufficient substitution* between virgin and recycled, reused, etc., materials: In this case, the rebound occurs because re-circulated products fail to effectively compete with primary production products so that consumers purchase more disposable products and hence increase the overall environmental impact. (b) *Re-spending or income effects*: In this case, the rebound occurs due to consumers purchasing additional goods and services, since the substitution of costly resources leads to price reductions, which in turn increase spending power so that a strong positive income effect overcompensates the initial substitution effect.

In the ongoing CER debate, the scientific community has developed two central ideas that appear to be antagonistic, at least at first sight. The first idea has acknowledged that economic incentives systemically reinforce CER; it, therefore, calls for degrowth (post-growth) circularity to mitigate rebounds (e.g., Schröder et al., 2019; Siderius & Poldner, 2021; Zink & Geyer, 2017). Siderius and Poldner (2021) have empirically investigated CER in the context of the Dutch circular textile and fashion industry and concluded that (linear) “[s]tructural economic incentives systemically reinforce rebound effects in the CE” (Siderius & Poldner, 2021, p. 9). The second idea aims at a decoupling of consumption and growth for mitigating rebounds, ultimately realizing “green growth” (e.g., Castro et al., 2022; Kjaer et al., 2019). Castro et al. (2022) have conducted a literature review on CER and developed a framework that combines the main characteristics and mechanisms (initiating, developing, and mitigating) of CER. Kjaer et al. (2019) have investigated CER in the business model context of product/service systems (PSS) with the aim of contributing to the debate on decoupling absolute resource consumption and economic growth. They have argued for three requirements for absolute resource decoupling: (i) ensure net resource reduction, (ii) avoid burden shifting between life cycle stages, and (iii) mitigate REs.

As illustrated in Table 1, we have observed that the current academic debate on CER is relatively immature, mostly discussing whether—and to what extent—the CER exists. There appeared a variety of tensions in the CER literature on, for example, the ambiguous role of optimization and economic incentivization (e.g., Siderius & Poldner, 2021; Zink & Geyer, 2017), semantics and ideological framings (e.g., Schröder et al., 2019), unclarity about how CE embodies the logics of the market-oriented system, that is, competitive processes (e.g., Kjaer et al., 2019), and ambiguous consumer behavior (e.g., Warmington-Lundström & Laurenti, 2020) among others. Scholarship has criticized that the existing literature has obtained “a limited understanding regarding the occurrence of rebound effects within a CE context” (Metic & Pigosso, 2022, p. 1). Thus, several studies (e.g., Castro et al., 2022; Metic & Pigosso, 2022; Zerbino, 2022a, 2022b) call for more in-depth conceptual research of CERs, analyzing functional opportunities for mitigation.

### 3 | METHODS

#### 3.1 | Initial review

As a preliminary step to our conceptual paper development, we investigated the theoretical background by evaluating peer-reviewed articles on “CE” and “REs.” We used keyword full-text search in Clarivate Web of Science, Elsevier’s Scopus, and Google Scholar, applying the following search query: “circular economy” OR “CE” AND (“rebound” OR “rebound effect” OR “unintended consequences” OR “CER” OR “RET”). This initial review provided us with an overview of available peer-reviewed literature. Subsequently, we skimmed the results of our searches by specifically looking for relevant content on CER effects. We identified only 18 peer-reviewed studies that intensively discuss CERs (see Table 1 in Section 2). These 18 scientific publications were carefully scrutinized by all contributing authors. During the review process, we focused on the peculiarities of CER and its mitigation opportunities.

#### 3.2 | Conceptual paper development

Following Gilson and Goldberg (2015), the purpose of a conceptual article is to propose new relationships between constructs and concepts. In line with Meredith (1993), we define *concept* as “a bundle of meanings or characteristics associated with certain events, objects, or conditions” (p. 5). Given this understanding, we apply an ordonomic perspective to create a theory-guided conceptual system, which “consists of multiple concepts with many interrelated propositions” (Meredith, 1993, p. 10). Hence, this forum article’s goal is to provide orientation by re-conceptualizing the frontline between post-growth and green-growth approaches to CER, improving our understanding of functional rebound mitigation opportunities.

**TABLE 1** Overview of peer-reviewed literature on circular economy rebound (CER).

#	Study	Method	CER examination
1	Castro et al. (2022)	Systemic literature review	Developed a conceptual framework that combines the main mechanisms (initiating, developer, and mitigating mechanisms) and characteristics of a CE rebound effect.
2	Chen (2021)	Conceptual study	Contributes a framework to align CE with the context of sustainable cities and clarifies the linkages between rebound effects and different phases of CE.
3	Corvellec et al. (2022)	Literature review	Critiques addressed to the CE and circular business models.
4	Figge and Thorpe (2019)	Conceptual study	They contributed to the CE rebound effect discussion by introducing another type of rebound, namely "symbiotic rebound."
5	Font Vivanco et al. (2022)	Systemic literature review	Reviewed a broader scope of rebound effect in sustainability sciences.
6	Kjaer et al. (2019)	Conceptual study	Investigated CE rebound effects in the product/service system (PSS) context to contribute to the debate on decoupling absolute resource consumption and economic growth.
7	Korhonen, Honkasalo, et al. (2018)	Conceptual study	Identified six challenges for a CE that relate to: (1) thermodynamics, (2) system boundaries, (3) limits posed by physical economic growth—CER, (4) path dependencies, (5) intra-organizational and inter-organizational strategies, and (6) physical flows.
8	Makov and Font Vivanco (2018)	Case study	Smartphone reuse in the United States to quantify, for the first time, rebound effects from reuse.
9	Metic and Pigosso (2022)	Systemic literature review	Contribute to the CE rebound effects (1) definitions; (2) triggers and drivers; (3) types and mechanisms; and (4) measurement approaches.
10	Niero et al. (2021)	Conceptual study	Investigated unintended effects of a CE transition. Contributes that the general life cycle assessment approach is not fully able to analyze and address CER.
11	Salvador et al. (2020)	Literature review	Circular business model research is not fully accounting for CER.
12	Schröder et al. (2019)	Perspective	They ascertained that "One unresolved issue for the circular economy is the potential rebound effect—also known as Jevon's Paradox." (p. 191)
13	Siderius and Poldner (2021)	Case study	They empirically investigated the CE rebound effect in the context of the Dutch circular textile and fashion industry.
14	Skelton et al. (2020)	Scenario analysis (macroeconomic)	Quantification of CER in the EU automotive supply chain.
15	Warmington-Lundström and Laurenti (2020)	survey	Resource sharing CER magnitude and likelihood.
16	Zerbino (2022a)	Case study	Investigated approaches on how firms can manage CER.
17	Zerbino (2022b)	Perspective	Recommendation: increase awareness about CER and develop holistic, actionable solutions to manage CER.
18	Zink and Geyer (2017)	Conceptual Study	They advanced the theory of the CE rebound effect. They demonstrated how the approach of CE rebound effects differs from the classical rebound approach

### 3.3 | The ordonomic perspective as a conceptual approach to CER

Applying an ordonomic perspective on the CER discourse acknowledges that a CE transition is a systemic task that creates novel *ideational* and *institutional* challenges. Against this backdrop, ordonomics relies on two fundamental pillars. First, it distinguishes between semantics (*order of ideas*) and governance structures (*order of incentives*) (Pies, 2016).<sup>1</sup> Second, ordonomics highlights the system(at)ic interplay of both (Pies et al., 2010): *ideas drive institutional development that can bring about coordinated changes of individual behavioral patterns.*

Since value creation needs to be organized through incentive arrangements, the establishment and adaptation of such arrangements demand governance (rule-setting processes) for the (re-)formation of institutional conditions and their incentive effects (Pies et al., 2009; 2010). Whether actors are successful in playing better games, however, depends on their understanding of the status quo and their imagination of potentially better games. This is why *semantics* is of crucial importance (Denzau & North, 1994; Pies et al., 2020; 2021): The zero-sum mindset of tradeoff perceptions can interfere with institutional reforms, while the win-win mindset of mutual betterment can help in identifying and implementing institutional solutions for mutual problems. A conceptual (re-)orientation of semantics can therefore help in gaining a shared understanding of common interests and in opening the view toward new value creation potentials (subsequently realized through improved governance for business optimization).

Given that competition is a *system imperative* in market-oriented economies,<sup>2</sup> it is a matter of governance and, finally, a matter of semantics whether optimization activities by firms move in the direction of linearity or circularity. Functional governance, guided by a win-win mindset, can be distinguished into *public ordering* and *private ordering*. While private ordering defines the “default mode” of innovation activities by private firms for added value, the provision of public ordering requires *collective action* to establish an enabling environment for functionally guiding privately organized innovation activities.<sup>3</sup> This perspective is in line with Siderius and Poldner (2021, p. 8), who have stated that “[r]ebound effects in the CE are not necessarily tied to specific CE strategies ... they rather emerge due to market dynamics and the level of competition.” It is therefore a major advantage that the ordonomic approach traces the CER debate back to a fundamental business ethical issue, namely, the perceived discrepancy between self-interest and public interest. This helps to understand that CER is the major peril to the implementation of a functional CE, even holding the potential to jeopardize the functionality of the entire CE concept.

## 4 | THE CER DEBATE: AN ORDONOMIC RE-CONCEPTUALIZATION

### 4.1 | The underlying tradeoff perception in the CER debate

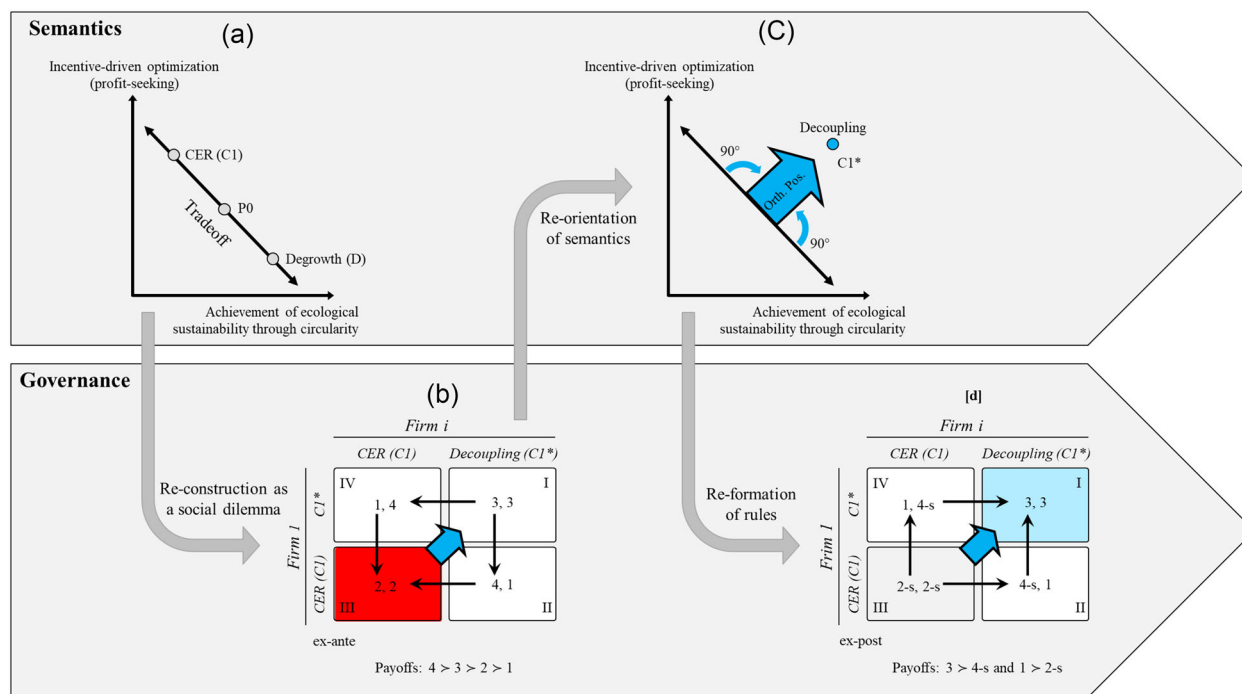
Within the CER literature, we have discerned two general mechanisms by which secondary production (e.g., reuse, recycling) may lead to the CER effect (Makov & Font Vivanco, 2018; Zink & Geyer, 2017), namely, (a) *insufficient substitutability* and/or (b) *strong positive income effects, overcompensating the substitution effect of technological efficiency gains*. From an ordonomic standpoint, a remarkable feature of these mechanisms is their grounding in neoclassical economics. Given that neoclassical approaches assume economic actors to *merely* practice “optimizing behaviors”, it can be acknowledged that this school of thought has been exposed to criticism in the CER literature. As a case in point, Siderius and Poldner (2021, p. 10 f.) state that “CER is also the environmental punishment that is the consequence of the lack of change in our behavior following an efficiency increase ... It is thus the consequence of linear (neoclassical), one dimensional thinking.” They further note that neoclassical assumptions of rationality might not hold anymore in the CE paradigm and that “these assumptions belong to the economic paradigm from which we are attempting to depart” (Siderius & Poldner, 2021, p. 9). Nevertheless, this kind of thinking postulates a tradeoff between the individual optimization of business activities and the achievement of societal desiderata, such as a sustainable CE transition, as shown in Figure 1a.

To illustrate, Zink and Geyer (2017) hold that an increase in resource productivity will directly lead to a CER “backfire” trajectory since “the clear implication is that the circular economy will create growth—growth means the rebound effect and a reduction in expected environmental benefits” (Zink & Geyer, 2017, p. 599). They argue that CER will eventually overcompensate the gains from CE innovation and therefore conclude that “[w]hat is truly required to reduce environmental impact is less production and less consumption” (Zink & Geyer, 2017, p. 600). Concurring with Zink and Geyer (2017), Siderius and Poldner (2021) connect growth in GDP (or production) to a CER backfire trajectory that ultimately leads to increased resource consumption and thus ensues a negative environmental impact of CE (Figure 1a). Thus, it is crucial to recognize that tradeoffs between societal desiderata and the pursuit of individual economic incentives within a so-called “optimization paradigm” tend to cause criticisms of neoclassical assumptions. We see this pattern confirmed in the CER case.

An ordonomic perspective, on the other hand, comprehends the prospect of such tradeoffs being resolved by implementing *governance reforms* that align pursuing individual incentives with societal goals. In the context of the CER debate, we discern the potentiality of such resolution in the idea of *decoupling* (e.g., Kjaer et al., 2019; Zerbino, 2022a, 2022b). Advocating authors have argued that green growth can combine higher material living standards with lower resource consumption. As a case in point, Kjaer et al. (2019, p. 32) propose that “the ultimate aim of CE should be to enable absolute resource decoupling, which goes beyond simply extracting more value from resources.” In ordonomic parlance, we re-conceptualize the idea of decoupling as an *orthogonal positioning* allowing us to overcome the perceived tradeoff between incentive-driven optimization (profit-seeking) and improvements of ecological sustainability and to change the direction of thought by 90° toward developing innovative CE governance (Figure 1c).

The key contribution of the ordonomic approach to the CER debate lies in re-conceptualizing the assumed tradeoff as in fact resulting from a social dilemma, one that can be overcome via innovative governance that re-forms incentive structures for optimizing behavior. Let us outline our ordonomic 4-step thought process to explain the interaction between the two analytical levels of semantics and governance (Figure 1).





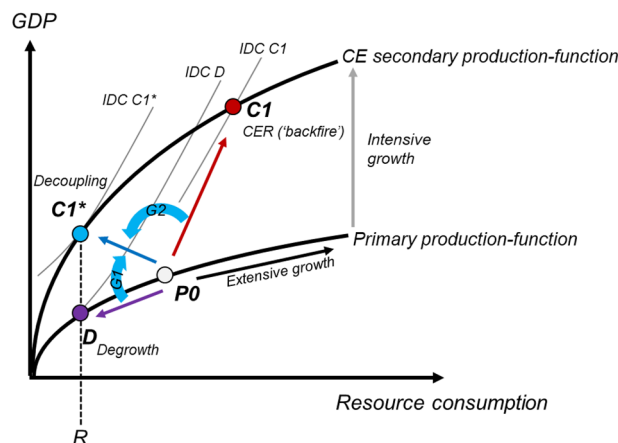
**FIGURE 1** Ordonomic reconceptualization of circular economy rebound (CER): tradeoff (a)—social dilemma (b)—orthogonal position (c)—re-formation (d).

1. We begin with the semantic notion of a tradeoff (Figure 1a). In this frame of perception, there is a natural tendency toward CER effects (point C1), triggering the idea that countering such CER effects requires degrowth (point D).
2. We reconstruct the tendency toward an undesirable CER effect as resulting from a social dilemma between competing firms (Figure 1b). Each firm must decide whether it innovates toward C1 or instead toward the generally more desirable outcome C1\* (decoupling). Faced with poor incentives, each single firm chooses C1 (Pareto-inferior Nash equilibrium). This explanation of the CER effect draws on a situational conflict between individual profit orientation and conserving resources, represented along the diagonal between quadrants II and IV. In this sense, it supports the notion of a tradeoff (Figure 1a). At the same time, however, it also undermines this notion since it identifies an element of situational harmony inherent to this dilemma, represented along the diagonal between quadrants III and I.
3. We correct the semantic tradeoff perception by identifying its blind spot. Instead of regarding the tradeoff as an inescapable conflict between profit-orientation and conserving resources (Figure 1a), we now complement this perspective with the important insight that a dilemma situation inherently encompasses both elements of conflict and elements of synergy. This view transcends the notion of an inescapable conflict. Given the starting point of a negatively sloped tradeoff line, this insight alters the trajectory of our thought by 90°. This is meant by the ordonomic term of an “orthogonal position” (Figure 1c). It helps to re-orient the semantic frame of perception from “win-lose” to “win-win” activities.
4. The orthogonal position provides a heuristic orientation for governance reforms that reshape the incentives for the firms playing the original social dilemma game. Improved incentives lead to improved results, switching the equilibrium from quadrant III to I (Figure 1d). A governance regime that makes it sufficiently costly for firms to use scarce resources re-directs them from C1 toward C1\*. This switch qualifies as a Pareto improvement, that is, as a mutual betterment (win-win): a reconciliation of profit-seeking and conserving resources.

This perspective allows us to re-construct and then de-construct the semantic notion of a tradeoff and to replace it with an orthogonal position. This shift in ideas enables a corresponding shift of incentives that overcome the original dilemma via improved governance that aims not just at changing individual firm behavior, but even equilibrium strategy combinations.

## 4.2 | An ordonomic view of the CER characteristics on a macro level

From an ordonomic perspective, the *case for degrowth* (e.g., Schröder et al., 2019; Siderius & Poldner 2021; Zink & Geyer, 2017) rests on the implicit assumption that CERs are not effectively manageable in the current growth-driven system of competitive markets. As illustrated in Figure 2, starting in point P0, the *case for degrowth* (point D) is based on three ideas. The first idea argues against extensive growth, that is, against moving along



**FIGURE 2** "Degrowth"—"CER-backfire"—"decoupling"—Macro level perspective. CER, circular economy rebound.

the primary production function to the right. The second idea argues against intensive growth, that is, a shift from the primary to the secondary production function, since it is assumed that such a shift necessarily backfires and leads to a CER effect like point C1, that is, a higher level of resource consumption than in the starting point P0. The third idea concludes that the only way to reduce resource consumption is by moving along the primary production function to the left, to point D.

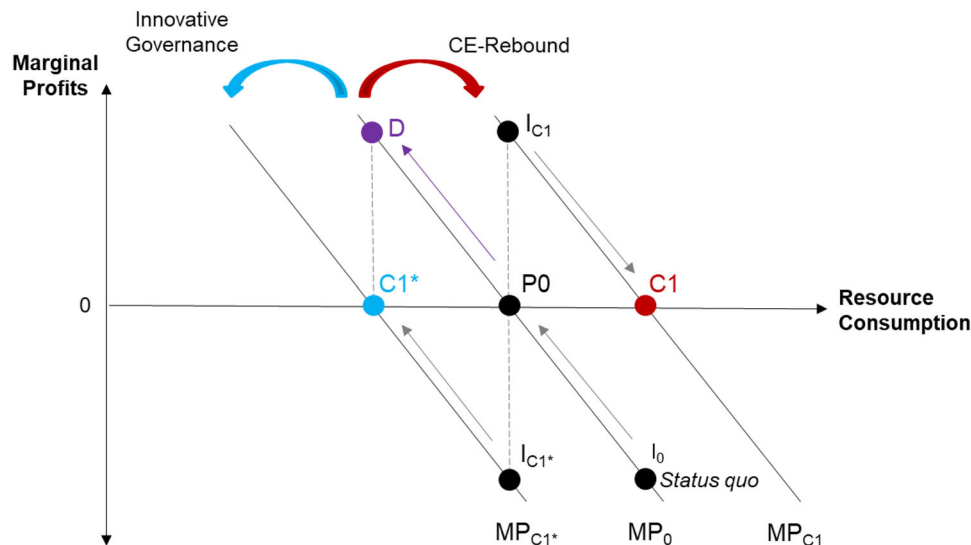
To "steelman" this *case for degrowth*, we have inserted indifference curves for an average citizen. For the sake of argument, we assume that this citizen indeed prefers point D over point C1. However, even given this non-trivial assumption, we can show that the argument in favor of degrowth still rests on a non-sequitur fallacy: It denies the possibility of reaching point C1\* via decoupling, which is certainly a more attractive solution than point D, since it realizes the same level of environmental protection (R), while at the same time offering a higher living standard (GDP). To be clear: Even if one concedes (for the sake of argument) that point D is more desirable than point C1, and point C1\* is certainly more desirable than points D and C1. However, assuming a natural tendency to point C1, proponents of degrowth shy away from intensive growth and prefer instead moving along the primary production function to the left, that is, reversing extensive growth. The underlying reason is not that they prefer point D over point C1\*. Rather, the reason is that they perceive that point C1\* is not feasible, *but is this true?*

Asking this question changes the focus from the normative aspect of *desirability* to the positive aspect of *feasibility*. With this step completed, we can now advance through four sequential stages.

1. An ordonomic perspective allows us to trace the occurrence of the CER effect to a type of incentive problem known as "free-riding" (i.e., a many-sided prisoners' dilemma), which typically accompanies the production of public goods. We argue that the CER effect consists of the insufficient provision of circular goods and services, for reasons similar to those explaining the insufficient production of public goods. Given this incentive structure, it would indeed be asking too much from firms under competitive market pressure to individually abstain from heading toward point C1.
2. The same reasoning applies to the movement from P0 to point D. Expecting firms to individually contribute to degrowth under competitive market pressures would be an unrealistic demand. One should never ask actors to behave against their vital self-interest: *ultra posse nemo obligatur*—no person is obliged beyond what she is able to do.
3. Given this deconstruction, the relevant alternatives are not points C1 and D but C1 and C1\*. C1\* becomes feasible once it is understood that point C1 is the result of a social dilemma that can be overcome. The crucial insight is that in a scenario of intensive growth, the incentive structure should not be regarded as fixed but as variable. It can be transformed via governance.
4. As illustrated in Figure 2, we can now introduce a distinction between two governance directions that need to be combined for a successful CER mitigation. Replacing decoupling for backfiring requires (1) governance for intensive economic growth (arrow G1) and (2) governance for effective environmental protection (arrow G2). There are two options for this combined improvement of the incentive structure, namely, (i) price simulation (Pigou, 1920) or (ii) price stimulation (Coase, 1960). While price simulation via taxes or subsidies leads to an administered price, price stimulation via creating property rights leads to a "real" market price inducing competitive processes for internalizing negative externalities or/and (even) creating positive externalities.

This conceptual clarification may help to redirect the focus from the assumption of unmanageable CER effects and the *non-optimization paradigm* of promoting degrowth toward the insight that the innovation of *governance by collective action* is necessary to effectively deal with the collective action phenomenon of free riding. Since CERs are the result of both macro-level market responses and firm-level strategies (Zerbino, 2022a), our article complements the semantics impact on the macro level by analyzing the semantics impact on firm-level governance.





**FIGURE 3** Circular economy (CE)-Rebound versus innovative governance (firm level perspective). MP, marginal profit line.

#### 4.3 | The CER effect, optimization, and governance on a firm level

The distinction between optimization and governance improves our understanding of how optimization and governance function in tandem. We argue that the impacts of optimization depend on the governance context (either linear or circular) in which they are exercised.

Figure 3 shows marginal profits on the ordinate and resource consumption on the abscissa.<sup>4</sup> Starting in the *status quo* (Figure 3, point  $I_0$ ), the grey arrow illustrates how a profit-oriented firm optimizes its behavior under given constraints. If marginal profit is negative, the firm moves along the marginal profit line to the left. Hence, resource consumption decreases until the  $MP_0$  curve intersects the abscissa in point  $P_0$  (where marginal profit is zero). Here, the firm realizes its maximum profit. Critics who argue in favor of degrowth and a deviation from optimization behavior support that firms move along the given MP-line in the direction of point D (degrowth) to further reduce resource consumption. While this so-called “non-optimization” behavior may be favorable in terms of short-term resource preservation; however, it is likely to jeopardize dynamic long-run innovation processes.

Focusing on systemic equilibria, a CE innovation that may lead to more resource consumption in absolute terms due to the CER “backfire” would shift the marginal profit line to the right ( $MP_{C1}$ ). Starting from point  $I_{C1}$ , and as long as marginal profit is positive, the firm moves down the line to the right and consumes resources until the  $MP_{C1}$  curve intersects the abscissa in point  $C_1$ , where marginal profit is zero (due to competitive pressure in a social dilemma situation caused by misleading incentive structures: analog to Figure 1b). In this case, the optimization behavior of private firms leads to more absolute resource consumption due to the CER “backfire” and thus confirms the contemporary criticism. However, this first part of the analysis does not account for the opportunity of *circular governance innovation* that can change the institutional boundary conditions by utilizing, for example, price signals for scarcity (price simulation [Pigou] or price stimulation [Coase]) to decrease absolute resource consumption by re-formed incentivization. It is therefore questionable to assume that intensive growth inescapably shifts the marginal profit line to the right. On the contrary, innovative governance for circularity can shift the MP-line to the left (from  $MP_0$  to  $MP_{C1*}$ ). The behavioral pattern then is to move from  $I_{C1*}$  to  $C_{1*}$ , where marginal profit is zero. This optimization behavior results in decoupling, that is, in an absolute decrease of resource consumption (due to a re-formation of rules: analog to Figure 1d). Our analysis conceptually shows that: (a) thinking in a pure optimization paradigm suggests that firms automatically move along a given marginal profit line (MP) consuming resources until marginal profits are zero, (b) thinking in a non-optimization paradigm may lead to short-term success in resource preservation, but likely faces societal resistance and jeopardizes long-run innovation activities due to a weakening of incentives, (c) the relevant alternative to the non-optimization paradigm is to think in terms of (un)successful governance, because (d) CERs are likely to occur due to prevailed, unadjusted, and thus misleading linear governance structures, whereas (e) innovative *circular governance* can shift the negatively sloped marginal profit lines to the left (from  $MP_0$  to  $MP_{C1*}$ ), thus decoupling optimization (and growth) from absolute resource consumption.

Taking this re-conceptualization into account, we acknowledge that optimization behavior aligns effectively with the CE paradigm when guided by *circular governance*. While Zink and Geyer (2017, p. 593) have warned that (1) “simply encouraging private firms to find profitable opportunities in the circular economy is likely to cause rebound and lower or eliminate the potential environmental benefit,” and (2) “that simply introducing the circular economy concept to free markets and profit-maximizing firms ... is very likely to result in rebound,” our forum article clarifies that CERs are indeed a problem of transforming linear governance into circular governance rather than a problem of the optimization behavior per se. We argue that it is beneficial *not* to deviate from the optimization logic but to focus on the appropriate incentivization for guiding actors toward dynamic CE

innovation processes for avoiding CERs. Instead of promoting non-optimizing behaviors, we need better ideas for improving incentives that align business optimization with CE desiderata.

## 5 | DISCUSSION AND CONCLUDING REMARKS

While the majority of recent studies on CER tend to focus on literature reviews or case studies (e.g., Castro et al., 2022; Font Vivanco et al., 2022; Metc & Pigosso, 2022; Skelton et al., 2020; Zerbino, 2022a), this forum article delivers a conceptual contribution to enhance the understanding of CERs by highlighting the role of semantics (*order of ideas*) and governance (*order of incentives*) and their dynamic interplay. Thus, we directly respond to the major concern by Schröder et al. (2019) who have noted that one “unresolved issue” for the CE is CER (see also Corvellec et al., 2022).

Motivated by expectations of inescapable CERs, several authors (e.g., Schröder et al., 2019; Siderius & Poldner, 2021; Zink & Geyer, 2017) hold that societies should refrain from pro-growth policies and that business firms should deviate from optimization to serve the public interest in a CE. Our article delivers a re-conceptualization that gives reasons against such concerns that carry the potential to deny the functionality and thus even the *raison d'être* of innovation toward a CE (and eventually the CE concept in general).

With regard to the macro level, we provide the conceptual clarification that green growth is superior to degrowth since the latter aims, for the sake of environmental sustainability, at willfully decreasing living standards, while the former aims at decoupling, that is, combining higher living standards with less resource use. With regard to the firm level, we provide a conceptual clarification to facilitate the CE transition by highlighting that it is not enough to change the behavioral strategies of single actors and that instead a coordinated change of equilibrium results is required, brought about by many actors changing their behaviors at the same time. Thus, we would like to draw attention to the incentive effects of institutional arrangements and their dynamic re-formation via governance. On both levels, macro and firm levels, it is questionable to take CERs for granted. Thus, our argumentation provides further clarifications to the initial findings by Zerbino (2022a, p. 8) who has noted that a “CE initiative generates CER because of both external systemic market responses and the internal firm’s strategy.” A functional governance of intensive growth is much more promising than sacrificing extensive growth and improving the framework for business optimization is much more promising than the hopes for non-optimization.

Adding to and expanding on the findings by Castro et al. (2022, p. 9) who have stated that “[t]he complexity of CER requires a new systemic way of governance,” our re-conceptualization shows that on the macro level it is not *growth* per se, and on the firm level, it is not *optimization* per se that decides whether outcomes are detrimental or beneficial. In both cases, popular semantics can lead us astray, and in both cases, re-thinking enables re-forming. Indeed, on both levels, environmental progress toward CE depends on the governance structures that incentivize and thus guide actors’ innovation and optimizing behaviors as well as their final equilibrium results. While the danger of CERs is real, they are not an inescapable fate. Instead, they are an *avoidable evil*. If we get our ideas right, we can get *circular governance* right.

Thus, our forum article emphasizes the opportunity to (re-)orient both the order of ideas (semantics) as well as the order of incentives (governance): We propose to transcend the perception of an inescapable tradeoff between economic growth (on the macro level) or business optimization (on the firm level) and the societal desideratum of environmental protection. Focusing on the level of governance, we can enable practitioners, politicians, and scholars to identify win-win options for re-directing optimization behavior toward promoting a sustainable CE transition. This comprises both public and private ordering. Since Castro et al. (2022, p. 9) have already acknowledged that “[i]f self-governance guarantees an integration of government, industry, and academics, the different perspectives of these stakeholders may prevent harmful CER,” our perspective implies that *individual innovation* activities by firms require private governance (2nd order) that, however, always necessitates a complementary “higher order” public governance (1st order) to enable the environment for 2nd order governance mechanisms to CE innovation mitigating CERs.

Consequently, we summarize the main insights of our conceptual contribution in four points:

1. The *decoupling* idea is both more desirable as well as more viable compared to degrowth since it can realize higher levels of well-being and therefore meet the needs of numerous societal actors. In contrast, it is extremely unlikely that degrowth could ever gain democratic majority support.
2. Properly governed, competition-driven *optimization* eventually allows for: (i) efficient use of limited resources, (ii) accelerating innovation dynamics, and (iii) realizing diffusion of innovation rents to society. In contrast, it is not clear at all how non-optimizing behavior could be effectively coordinated to bring about the desired *systemic* effects.
3. *Optimization* and *governance* should not be perceived as substitutes but rather as complementary concepts. The core idea is to create functional rules that catalyze and canalize efficient resource use for mitigating CERs.
4. Politicians, practitioners, and scholars are requested to innovate functional *collective commitments* for CE to create an enabling environment for the successful innovation of individual commitments permitting effective optimization behavior: *Public ordering* must enable and encourage *private ordering*.

Our study is subject to several limitations which, at the same time, suggest possible areas for future research. First and foremost, our argument assumes that stakeholders are willing to engage in circular governance processes. However, in practice, such willingness might be influenced by various factors such as power dynamics and differing views on the CE and sustainability in general. Further, whereas our contributions suggest governance reforms intended for CER mitigation, we are aware that the implementation of such reforms is premised on their widespread acceptance among the concerned stakeholders. This acceptance may become less likely insofar as stakeholders may develop divergent mental models, for example, due to their possible heterogeneity in terms of size, resource endowment, and capabilities. Thus, we suggest that future research could focus on investigating public and private governance structures that incentivize CE transition and promote mutual understanding among stakeholders. In addition, a substantial research effort is needed for developing and testing tools for stakeholder dialogues and governance engagement, as well as for analyzing, measuring, and communicating narratives adopted by stakeholders. Whereas our present paper is predominantly conceptual, it prepares the ground for empirical studies that provide real-world examples and practical applications of our argument. Empirical analyses of current (linear) governance structures as well as best practices in circular-driven industries, both in the Global North and Global South, would be particularly welcome. Finally, given that CER may vary according to geographical peculiarities and resource endowments, a further limitation of our argument pertains to its possibly imperfect applicability in emerging economies, such as those in the Global South. Since formal and informal institutions in the Global North and South are often widely different, future research should carefully consider the implications of these differences for the organization of the governance reform processes needed for enabling CER mitigation.

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## ENDNOTES

<sup>1</sup> Following Williamson (2010; p. 674), we define governance as the “means by which to infuse order, thereby to mitigate conflict and realize mutual gain.”

<sup>2</sup> In a properly designed market economy, the incentive effects of competition serve three systemic functions: (i) they direct production to serve consumption at low cost, (ii) they direct firms toward dynamically innovating products and processes, and (iii) they enforce the diffusion of innovation rents to society (see Aghion et al., 2021; Baumol, 2010; Cowen, 2019; de Ridder et al., 2023; Pies & Hielscher, 2023).

<sup>3</sup> Ordonomics suggests using credible commitments (Williamson, 1983) to improve situational incentives for mutual betterments. This ordonomic perspective has already proven functional in the application to corporate social responsibility, corporate sustainability, and CE research (e.g., Beckmann et al., 2014; Pies et al., 2009, 2014, 2021; Pies & Schultz, 2023; Schultz et al., 2021, 2023, Schultz, 2021, 2022; Schultz & Pies, 2023; Schultz & Reinhardt, 2022, 2023; Schultz & Rhein, 2024).

<sup>4</sup> Abscissa and terminologies are chosen in analogy to the macro-level conceptualization in Figure 2.

## REFERENCES

- Aghion, P., Antonin, C., & Bunel, S. (2021). The power of creative destruction. In *The power of creative destruction*. Harvard University Press.
- Bakker, C. A., Mugge, R., Boks, C., & Oguchi, M. (2021). Understanding and managing product lifetimes in support of a circular economy. *Journal of Cleaner Production*, 279, 123764.
- Baumol, W. J. (2010). *The microtheory of innovative entrepreneurship*. Princeton University Press.
- Beckmann, M., Hielscher, S., & Pies, I. (2014). Commitment strategies for sustainability: How business firms can transform trade-offs into win-win outcomes. *Business Strategy and the Environment*, 23(1), 18–37.
- Blomsma, F., Bauwens, T., Weissbrod, I., & Kirchherr, J. (2023). The ‘need for speed’: Towards circular disruption—What it is, how to make it happen and how to know it’s happening. *Business Strategy and the Environment*, 32(3), 1010–1031.
- Bocken, N., Olivetti, E. A., Cullen, J. M., Potting, J., & Lifset, R. (2017). Taking the circularity to the next level: A special issue on the circular economy. *Journal of Industrial Ecology*, 21(3), 476–482.

- Brookes, L. (1990). The greenhouse effect: The fallacies in the energy efficiency solution. *Energy Policy*, 18(2), 199–201.
- Castro, C. G., Trevisan, A. H., Pigosso, D. C., & Mascarenhas, J. (2022). The rebound effect of circular economy: Definitions, mechanisms and a research agenda. *Journal of Cleaner Production*, 345, 131136.
- Chen, C. W. (2021). Clarifying rebound effects of the circular economy in the context of sustainable cities. *Sustainable Cities and Society*, 66, 102622.
- Coase, Ronald H. (1960). The problem of social cost. *Journal of Law and Economics*, 3, 1–44.
- Corvellec, H., Stowell, A. F., & Johansson, N. (2022). Critiques of the circular economy. *Journal of Industrial Ecology*, 26(2), 421–432.
- Cowen, T. (2019). *Big business. A love letter to an American anti-hero*. St. Martin's Press.
- Denzau, A. T., & North, D. C. (1994). Shared mental models: Ideologies and institutions. *Kyklos*, 47, 3–31.
- de Ridder, K., Schultz, F. C., & Pies, I. (2023). Procedural climate justice: Conceptualizing a polycentric solution to a global problem. *Ecological Economics*, 214, 107998.
- Figge, F., & Thorpe, A. S. (2019). The symbiotic rebound effect in the circular economy. *Ecological Economics*, 163, 61–69.
- Font Vivanco, D., & van der Voet, E. (2014). The rebound effect through industrial ecology's eyes: A review of LCA-based studies. *International Journal of Life Cycle Assessment*, 19, 1933–1947.
- Font Vivanco, D. F., Sala, S., & McDowall, W. (2018). Roadmap to rebound: How to address rebound effects from resource efficiency policy. *Sustainability*, 10(6), 2009.
- Font Vivanco, D., Freire-González, J., Galvin, R., Santarius, T., Walnum, H. J., Makov, T., & Sala, S. (2022). Rebound effect and sustainability science: A review. *Journal of Industrial Ecology*, 26(4), 1543–1563.
- Giampietro, M., & Mayumi, K. (2018). Unraveling the complexity of the Jevons Paradox: The link between innovation, efficiency, and sustainability. *Frontiers in Energy*, 6, 1–13.
- Gilson, L. L., & Goldberg, C. B. (2015). Editors' comment: So, what is a conceptual paper? *Group & Organization Management*, 40(2), 127–130.
- Goyal, S., Chauhan, S., & Mishra, P. (2021). Circular economy research: A bibliometric analysis (2000–2019) and future research insights. *Journal of Cleaner Production*, 287, 125011.
- Greening, L. A., Greene, D. L., & Difiglio, C. (2000). Energy efficiency and consumption—The rebound effect—A survey. *Energy Policy*, 28(6–7), 389–401.
- Jenkins, J., Nordhaus, T., & Shellenberger, M. (2011). *Energy emergence: Rebound and backfire as emergent phenomena*. Breakthrough Institute.
- Jevons, W. S. (1865). *The coal question. An inquiry concerning the progress of the nation and the probable exhaustion of our coalmines*. Macmillan and Co.
- Khazzoom, J. D. (1980). Economic implications of mandated efficiency in standards for household appliances. *The Energy Journal*, 1(4), 21–40.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232.
- Kjaer, L. L., Pigosso, D. C., Niero, M., Bech, N. M., & McAloone, T. C. (2019). Product/service-systems for a circular economy: The route to decoupling economic growth from resource consumption? *Journal of Industrial Ecology*, 23(1), 22–35.
- Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E. (2018). Circular economy as an essentially contested concept. *Journal of Cleaner Production*, 175, 544–552.
- Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: The concept and its limitations. *Ecological Economics*, 143, 37–46.
- Makov, T., & Font Vivanco, D. (2018). Does the circular economy grow the pie? The case of rebound effects from smartphone reuse. *Frontiers in Energy Research*, 6, 39.
- Metic, J., & Pigosso, D. C. (2022). Research avenues for uncovering the rebound effects of the circular economy: A systematic literature review. *Journal of Cleaner Production*, 368, 133133.
- Meredith, J. (1993). Theory building through conceptual methods. *International Journal of Operations & Production Management*, 13(5), 3–11.
- Morseletto, P. (2020). Targets for a circular economy. *Resources, Conservation and Recycling*, 153, 104553.
- Niero, M., Jensen, C. L., Fratini, C. F., Dorland, J., Jørgensen, M. S., & Georg, S. (2021). Is life cycle assessment enough to address unintended side effects from circular economy initiatives? *Journal of Industrial Ecology*, 25(5), 1111–1120.
- Pies, I., Beckmann, M., & Hielscher, S. (2010). Value creation, management competencies, and global corporate citizenship: An ordonomic approach to business ethics in the age of globalization. *Journal of Business Ethics*, 94, 265–278.
- Pies, I. (2016). The ordonomic approach to order ethics. In C. Luetge & N. Mukerji (Eds.), *Order ethics: An ethical framework for the social market economy* (pp. 19–35). Springer.
- Pies, I., Hielscher, S., & Beckmann, M. (2009). Moral commitments and the societal role of business: An ordonomic approach to corporate citizenship. *Business Ethics Quarterly*, 19(3), 375–401.
- Pies, I., Hielscher, S., & Everding, S. (2020). Do hybrids impede sustainability? How semantic reorientations and governance reforms can produce and preserve sustainability in sharing business models. *Journal of Business Research*, 115, 174–185.
- Pies, I., Schreck, P., & Homann, K. (2021). Single-objective versus multi-objective theories of the firm: Using a constitutional perspective to resolve an old debate. *Review of Managerial Science*, 15, 779–811.
- Pies, I., & Hielscher, S. (2023). The moral legitimacy of profit orientation. In T. Talaulicar (Ed.), *Research handbook on corporate governance and ethics* (pp. 328–347). Edward Elgar.
- Pies, I., & Schultz, F. C. (2023). The governance of sustainable business model innovation—An ordonomic approach. *Scandinavian Journal of Management*, 39(1), 101246.
- Pigou, A. C. (1920). [1929] *The economics of welfare* (3rd ed.). Macmillan.
- Prieto-Sandoval, V., Jaca, C., & Ormazabal, M. (2018). Towards a consensus on the circular economy. *Journal of Cleaner Production*, 179, 605–615.
- Salvador, R., Barros, M. V., da Luz, L. M., Piekarski, C. M., & de Francisco, A. C. (2020). Circular business models: Current aspects that influence implementation and unaddressed subjects. *Journal of Cleaner Production*, 250, 119555.
- Saunders, H. D. (1992). The Khazzoom-brookes postulate and neoclassical growth. *Energy Journal*, 13(4), 131–148.
- Saunders, H. D. (2000). A view from the macro side: Rebound, backfire, and Khazzoom–Brookes. *Energy Policy*, 28(6–7), 439–449.
- Schröder, P., Bengtsson, M., Cohen, M., Dewick, P., Hofstetter, J., & Sarkis, J. (2019). Degrowth within—Aligning circular economy and strong sustainability narratives. *Resources, Conservation and Recycling*, 146, 190–191.
- Schultz, F. C., Everding, S., & Pies, I. (2021). Circular supply chain governance: A qualitative-empirical study of the European polyurethane industry to facilitate functional circular supply chain management. *Journal of Cleaner Production*, 317, 128445.

- Schultz, F. C. (2021). Governance as a "game changer" for the circular economy: A commentary on circular supply chain governance. *Academy of Strategic Management Journal*, 20(6), 1–3.
- Schultz, F. C. (2022). The circular economy and economic growth—An irreconcilable tradeoff? *Resources, Conservation and Recycling*, 183, 106351.
- Schultz, F. C., & Reinhardt, R. J. (2022). Facilitating systemic eco-innovation to pave the way for a circular economy: A qualitative-empirical study on barriers and drivers in the European polyurethane industry. *Journal of Industrial Ecology*, 26(5), 1646–1675.
- Schultz, F. C., & Reinhardt, R. J. (2023). Technological challenges and opportunities to plastics valorisation in the context of a circular plastics economy in Europe. *Sustainability*, 15(4), 3741.
- Schultz, F. C., Valentinov, V., Kirchherr, J., Reinhardt, R. J., & Pies, I. (2023). Stakeholder governance to facilitate collaboration for a systemic circular economy transition: A qualitative study in the European chemicals and plastics industry. *Business Strategy and the Environment*, 00, 00. <https://doi.org/10.1002/bse.3592>
- Schultz, F. C., & Rhein, S. (2024). A colorful bouquet of circular economy research directions: Shifting the circular economy debates from scholarly linearity to a mutual learning journey for circular applicability. *Resources, Conservation & Recycling*, 202, 107346. <https://doi.org/10.1016/j.resconrec.2023.107346>
- Schultz, F. C., & Pies, I. (2023). The circular economy growth machine—A critical perspective on "post-growth" and "pro-growth" circularity approaches. *Journal of Industrial Ecology*, 00, 00. <https://doi.org/10.1111/jiec.13450>
- Siderius, T., & Poldner, K. (2021). Reconsidering the circular economy rebound effect: Propositions from a case study of the Dutch Circular Textile Valley. *Journal of Cleaner Production*, 293, 125996.
- Skelton, A. C., Paroussos, L., & Allwood, J. M. (2020). Comparing energy and material efficiency rebound effects: An exploration of scenarios in the GEM-E3 macroeconomic model. *Ecological Economics*, 173, 106544.
- Sorrell, S., & Dimitropoulos, J. (2008). The rebound effect: Microeconomic definitions, limitations and extensions. *Ecological Economics*, 65(3), 636–649.
- Sorrell, S. (2007). *The rebound effect: An assessment of the evidence for economy-wide energy savings from improved energy efficiency* (Project report). UKERC.
- Sorrell, S. (2009). Jevons' paradox revisited: The evidence for backfire from improved energy efficiency. *Energy Policy*, 37(4), 1456–1469.
- Velenturf, A. P., & Purnell, P. (2021). Principles for a sustainable circular economy. *Sustainable Production and Consumption*, 27, 1437–1457.
- Warmington-Lundström, J., & Laurenti, R. (2020). Reviewing circular economy rebound effects: The case of online peer-to-peer boat sharing. *Resources, Conservation & Recycling: X*, 5, 100028.
- Wei, T. (2007). Impact of energy efficiency gains on output and energy use with Cobb–Douglas production function. *Energy Policy*, 35(4), 2023–2030.
- Wei, T. (2010). A general equilibrium view of global rebound effect. *Energy Economics*, 32, 661–672.
- Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *The American Economic Review*, 73(4), 519–540.
- Williamson, O. E. (2010). Transaction cost economics: The natural progression. *American Economic Review*, 100(3), 673–690.
- Wüst, S., Schaltegger, S., Wolff, F., Lautermann, C., Schöpflin, P., & Thiel, D. (2022). Konzeptioneller Rahmen zur Erforschung von unternehmensbezogenen Rebound-Effekten. Konzeptpapier im Rahmen des Projekts "Ganzheitliches Management von Energie- und Ressourceneffizienz in Unternehmen" (MERU).
- Zerbino, P. (2022a). How to manage the Circular economy rebound effect: A proposal for contingency-based guidelines. *Journal of Cleaner Production*, 378, 134584.
- Zerbino, P. (2022b). Circular economy rebound: The third wheel on the date between circularity and sustainability. *Journal of Circular Economy*, 00, 00–00. <https://doi.org/10.55845/UREH6873>
- Zink, T., & Geyer, R. (2017). Circular economy rebound. *Journal of Industrial Ecology*, 21(3), 593–602.

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