

Recommerce Rebound Effects- The Case of Second-hand Apparel

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Introduction

Reuse is widely recognized as one of the main cornerstones of sustainability and a key strategy in the much-needed circular economy transition (Cooper and Gutawski, 2017). By extending product lifespans, reuse allows to meet human needs with fewer material and energy inputs (Makov & Font Vivanco, 2018; Makov et al., 2018, Zink and Gayer, 2017). For example, estimates suggest that the average T-shirt is only worn 7-20 times while its functional durability typically extends far beyond that. Since most of the environmental impacts associated with apparel are related to production stages, reuse of pre-owned garments, is seen as an especially promising sustainability strategy (Niinimäki et al., 2020; Vesterinen & Syrjälä, 2022; Moon 2023).

Though apparel reuse is by no means a new phenomenon, digital second-hand markets, also referred to as reCommerce, and specifically those focusing on fashion and apparel items have experienced significant growth in the past few decades (Makov et al., 2018; Meshulam et al., 2022). Driven by the convenience of online platforms, the growing availability of apparel items, and increased consumer interest in sustainable fashion alternatives, the global second-hand apparel market is expected to reach \$350 billion globally by 2028, according to recent industry reports (ThredUp, 2023; Statista, 2023). Yet despite its vast potential, the net environmental benefits of reuse through second-hand markets may fall short of expectations.

Pre-owned (i.e. used) items are often not perfect substitutes for new ones. Research suggest that consumers expect used products to have shorter lifespans compared to identical new items (Sandin and Peters, 2018; Amatuni et al., 2023). As such, purchasing a pre-owned apparel items doesn't always displace the purchase nor lead to the avoided production of a new item at a 1:1 ratio (Sandin and Peters,

2018). In fact, despite fears across different industries that sales of used products cannibalize sales of new ones, research suggests that higher sales volumes in second-hand markets don't necessarily lower sales of new ones substantially (Blass & Geyer, 2006; Thomas, 2012, Zink and Gayer, 2017). Instead, the availability and expansion of second-hand markets often times triggers additional demand—a phenomenon typically studied under the construct of environmental rebound effect Font Vivanco et al., 2022; Makov & Font Vivanco, 2018).

Rebound effects are broadly defined as the share of expected environmental benefits that are offset when behavioral and market responses to improved environmental efficiency, trigger added demand. In a recent survey of US second-hand shoppers, many respondents indicated they agree with the statement *"if I couldn't shop second-hand, I would be buying less apparel"* (ThredUp 2022, pg 22). Such added demand for clothing, can be conceptualized as a direct rebound effect. Relatedly, when consumers use money saved from buying second-hand on other products and services (e.g. food or leisure) such added consumption can be conceptualized as indirect (or re-spending) rebound effects (Meshulam et al., 2022). While, the environmental impacts associated with added demand from direct or indirect rebound may offset some or even all of the expected environmental benefits of buying used apparel, these are seldom taken into account fully by researches, businesses, policy makers, or sustainability advocates. As a result, the potential contribution reCommerce can make to climate change mitigation and keeping within planetary boundaries may be systematically overestimated.

Methods

Here we quantify second-hand apparel rebound effects and assess the share of expected environmental benefits that are offset under

three scenarios- I) No rebound, II) indirect rebound only, and III) full rebound.

Building on data covering over 11 million pre-owned apparel items sold in the US during 2023 via eBay.com, we first quantify expected environmental benefits of second-hand apparel using EXSIOBASE - an environmentally extended input output model which allows us to assess environmental impacts such as GHG emissions based on monetary data (Stradler et al., 2018). Under scenario I (No rebound) we assume all used items bought are perfect substitutes for new ones, and each purchase of a used clothing item leads to the avoided production (and subsequently avoided impacts) of a new one. Under Scenario II (Indirect rebound only), we account for cost savings resulting from cheaper prices in 2nd hand markets and consider re-spending rebound effects- namely, the share expected benefits which are offset when consumers use money saved to buy other (non-apparel) products and services. Following the approach outlined in Meshulam et al. (2022), we model re-spending of marginal savings across consumption categories (COICOP) using Almost ideal demand model (AIDS), and then quantify negated environmental benefits using EXSIOBASE. Finally, we account for both re-spending and imperfect substitution between new and used items under scenario III (full rebound). Combining AIDS with market research reports and surveys among US second-hand apparel shoppers we assess the share of expected GHG emission eroded. Specifically, we assume a 64% displacement rate between used and new apparel items, and that all other cost savings are re-spent on the other consumption categories proportionally.

Results

We find that under the Baseline scenario (Scenario I), expected avoided emissions resulting from reuse of apparel items sold in the US via eBay.com amounted to almost 340 million kg of CO_{2e}. Of these, 47% were potentially offset by indirect rebound effects (Scenario II), as consumers re-spent the money saved by shopping second-hand to buy other products and services. When also accounting for imperfect substitution (Scenario III) where only 64% of used items replace new ones (Farfetch, 2020; ThredUp, 2022), we find that 55% of the expected avoided GHG were potentially offset on account of both direct and indirect rebound effects (Scenario III).

Conclusions

reCommerce holds much promise to alleviate the environmental impacts associated with apparel consumption through reuse. However, greater material efficiency, cheaper prices, and the ease of buying via second-hand digital platforms may trigger added demand and rebound effects. Here we propose a comprehensive approach to fully account for both income effects and imperfect displacement under the construct of rebound effects. Our results indicate that rebound can potentially erode over half of the expected environmental benefits of apparel reuse. These results highlight the limits of sustainable behavioral changes that also lower the effective price of goods and such savings are typically re-spent and thus have environmental impacts. To the best of our knowledge, this work presents one of the first attempts to quantify rebound effects resulting from apparel reuse via secondary markets. More work is needed to ascertain if and how rebound effects would look under different replacement rates, geographies, and for different items or consumer segments. In sum, our findings illustrate the importance of incorporating rebound estimates in environmental assessment of recommerce.

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