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DEPOSIT REFUND SYSTEMS ARE MORE EFFECTIVE THAN MANDATES

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INTRODUCTION

Recent speculation that a federal level bill for a deposit return system (DRS) (commonly called a bottle bill), as well as recent efforts by states to reform DRSs, has renewed interest in what such environmental policies could mean.¹ This policy brief explains what a DRS is, how effective DRSs are and how they compare to alternative recycling policies. Additionally, it highlights how market-based recycling policies such as a DSR might offer policy insight into broader environmental concerns.

BACKGROUND: WHAT ARE DEPOSIT REFUND SYSTEMS (ALSO KNOWN AS BOTTLE BILLS)?

A DRS is a recycling policy whereby a fee is levied on a recyclable product (usually a bottle or some returnable container). This fee is then refunded at the time of deposit. In Massachusetts, for example, each aluminum beverage can has a 5 cent fee attached to it; customers are refunded that fee when they deposit these cans. DRSs began as an environmental policy in the 1970s to address waste of single-use bottles, but have not been expanded much since.² In fact, all of the sys-

tems currently in place—except for those in Hawaii (2002) and Guam (2010)—were enacted between 1971 and 1986.³

The philosophy of the DRS is that a market-based policy that creates a financial motive for recycling behavior can result in improved recycling rates. DRSs are often supported by both environmental advocates and the consumers of recyclable materials, especially companies utilizing aluminum cans. Aluminum recycles infinitely, and it is often lower cost for companies to utilize recycled aluminum than it is to utilize virgin aluminum. This means that despite the presence of a fee that intrinsically diminishes demand for canned beverages, some companies support DRSs because boosted recycling rates mean reduced material input costs, resulting in net profits.⁴

Opposition to DRSs can come in two forms: some believe that curbside recycling programs are more convenient and could lead to higher recycling rates, so they view DRSs as unnecessary; others believe DRSs represent an implicit tax and government expansion, and that the ecological and economic benefit of recycling is outweighed by the economic harm of redirecting capital to recycling instead of potentially more productive uses.

A comparison of data from DRS states to non-DRS states shows that curbside programs are less effective than DRSs. It is important to note that curbside recycling is not always convenient for beverage containers, which are not necessarily consumed at residences, or for consumers that do not own a home or lack residential access to curbside recycling.

The suggestion that DRSs create economic harm fails to acknowledge the implicit utility of what is sometimes referred to in economics as “the commons,” which is the value people place on having access to a clean environment, and the costs they are willing to bear to maintain it.⁵ In economics, preserving the environment can be a challenging issue because the cost for someone to pollute is essentially zero, but the transaction cost of recycling or proper waste management entails some burden on an individual. There is also limited private sector value in waste management—trash is trash, and only in rare instances does garbage contain value that outweighs the burdens of claiming the value (sorting, reusing, processing, etc.). As such, even the most small-government minded economists acknowledge that waste management is a public good that requires governmental policy to address, otherwise littering and environmental destruction would be rampant. It should also be noted that, generally, wealthier nations put a premium on environmental quality, since as citizens become wealthier, they are more likely to be willing to pay a premium to preserve the environment.⁶

From a free-market perspective, a DRS can be a superior waste management policy to government mandates because

individuals respond to price incentives, which the DRS provides. Additionally, enforcement of recycling or waste management mandates is difficult; unless there is a police officer on every corner or mile of interstate, catching littering or the dumping of waste is unlikely. The DRS provides a market-based alternative to the need for large governmental programs that may offer worse outcomes while also being more difficult to enforce.

STATES WITH DRSS OUTPERFORM OTHERS

Recycling Rates in States with DRSS

Existing research strongly suggests that DRSS are substantially effective in boosting recycling rates because states with DRSS have far higher container recycling rates than states that do not. There are currently 10 states with DRSS, plus Guam. A 2021 analysis found that seven of the 10 highest recycling states have DRSS.⁷ Table 1 below shows that Maine is the state with the highest overall recycling rate (excluding cardboard), at 72 percent.⁸ The highest recycling rate for a state without a DRS is Minnesota, at 49 percent, which is 7th overall in the nation.⁹ The top five recyclers—Maine, Vermont, Massachusetts, Oregon and Connecticut—all have DRSS.¹⁰

TABLE 1: RECYCLING STATES WITH DRSS

Rank	State	Recycling Rate (without Cardboard)	Bottle Bill?
1	Maine	72 percent	Yes
2	Vermont	62 percent	Yes
3	Massachusetts	55 percent	Yes
4	Oregon	55 percent	Yes
5	Connecticut	52 percent	Yes
6	New York	51 percent	Yes
7	Minnesota	49 percent	No
8	Michigan	48 percent	Yes
9	New Jersey	46 percent	No
10	Iowa	44 percent	Yes
11	California	44 percent	Yes
12	Wisconsin	44 percent	No
13	Maryland	44 percent	Yes

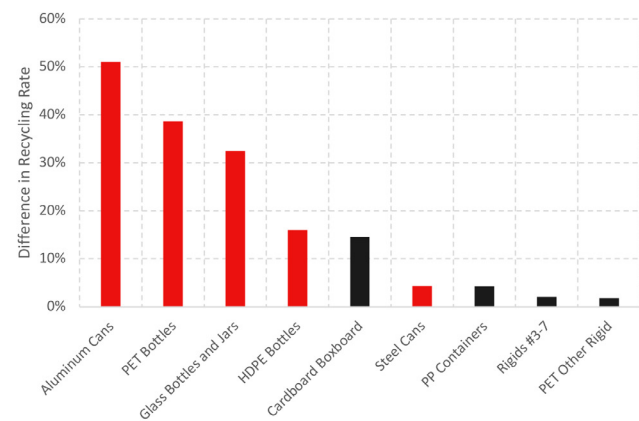
Source: "The 50 States of Recycling," *Eunomia*, March, 2021, p. 12. <https://www.ball.com/getattachment/37f5f87f-d462-44c5-913f-d3075754741a/50-States-of-Recycling-Eunomia-Report-Final-Published-March-30-2021-UPDATED-v2.pdf.1>.

The report effectively establishes that states with DRSS do indeed recycle more, but the presence of a DRS is only one aspect that influences individual recycling behavior. It is fair

to question how we know the DRS is the reason for those higher recycling rates.

To ascertain if it is the DRS that causes recycling rates to increase, we examined the recycling rates of various materials by state and compared the recycling rates for those materials between states that do and do not have DRSS. Figure 1 below shows the difference in recycling rates between DRS and non-DRS states, with red bars for materials that are typically covered by a DRS and black bars for materials that would not be covered by a DRS.

FIGURE 1: DIFFERENCE BETWEEN DRSS AND NON-DRSS STATES



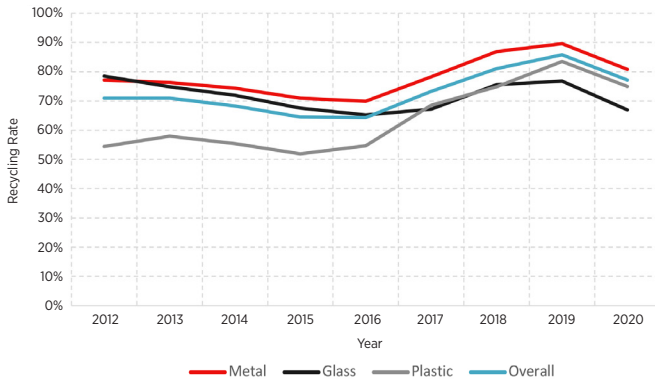
Source: R Street Institute estimates based on data from "The 50 States of Recycling."¹²

The data reveals that materials that are covered by the DRS have significantly higher recycling rates than materials not covered, and states with DRSS have comparable recycling rates to non-DRS states for other recyclable materials. This indicates that it is the DRS, not a cultural difference or governmental policy, that induces the recycling behavior.

Impact of Size of DRSS

Another way to test if the DRS is what is causing a change in recycling is to observe recycling rates before and after the implementation of a DRS. Unfortunately, since most DRSS began in the 1970s, there is limited data that would allow for such a comparison. However, in 2017 Oregon changed its DRS, increasing its refund from 5 cents to 10 cents per container.¹³ Figure 2 shows the change in recycling rates that occurred.

FIGURE 2: OREGON RECYCLING RATES



Source: "Beverage Container Return Data," *Oregon Liquor and Cannabis Commission*, 2012-2020. https://www.oregon.gov/olcc/Pages/bottle_bill.aspx.¹⁴

After Oregon's increase in the deposit, recycling rates increased overall by 9 percent. The change in recycling rates in Oregon presents strong evidence that the change in the DRS caused recycling rates to rise. That larger deposits further increase recycling rates is consistent with the economic rationale behind DRSS, which assumes that consumers respond to price incentives in their recycling behavior.

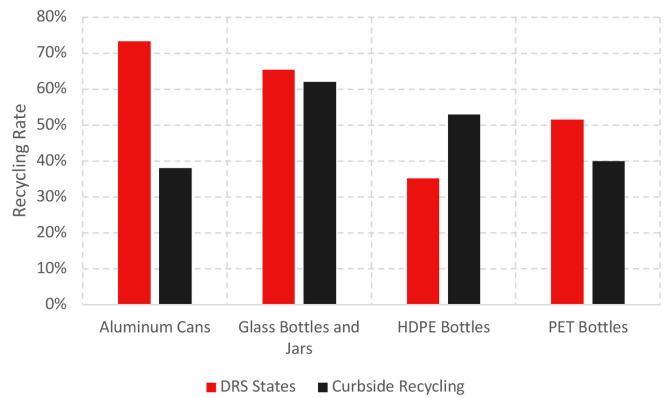
For example, both Oregon and Michigan—the only two states that have 10 cent deposits—consistently have higher recycling rates than other states with DRSS: Oregon has rates in the 80 plus percent range and Michigan sometimes exceeds 90 percent.¹⁵

For policymakers this insight can be important, since there may be good reasons for some containers or materials to have different deposit rates. Larger deposits for larger containers, for example, can remedy misaligned incentives where a consumer aims to buy larger bottles to pay smaller deposit fees or if certain materials may be more in need of reclamation due to their value (aluminum) or their environmental impact (plastics).

DRSs vs Curbside Recycling

One question is whether the recycling rates observed in DRS states can be captured with well implemented curbside recycling programs. Figure 3 compares the recycling rate of curbside programs with that of DRS states for containers most typically covered by a DRS.

FIGURE 3: BOTTLE RECYCLING RATES DRS VS CURBSIDE



Sources: "The 50 States of Recycling by Eunomia," <https://www.ball.com/getattachment/37f5f87f-d462-44c5-913f-d3075754741a/50-States-of-Recycling-Eunomia-Report-Final-Published-March-30-2021-UPDATED-v2.pdf>; "2020 State of Curbside Recycling Report," The Recycling Partnership, 2020, p. 10. https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2020/02/2020-State-of-Curbside-Recycling.pdf.¹⁶

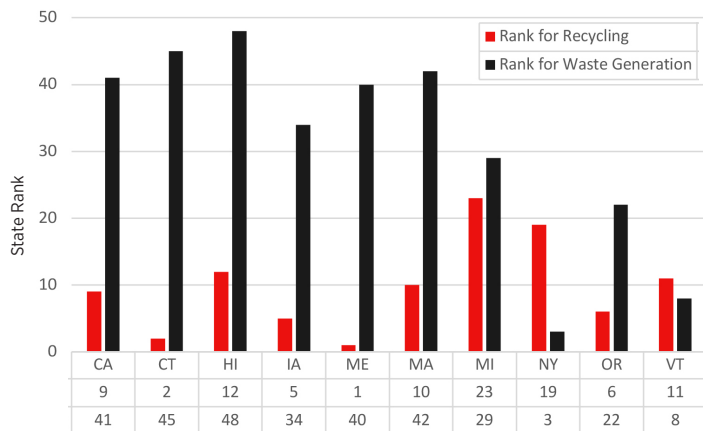
The data shows that aluminum cans have far higher recycling rates under a DRS than a curbside program, and glass and PET containers only have marginally higher rates than curbside recycling. Only HDPE bottles have lower recycling rates under DRSS than curbside programs. One potential reason for differences is that curbside recycling may be preferable for containers more commonly found at home, such as HDPE bottles, while containers found outside of the home such as aluminum cans may be more commonly recycled through a DRS.

Regardless, the takeaway is that DRS programs are more effective than curbside recycling at improving material reclamation rates. While a central-planning mindset to simply mandate recycling through curbside programs may be appealing, it is unlikely to be as effective as a market-based program such as a DRS.

DRSs likely have minimal impacts on consumption

Conventional economics suggests that a fee imposed on a commodity, such as that created by a DRS, will reduce consumption of that commodity. A common critique of DRSS is that they effectively force a tax on a product, and unclaimed redemption value enriches the state while harming businesses via a tax on their product. If this is true, we would expect to see states with DRSS not only have high recycling rates, but also low waste generation rates since the deposit fee would reduce product consumption. Figure 4, though, illustrates those states with DRSS not only rank well for recycling rates, but often rank poorly for waste generation.

FIGURE 4: DRS STATES RECYCLING RANK VS WASTE GENERATION RANK



Source: “The 50 States of Recycling by Eunomia,” <https://www.ball.com/getattachment/37f5f87f-d462-44c5-913f-d3075754741a/50-States-of-Recycling-Eunomia-Report-Final-Published-March-30-2021-UPDATED-v2.pdf>.¹⁷

Essentially, the data shows the opposite of the expected outcome is occurring: people living in states with DRSs generate more waste, not less. This could be due to other factors, such as income and living standards (many DRS states are high-income), or perhaps the value of the fee is low relative to the utility of the commodity (5 cents being too small to discourage the purchase of a \$1 beverage). It could also be that beverage producers are taking on the cost of the DRS to keep prices low, or that consumers feel that the presence of the DRS program alleviates environmental concerns associated with consumption. Regardless, it seems unlikely that the imposition of the DRS fee in most circumstances is likely to significantly reduce consumption—unless the fee is exceptionally large.

POTENTIAL ADVANTAGES OF ENHANCED RECYCLING RATES

Traditionally, many have viewed recycling as an environmental policy aimed at reducing littering and dumping. More recently, interest has grown in the idea of a “circular economy” that can minimize its reliance on virgin materials for growth.¹⁸ The economic potential for a circular economy may be limited, since typically the cost of reclamation and recycling exceeds the benefit compared to the use of virgin materials, especially for products that cannot be recycled infinitely, such as plastics.¹⁹ However, recent research regarding the material requirements of achieving net-zero emission pathways by 2050 has cast light on the need for significantly greater rates of recycling than are practiced today.

Clean energy and related technologies are substantially more mineral intensive than conventional energy. Electric vehicles, for example, require about six times as many minerals as conventional vehicles.²⁰ An onshore wind turbine is about nine times more mineral intensive than a natural gas power

plant.²¹ A 2018 study estimated that a complete clean energy transition by 2050 would require 34 percent of global aluminum reserves, 129 percent of cobalt reserves, 88 percent of copper reserves and 128 percent of lithium reserves.²²

China is the dominant supplier for 21 of the 35 currently recognized critical minerals, raising concerns of national security vulnerabilities as well as exacerbating unethical sourcing of materials.²³ One study stated that “recycling is the most important strategy to reduce primary [mineral] demand,” and that “encouraging recycling and responsible sourcing are the key strategies to promote environmental stewardship and respect of human rights in the supply chain.”²⁴

There are also potential climate benefits from increased recycling rates. For each ton of aluminum produced, 11.62 metric tons of greenhouse gases (carbon dioxide equivalent) are released and 4.85 metric tons of greenhouse gases are released per ton of lithium produced.²⁵ Recycling can avoid some of this pollution, as the energy inputs required for producing recycled aluminum are approximately 90 percent lower than for virgin aluminum.²⁶ The total climate benefit to be had from recycling is likely modest; a previous R Street Institute analysis found that a 10 percent increase in aluminum beverage container recycling in the United States would yield only about 1.7 million metric tons of annual emission benefit—about four hundredths of a percent of annual U.S. greenhouse gas emissions.²⁷ Given current recycling rates in the United States and landfilled materials, recycling is unlikely to be a major climate solution. However, when considering the potential for avoiding future demand increases of virgin materials, there may be significantly more climate benefit to be had.

Policymaker interest in recycling is becoming less about economic optimization and more about avoiding reliance on China and ensuring material availability for a future that may have potentially significantly higher materials demand than today.²⁸ As such, it is prudent for policymakers to understand what policies may be effective in boosting recycling rates.

DRSs, which are conventionally thought of as important for recycling beverage containers, may be a prototypical policy for enhancing recycling of other materials. Some materials naturally have high recycling rates due to their recoverable value and low transaction cost for recycling. Paper and cardboard, for example, have exceptionally high recycling rates because much of their materials usage occurs in commercial environments where there is no advantage to conventional disposal over recycling.

For materials like those found in electronic waste, though, there may be more value in market-based recycling schemes similar to that of a DRS. United Nations data indicates that recycling rates for electronic waste are 42.5 percent in

Europe, but only 11.7 percent in Asia, 9.4 percent in the Americas and a mere 0.9 percent in Africa.²⁹ There are significant opportunities for recycling to improve materials reclamation beyond beverage containers, and in those instances a market-based policy is likely to yield better outcomes.

CONCLUSION

There are potentially good reasons for why policymakers may want to improve recycling rates, be it in pursuit of environmental reasons or to reduce materials reliance on foreign sources. For beverage containers, there is strong evidence to support several claims:

1. DRSS are more effective at inducing recycling behavior than curbside programs, affirming economic theory that financial incentives are a better motivator for recycling behavior than mandates.
2. The value of the deposit matters; states with higher values for redeeming beverage containers have higher recycling rates, indicating that should it be necessary to ensure higher recycling rates for specific materials or containers, a larger deposit will increase recycling rates.

These findings are consistent with a conventional understanding of economics, which is that incentives play a significant role in behavioral change. If policymakers do adopt recycling-focused policies, they would be better served by pursuing market-based mechanisms over increased regulation.

ABOUT THE AUTHOR

Philip Rossetti is a Senior Fellow for Energy and Environment at the R Street Institute. He has worked extensively on energy and environmental issues, working at the Select Committee on the Climate Crisis before joining R Street. His work primarily focuses on identifying market-based solutions to environmental challenges that improve outcomes and reduce costs.

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