

# Plastic Bag Externalities and Policy in Rhode Island

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## Introduction

The environmental externalities associated with plastic bag production and disposal, which include CO<sub>2</sub> emissions, water pollution, and solid waste, exemplify a classic tragedy of the commons. Individual consumers benefit from the use of plastic bags because they can easily carry purchased goods without the burden of carrying around reusable bags, while the population as a whole bears the collective cost of the production and disposal of plastic bags. Rhode Island, in particular, has had problems disposing of and properly containing litter at the rapidly filling Central Landfill, causing concern from the solid waste management sector. While original policy efforts focused on encouraging the use of biodegradable paper bags and the recycling of plastic bags, it has become clear in recent years that these measures do not match the scope of the problem. In fact, paper bags are not biodegradable in landfills and are more environmentally damaging than their plastic counterparts.

In response to the problem, legislation in the form of an amendment to Chapter 23-18.11 “Promotion of Paper Bag Usage” of the Rhode Island Health and Safety Act has been proposed in Rhode Island. This amendment aims to control litter from retail bags by encouraging the use of reusable bags as opposed to plastic *or* paper bags. This bill seeks to encourage consumers to utilize reusable bags through a 3 cent retailer-funded consumer rebate for each bag an individual brings to the store.

While shifting the focus from promoting the choice of paper bags to encouraging the use of reusable bags is certainly a step in the right direction, the incentive structure of the proposed amendment is poorly designed and does not meet the needs of the plastic bag problem in Rhode Island. In fact, through an extensive cost/benefit analysis, we estimate the total social cost of a single 1 cent bag sold in Rhode Island at over 11 cents. Although it would certainly be more politically challenging, Rhode Island legislators should consider an 11 cent tax on the sale of plastic bags because it is the best policy to internalize the externalities of plastic bag consumption.

## Solid Waste Management in Rhode Island

As owners and managers of the central landfill, the Rhode Island Resource Recovery Corporation (RIRRC) has an economic incentive to reduce the plastic bag waste stream in Rhode Island. RIRRC is responsible for any trash blown off the landfill to neighboring land.<sup>1</sup> As a result, they have received fines totaling \$1 million annually from the Rhode Island Department of Environmental Management (RIDEM) for trash found on the perimeter of the landfill.<sup>2</sup> As plastic grocery bags account for a large quantity of this litter (192 million bags are consumed annually in Rhode Island), it is in the best interest of RIRRC to reduce the number of plastic bags that it takes into the landfill.<sup>3</sup>

RIRRC has been proactive in the past in attempting to reduce the number of plastic bags that come into its landfill. On September 1, 2005, RIRRC, along with the RI Food Distributors Administration (RIFDA), initiated ReStore, a plastic bag recycling program which provided receptacles to many supermarkets in Rhode Island. This project has led to the recycling of 18 million plastic bags over the course of the past year, or a 9.2% recycling rate of plastic bags.<sup>4</sup> These collected plastic bags become a versatile, nontoxic, composite product used as a wood substitute. However, this means that Rhode Islanders are still sending over 180 million bags to the Central Landfill annually. Thus, RIRRC and the Rhode Island Legislature have realized that they cannot simply encourage recycling but must reduce the overall consumption to truly internalize the disposal externalities of plastic bags.<sup>5</sup>

### **The Evolution of Rhode Island Plastic Bag Legislation**

#### Analyzing the Original Legislation

In response to the original concerns regarding the rapidly filling Central Landfill, the Rhode Island legislature passed Chapter 23-18.11 “Promotion of Paper Bag Usage” of the Rhode Island Health and Safety Act which sought to decrease plastic bag waste and litter in the state. This act utilized two methods for prompting this change. First, the bill stipulates that retailers must provide paper bags at equal cost to plastic bags in spite of the higher cost of paper bags (0.03¢/bag for paper as opposed to 1¢/bag for plastic). It also requires plastic bag recycling at retail stores selling greater than 8 millions dollars worth of goods per year.

Contrary to the rationale behind the original bill, paper bags are not readily biodegradable in landfills. Furthermore, externalities at all stages of a bag's life cycle, including air pollution, water contamination, and solid waste production, are fewer for plastic bags than paper bags (See Table 1.1). Thus encouraging a shift to paper bag consumption did not address Rhode Island's landfill capacity problem.

#### The Current Amendment and the Future of Plastic Bag Regulation in RI

Recognition of the externalities associated with both paper and plastic bag use prompted members of the Rhode Island Litter Task Force, including Barry Schiller (a representative from the Sierra Club), to propose an amendment to Chapter 23-18.11 “Promotion of Paper Bag Usage” of the Rhode Island Health and Safety Act.<sup>6</sup> The primary objective of the proposed amendment is to control litter from retail bags by encouraging the use of reusable bags as opposed to paper *or* plastic bags.<sup>7</sup> In addition to modifying the title of the statute to read “The Promotion of Paper and Reusable Bag Usage,” the amendment seeks to reduce retail packaging by offering economic incentives to consumers to bring their own bags to stores (rather than relying on the retailer to provide either paper or plastic bags). The amendment obliges retailers to provide a 3 cent credit rebate to consumers for each bag they bring to a retail establishment for reuse in the packaging of their purchased goods. Rather than placing a Pigovian tax on packaging consumption, which would place the burden of a tax on either the consumers or the store owners, the amendment seeks to provide a reward incentive for consumers to provide their own bags. This promotes consumers to recycle by creating an indirect economic disincentive for the continued use of wasteful single use packaging.

The amendment to the Litter Act was introduced to the House (House Bill 7001) by Representative Schadone on January 31, 2006 and proposed by Senators Ruggerio, Sosnowski, Paira-Weed, Badeau, Cicconeto to the Senate (Senate Bill 2669) on February 9, 2006. The amendment was referred to the House Corporations Committee, which scheduled a hearing for consideration on February 7, 2006, and the Senate Environment and Agriculture Committee, which scheduled a hearing for April 5, 2006. Both committees recommended that the measure be held for further study.

Table 1.1: Environmental Externalities of Plastic and Paper Bags Compared

	Plastic Bags*	Paper Bags*
<b>Production</b>		
Energy Consumption	594 BTUs / bag	2511 BTUs /bag
Airborne Chemical Pollution	1.1 grams / bag	2.7 grams / bag
Waterborne Chemical Pollution	0.025 grams / bag	1.25 grams / bag
Materials	0.0048 gallons of oil	0.0014 trees
<b>Transportation</b>		
Number of Trucks to Transport One Shipment of Bags	1 truck	7 trucks
<b>Recycling</b>		
Rate	0.6 % of plastic bags	19.4% of paper bags
Energy Consumption	17 BTUs / bag	1444 BTUs / bag
<b>Disposal</b>		
Landfill	non biodegradable in landfill environment	non biodegradable in landfill environment
	often blow off landfill property	8x more massive than plastic bags
Litter	1000 years to biodegrade	readily biodegradable
	capable of absorbing one million times the concentration of compounds, including PCBs and DDE, as seawater	leaches toxic chemicals stemming from the heating of wood chips to make the original bag
	46,000 pieces of plastic/sq mile in ocean	
	Plastic bags are linked to 100,000 marine deaths/yr	

\*All data from Franklin Associates LTD, 2004

### A Cost/Benefit Analysis of Plastic Bag Consumption

While the amendment is clear in its purpose and mechanism, it does not contain an analysis of the true cost and benefits of its implementation. An analysis of the bill would not be complete without considering the opportunity cost of choosing this specific approach for addressing the plastic bag problem. In other words, is this policy measure better than the alternatives?

In order to determine the socially optimal policy solution to the plastic bag problem, one must first identify the scope and nature of the problem. While the \$1 million dollars paid in annual fines and cleanup costs by RIRRC is the primary

motivation for the legislature's desire to reduce plastic bag consumption, the external costs of plastic bags extend far beyond this problem. Using scientific articles on the environmental damage of plastic bags and waste management data from cities across the country, we were able to construct a table of environmental externalities. From this data we quantified the external cost of production, transportation, and consumption externalities (See Table 1.2 for an estimate of the social cost per bag and Appendix B for the underlying calculations).

Table 1.2: Environmental Externalities of Plastic and Paper Bags Compared

Stage in Bag's Life Cycle	External Cost Borne by Society (¢ / bag)*
<b>Production</b>	
CO <sub>2</sub> Emissions:	0.20¢ / bag
<b>Transportation</b>	
CO <sub>2</sub> Emissions:	unknown
<b>Disposal</b>	
Litter:	5.20¢ / bag
Landfill:	2.92¢ / bag
Improper Recycling:	2.20¢ / bag
<b>Total Social Cost per Bag:</b>	<b>10.52¢ / bag</b>

\*See Appendix B for Calculations

Conservative calculations of the social cost of litter, CO<sub>2</sub> emissions from bag production, land filling, and improper recycling of plastic bags reveals that each 1 cent plastic bag used at a retail outfit in Rhode Island costs over 10.52 cents for society as a whole. We propose that the Litter Task Force should use this number as a baseline representative of the magnitude of the market failure which the Rhode Island legislature must address. Taking this statistic into account, the Litter Task Force should reconsider their amendment and, ultimately, reframe it using a mechanism which most efficiently aligns personal incentives with the social goal of reducing plastic bag consumption.

### Analyzing the Current Policy

While politically feasible, the current policy proposal will be insufficient to change behavior habits and thus cannot create a significant decrease in the 192 million plastic bags consumed annually in Rhode Island.<sup>8</sup> We found three inherent flaws which prevent the amendment from being effective. First, the amount of the subsidy is too small to cover the actual cost as proven by our above calculations. Additionally, the small amount of the rebate, 3 cents, will not be sufficient incentive for consumers to change their behavior. Second, the subsidy is not a true subsidy, but a de facto 3 cent tax on retailers for every consumer that brings their own bag. If plastic bags only cost 1 cent for retailers to buy but they have to pay 3 cents for each reusable bag that a consumer brings, then it is clearly in each retailer's self-interest to do everything possible to *discourage* consumers from bringing their own bags. Third, in its current form, the policy is dependent on the retailers' publicizing the rebate. Since the success of the policy is dependent on retailers, who are losing money from the deal, the bill will have little effect on reducing plastic bag consumption.

## **Considering the Alternative Policy Options**

### Knowledge

The simplest and most publicly acceptable solution for the Rhode Island legislature would be an information campaign aimed at explaining the externalities of bag consumption and encouraging the use of reusable shopping bags. In essence, this program would be an expansion of RIRRC and RIFDA's ReStore program to facilitate and encourage the recycling of plastic shopping bags. While ReStore clearly affected behavioral changes, the change came at an initial investment cost of \$400,000 to RIRRC. Additionally, the program only *encouraged* consumers to recycle their bags, rather than motivating a more dramatic behavioral change through economic incentives. Thus, while a legislature-initiated campaign to implore the public to switch to reusable bags might cause some change, it would most likely fail to adequately address the socially inefficient over-consumption of plastic bags. Although RIRRC might agree to fund a portion of the program, an information campaign would still cost the government thousands of dollars in funds that simply are not available to the RIDEM in light of recent budget cuts. Even though educational strategies are publicly acceptable, an information campaign would be a poor (even unfeasible) public policy from a fiscal and cost-internalizing perspective.

### Command and Control

A less expensive measure for reducing plastic bag consumption would be to simply ban plastic bags as Bangladesh did in 2002.<sup>9</sup> After discovering that improperly disposed plastic bags clogged drains and led to increased flooding during the monsoon season, the government of Bangladesh banned polyurethane bags entirely. This command and control policy made sense for Bangladesh because plastic bag externalities were particularly high in the nation as a result of its weather (2/3 of the nation flooded in both 1988 and 1998) and high litter rate (85% for plastic bags).<sup>10</sup> Considering the presence of jute bags as a biodegradable and locally available alternative to plastic bags for Bangladesh, a mandated reduction in the country's non-biodegradable waste stream was both economical and feasible.

In Rhode Island however, a ban on these bags might lead to a socially inefficient under-allocation of plastic bags. In some cases, such as the packaging of meat and unpacked produce, plastic bags are the most sanitary option. For these health and safety reasons, the 11 cent societal cost of the plastic bag would be worth the prevention of possible illness or contamination. Additionally, a ban might push in-state plastic bag producers out of business causing undue economic harm. In turn, this harm could create a concentrated stake holder opposition to a bill with diffuse societal benefits, thereby making it difficult to pass. In general, due to the contrasting external circumstances in Rhode Island and Bangladesh, this command and control policy would not make sense for Rhode Island.

### Tradable Permits

Though unprecedented in Federal policy, Rhode Island could consider a marketable permit solution to the plastic bag problem. Rather than banning plastic bag consumption entirely, Rhode Island could assign each supermarket and retail outlet a specific number of plastic bag credits. The total number of bag credits could be set to the

amount that the state estimates to be the socially optimal level. This system would then allow supermarkets that consume a large amount of plastic bags to trade for credits from companies that could more easily reduce their plastic bag consumption. Although this system would ideally lead to a socially efficient allocation of plastic bags, it would involve extensive (and expensive) government oversight. If the government decided to lower the amount of plastic bags below the initial ceiling, it would have to purchase a set amount of plastic bag permits at additional cost to the taxpayers. Additionally, while it is possible to estimate the externalities associated with plastic bags, it is far more difficult to determine the number of plastic bags that should be consumed annually in Rhode Island without any knowledge of the demand curve for plastic bags. Thus, although a creative application of tradable permits, this is probably not the best or most politically feasible approach to solving the plastic bag problem.

#### Transfer (Subsidy)

While a store-funded rebate clearly creates a system of perverse incentives, a true subsidy would provide economic incentive to change behavior through positive reinforcement of positive actions, hopefully dispelling the de facto cost on retailers. Unfortunately, a true subsidy of reusable bags in the form of a consumer rebate would be prohibitively expensive for the state government to fund. If the government wanted to shift demand for plastic bags to the socially efficient level, they would have to offer an 11 cent rebate to each consumer that brings their own bags to a store. Even a more moderate 3 cent rebate would not be politically feasible as it could cost hundreds of thousands of dollars while creating insufficient change in consumer bag purchasing patterns.

#### Transfer (Tax)

The final policy option for the Rhode Island legislature is a tax, imposed either on the retailer or the consumer. Given the fact that a tax could be set equal to the value of the external costs of a plastic bag, the socially efficient number of plastic bags would not need to be known to policy makers. Unlike a subsidy, the tax would cost the state little to enforce while generating revenue that could be used to address Rhode Island's litter problem.

By analyzing and contrasting the similar plastic bag tax policies of Ireland (tax on the consumer) and Denmark (tax on the producer), the socially optimal policy for Rhode Island's plastic bag problem can be predicted. In March of 2002, Ireland implemented a PlasTax of 0.15 euros on one-time use plastic bags (with exceptions for bags used for packaging meat and produce).<sup>11</sup> Within months, plastic bag consumption dropped over 90% and litter visibly decreased across the nation. (In a nation highly dependent on tourism, the aesthetic detriment of plastic bags was a main catalyst for this legislation.) In the next year, plastic bag consumption dropped from 1.2 billion bags to 60 million bags while 9.6 million euros were generated for environmental protection.<sup>12</sup> After initial opposition to the tax, retailers ended up strongly supporting the bill as the average supermarket increased reusable bag sales while saving 50 million euros/year from lower grocery bag stocking costs.<sup>13</sup> Finally, enforcement costs borne by the Irish government were minimal as the tax receipts were provided to the government along with revenues from the national Value Added Tax (VAT).

Conversely, Denmark taxes retailers a similar amount as part of a general waste tax. While this tax has reduced plastic bag consumption 66% since its implementation, the results are less dramatic than Ireland's because consumers are often unaware of the increased cost of the bags they are "purchasing" as many grocery stores simply incorporate the cost of the tax into the price of their products.<sup>14</sup> However, this tax does provide incentives for retailers to find innovative ways to reduce bag consumption. Overall, a Pigovian tax on plastic bags is much more effective if placed on the consumers because the goal of the tax is to effect consumer behavior, not cause retailers to incorporate the tax into their product pricing.

### **Policy Recommendation for Rhode Island State Legislature**

While it would certainly draw the attention of anti-tax factions, the Rhode Island legislature should push for a bag tax of at least 11 cents on plastic bags at the checkout counter. A Pigovian tax on consumers is clearly the optimal policy to internalize the quantifiable external cost of these environmentally damaging bags. In this case, market-based policy would operate more efficiently than its command and control counterpart because the external costs of plastic bags are known while the optimal number is unknown due to the uncertain nature of the demand curve. While a subsidy would be more politically popular than a tax, a true subsidy would be too expensive to fund and the proposed store-funded rebate would be ineffective in addressing the environmental problems as a result of the indirect effects of its incentive structure.

Following the success of its Irish counterpart, a Pigovian tax on consumers would be the most effective policy to decrease litter and address the state's landfill crunch. For once, Rhode Island, a noted progressive state, could be the leader on an important environmental issue rather than following in the footsteps of neighboring Massachusetts. Instead of yielding to the political pressures against increased taxation, the state should consider the environmental and quality of life issues at stake and pass a Pigovian tax of at least 11 cents on all disposable bags.

**Appendices**Appendix A: Plastic Bag Consumption in Rhode Island and US

## I. Consumption

- A. 192 million plastic bags/yr in Rhode Island<sup>15</sup>
- B. 100 billion plastic bags/yr in the US<sup>16</sup>
- C. 10 billion paper bags/yr in the US<sup>17</sup>

## II. Cost

- A. Plastic Bags cost \$ 0.01/bag<sup>18</sup>
- B. Paper Bags cost \$ 0.03/bag<sup>19</sup>

## III. Disposal

- A. Plastics comprise 11.3% of waste stream and a disproportionate percentage of litter<sup>20</sup>
- B. RIRRC pays \$ 1 million annually cleaning up plastic bags that are blown off its property and paying litter fines for those bags that it is unable to collect<sup>21</sup>

Appendix B: Cost Calculations of Plastic Bag Externalities

## I. Estimation of the Cost of the Production Externalities/Bag

- A. Social Cost of CO2 Emissions from Production of a Bag

It takes 594 BTUs to produce a single plastic bag. The production process produces 6.1 kg CO<sub>2</sub>/ 210MJ<sup>22</sup>

$$\frac{6.1kg\ CO_2}{210MJ} = \frac{0.029kg\ CO_2}{MJ}$$

$$\frac{594BTUs}{bag} \times \frac{MJ}{947.817BTU} \times \frac{0.029kg}{MJ} \times \frac{2.2lb}{kg} = \frac{0.04lb\ of\ CO_2}{bag}$$

The estimated cost of CO<sub>2</sub> is \$0.05/lb. Thus, the social cost of 0.04 lb of emissions is 0.05\*0.04= **\$0.0020 /bag.**

- B. Social Cost of Waterborne and Chemical Wastes/Bag

It is virtually impossible to estimate the cost of the 1.125 grams of atmospheric and waterborne chemical waste because there are so many different types of chemicals in this mixture that cause vastly different



amounts of environmental damage.<sup>23</sup> However, it is likely that the cost of these byproducts of the production process are less than that of the carbon dioxide emissions because there is much more CO<sub>2</sub> emitted by weight/bag than other chemical waste.

## II. Estimation of the Cost of Transportation Externalities/Bag

It is very difficult to estimate the social cost associated with the transport of the plastic bags from factories to retailers. First, it is difficult to estimate the amount of externalities associated with a gallon of gasoline to begin with. Second, the average transport distance of plastic bags is unknown.

## III. Estimation of the Cost of Disposal Externalities/Bag<sup>24</sup>

### A. Social Cost of Litter

An estimate for the social cost of plastic bag litter was obtained through finding the amount of money San Francisco paid cleaning up plastic bags and dividing this by the total number of bags consumed annually.

Cost of Street Cleaning: \$ 26,000,000/yr  
 Plastic Bags Percentage of Litter: 10%  
 Number of Plastic Bags Sold: 5,000,000/yr

$$\frac{\$26,000,000 / \text{yr}}{\text{litter}} \times \frac{0.1 \text{ plastic bags}}{1 \text{ unit of litter}} \times \frac{1}{5,000,000 \text{ plastic bags}} = \$ 0.052/\text{bag}$$

### B. Social Cost of Land Filling Plastic Bags

RIRRC bears two principal costs from proper plastic bag disposal. The first is the processing cost of the bags. This cost is **\$ 0.024/bag**. The second is the cost of litter pickup and fines stemming from plastic bags that blow off of the Central Landfill site. This cost is \$ 1 million/yr. Since Rhode Islanders consume 192 million bags/yr, these cleanup costs add an additional 1/192= **\$ 0.0052/bag**.

### C. Social Cost of Improper Recycling and Composting of Plastic Bags

Once again, data from San Francisco facilities will be used to calculate the social cost from plastic bags in the recycling stream.

Cost of Removing Bags from Recycling Stream:  
 494,000/yr  
 Cost of Clearing Machinery Jams Cause by Plastic Bags:  
 100,000/yr

Reduced Revenue on the Sale of Recyclables Due to Bag Contamination:

100,000/yr

Cost of Removing Bags from Compost:

400,000/yr

Total:

\$1,094,000/yr

\$ 1,094,000/yr \*1/5,000,000 bags = **\$ 0.022/bag**

IV. Total Social Cost of a Single Plastic Bag

CO2 Emissions: \$ 0.0020/bag

Litter: \$ 0.0520/bag

Landfill: \$ 0.0292/bag

Improper Recycling: \$ 0.0220/bag

**Total: \$ 0.1052/bag**

**Thus, a Low Estimate of the social cost of a single plastic bag is 10.52 cents.**

**Endnotes**

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6. Schiller, Barry. Telephone interview. 12 Apr. 2006. 4.
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10. Ibid.
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