Economic Impacts of the Proposed GSA Single-Use Plastics Rule

October 2022

This Is **Plastics**

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List of Acronyms

Abbreviation	Definition
ACC	American Chemistry Council
ANPR	Advance Notice of Proposed Rulemaking
Btu	British Thermal Unit
EPS	Expanded Polystyrene
FY	Fiscal Year
GSA	General Services Administration
GSAR	General Services Administration Regulation System
IMPLAN	Impact Analysis for Planning
NAICS	North American Industrial Classification System

Executive Summary

In this report, the Plastics Industry Association (PLASTICS) estimates the economic impacts if the General Services Administration ("GSA") were to disallow spending on products containing single-use plastics and plastics packaging based on a petition by The Center for Biological Diversity, along with 180 signatories. For this analysis, the definition of single-use plastics includes plastics packaging, unlaminated plastic film, plastic sheet, polystyrene foam and plastic bottles. PLASTICS collected spending data from the federal government on expenditures made by the GSA by fiscal year, economic sector, and state.

PLASTICS found the "direct" expenditures by GSA on single-use plastics is limited, totaling about $2 million per year for applications such as wrapping any printed materials. However, PLASTICS found GSA supports approximately $400 million per year of expenditures on single-use plastics through the intermediate purchases of goods and services.

ES Table 1 shows the U.S. economic activity "at risk" from decreased purchases of single-use plastics during the last four fiscal years if the proposed GSA rule had been active. The production of single-use plastics supports indirect suppliers in plastics' supply chain, such as chemical manufacturers, industrial machinery manufacturers, and the various "support" sectors like construction, transportation and business services. The employees of these sectors would also have spent the paychecks they derive from them, creating the induced impact. Overall, implementing the proposed rule would have put almost 5,000 U.S. jobs "at risk."

ES Table 1 – U.S. jobs supported by GSA single-use plastic purchases "at risk" from the rule (# of jobs)

Category	FY 2019	FY 2020	FY 2021	FY 2022	Average
Direct	940	1,130	1,800	920	**1,200**
Indirect	1,480	1,800	2,860	1,470	**1,900**
Induced	1,420	1,730	2,750	1,410	**1,830**
TOTAL >>	3,840	4,660	7,410	3,800	**4,930**

PLASTICS further developed the "at risk" analysis in ES Table 1 to include the economic impact of reallocating dollars spent on plastics packing materials to alternatives. To conduct this analysis, PLASTICS assumed that alternatives would be primarily paper products, with aluminum and glass products comprising a smaller expected share of overall product substitution. This analysis showed that switching from single-use plastics to alternative materials would be more expensive for GSA and, by extension, U.S. taxpayers.

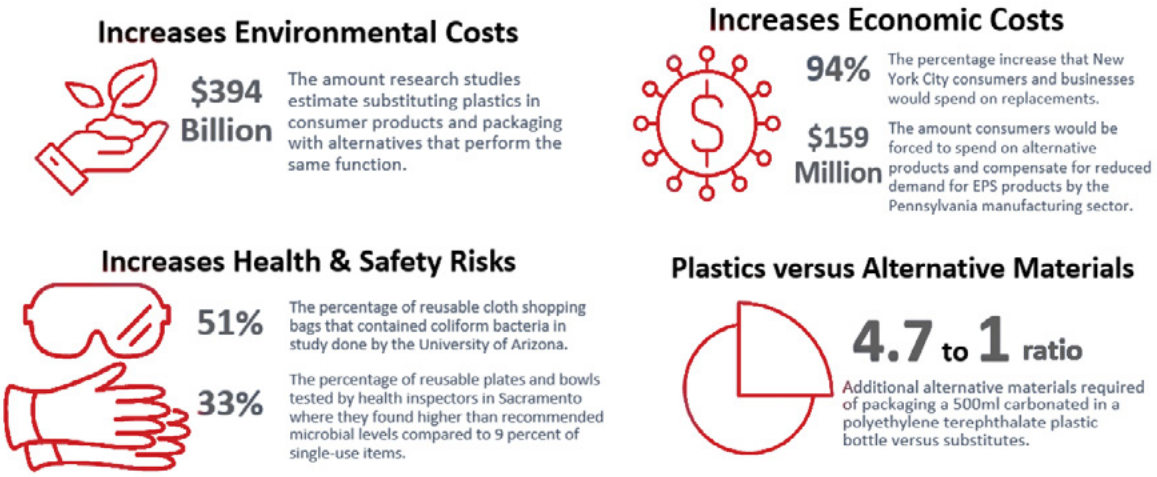
PLASTICS assessed replacing single-use plastics from FY 2019 through FY 2022 with paper, aluminum, and glass, assuming that using these materials would result in a 75 percent increase in cost. This assumption was based on a literature survey of plastic bans and their cost implications. PLASTICS's modeling shows higher costs for GSA. These cost increases are expected to translate into a reduction in household spending in the form of higher taxes.

ES Table 2 shows the estimated net impact to U.S. jobs that would have resulted if the proposed rule had been implemented from FY 2019 through FY 2022. While over 8,000 jobs would have been supported by increased expenditures on alternative materials, almost 5,000 jobs would have been lost in plastics and plastics' supply chain and a further 4,000 jobs would have been lost economy-wide due to higher taxes that reduced household incomes and purchasing power. The net impact would have been an estimated 560 U.S. jobs lost.

ES Table 2 – Net impact to U.S. jobs from proposed GSA rule (# of jobs)

Category	FY 2019	FY 2020	FY 2021	FY 2022	Average
Alternative Gains	6,400	7,760	12,330	6,340	**8,210**
Plastics Losses	-3,840	-4,660	-7,400	-3,800	**-4,930**
Taxpayer Impact	-3,000	-3,630	-5,780	-2,970	**-3,850**
TOTAL >>	-440	-530	-850	-430	**-560**

Besides economic losses, a GSA ban on single-use plastics would have broader implications. Third-party studies reviewed by PLASTICS show that the plastics are lighter weight, more flexible and less likely to cause injury that alternatives such as paper, metals and glass as well as being lower cost for the GSA. Key facts gleaned from the studies of substituting plastics for alternative materials are below:



Introduction

The Center for Biological Diversity, along with 180 signatories, submitted a petition to the GSA on February 3, 2022, requesting GSA to "revise the GSAR [The General services Administration Regulation System] to restrict the procurement and use of single use plastic, with exemptions for disability accommodations, medical use, and disaster response."[1] Specifically, the petitioners request "for the GSA to publish regulations to prohibit the sale or distribution of single-use plastic bags and other single-use products, including plastic utensils, straws, other non-recyclable food service products and single-use personal care product containers." [2]

In response to the petition, GSA has published an advance notice of proposed rulemaking ("ANPR") to "seek public feedback pertaining to the use of plastic consumed in both packaging and shipping, as well as other single-use plastics for which the agency contracts."[3] To assist in its rulemaking, the GSA asks in its ANPR for commenters to respond to a series of questions related to the economic impacts of eliminating single use plastics.

This report addresses the potential impacts of proposed rules around the GSA reducing or eliminating the purchase of products with single-use plastics.[4] The GSA is the federal agency that provides support services for other federal agencies, such as information technology management or overseeing the construction of buildings.

In this report, PLASTICS estimates the potential impact of this proposed rule using two approaches:

1. An economic impact analysis of the potential rule's effect on the U.S. economy and specifically the manufacturing sectors that create single-use plastics and its alternatives
2. A literature review of the qualitative impacts of a ban on single-use plastics across economic, environmental and health and safety outcomes

1 https://www.biologicaldiversity.org/campaigns/ocean_plastics/pdfs/GSA-Petititon.pdf
2 Ibid.
3 https://www.regulations.gov/document/GSA-GSAR-2022-0014-0001
4 https://www.federalregister.gov/documents/2022/07/07/2022-14403/general-services-administration-acquisition-regulation-gsar-single-use-plastics-and-packaging

Role of Single-Use Plastics

Plastics play a major role in U.S. manufacturing. Plastics production is the sixth-largest manufacturing industry in terms of shipments in 2020.[5] According to the 2022 Size and Impact Report by the Plastics Industry Association, the U.S. plastics sector accounted for an estimated $468 billion in goods and supported 808,500 U.S. jobs in 2021. Accounting for indirect economic impacts, the plastics sector supported $600.4 billion in shipments and 1.5 million U.S. jobs across the economy in 2021.[6]

The production of plastics has outpaced the growth of almost every other material since the 1950s.[7] The emergence of industrial polymer chemistry has increased the scale of plastics' possibilities, where products can be made in massive quantities cheaply, reliably, and with a remarkable ability to achieve a range of physical properties through their composition and processing.[8]

Single-use plastics not only provide direct economic benefits to the economy but also support multiple industries, including packaging, construction, transportation, healthcare and electronics. These industries rely on the polymer as an important enabler because it contributes to higher levels of resource productivity by reducing food waste through extending shelf life and reducing fuel consumption for transportation by decreasing packaging weight.[9] For example, a bag of chips is light, flexible, and almost impenetrable by moisture, air, or bacteria; it is also chemically inert, thermally sealable, and very inexpensive.[10]

Alternatives to Single-Use Plastics

Conceptually, plastics alternatives, such as steel, aluminum, glass, paper, textile, wood, mineral wool, leather, residual non-substitutable plastic resin and rubber, could replace plastic in a multitude of consumer goods; however, it is not practical because the alternatives result in higher quantities and costs to attain the same results. For example, packaging a 500ml carbonated beverage in a typical polyethylene terephthalate plastic bottle requires approximately 30 grams of plastic. On the other hand, an equivalent bottle manufactured from a weighted average mix of alternative materials (tin, aluminum, glass, and paper) would weigh 141 grams indicating a mass ratio of 4.7 to 1.[11]

To illustrate the increased resource use and cost of alternative materials in comparison to plastics, Table 1 shows the estimated quantities of plastic and alternative materials demanded in each consumer goods sector per million of revenue.

5 https://e.plasticsindustry.org/hubfs/Executive%20Summary_2022-Size%20%20Impact%20Report_9.13.pdf
6 Ibid.
7 https://www.weforum.org/agenda/2019/10/plastics-what-are-they-explainer/
8 Ibid.
9 https://ellenmacarthurfoundation.org/the-new-plastics-economy-rethinking-the-future-of-plastics-and-catalysing
10 https://www.weforum.org/agenda/2019/10/plastics-what-are-they-explainer/
11 https://www.americanchemistry.com/content/download/6921/file/Plastics-and-Sustainability-A-Valuation-of-Environmental-Benefits-Costs-and-Opportunities-for-Continuous-Improvement.pdf

Table 1 — Plastic and Alternative Material Demand per Million of Revenue (Metric Tons per Million US$)[12]

	Business as Usual (Tonnes/$ Million)			Plastic Alternatives (Tonnes/$ Million)			
Consumer Goods Sector	Plastic in Product	Plastic in Packaging	Total Plastic	Alternatives in Product	Alternatives in Packaging	Total Alternatives	Alternatives' Intensity
Automobiles	3.5	0.1	3.6	8	0.2	8.2	2.3
Soft drinks and ice	0	15.4	15.4	0	112	112	7.3
Clothing and accessories	3.2	0.3	3.5	4.6	0.9	5.4	1.5
Consumer electronics	3.4	0.8	4.2	10.4	1.9	12.3	2.9
Durable household goods	10.8	4.2	15	41.4	10.9	52.3	3.5
Food	0	3.1	3.1	0	14.4	14.4	4.6
Personal products	4	4.5	8.5	12.2	32	44.1	5.2
Athletic goods	10.6	3.6	14.2	35.8	9.1	44.9	3.2
Toys	21.8	11.9	33.7	102.6	30.2	132.8	3.9
Tobacco	0.5	0	0.6	0.8	0.1	0.9	1.5
Furniture	12.3	1.5	13.8	27.6	3.6	31.2	2.3
Non-durable household goods	4.9	2.9	7.8	19.3	12.1	31.4	4.0
Footwear	9.8	3.2	13	34.6	7.4	42	3.2
Medical and pharmaceutical products	0	2.9	2.9	0	12.1	12.1	4.2
Retail	0	0.5	0.5	0	1.7	1.7	3.4
Restaurants and bars	0	1.1	1.1	0	3.3	3.3	3.0

The data summarized in Table 1 show that greater quantities of alternative materials such as paper, metals and glass are needed to provide the same function and utility as plastics. This implies that relying on alternatives increases shipping weight and energy consumption in the transport of goods and their packaging, thus lowering their total efficiency. This efficiency loss is largely realized in nondurable and perishable items, such as beverages, food and pharmaceuticals.

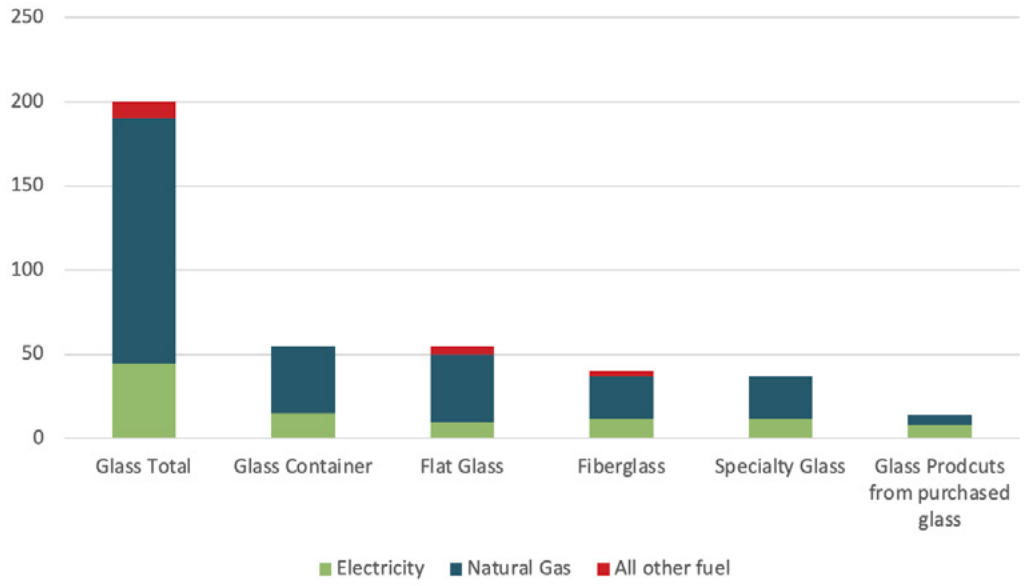
12 Ibid. The final column "Alternatives' Intensity" was calculated by PLASTICS based on source material.

Glass

Glass is the most common plastic alternative, accounting for just under 50 percent of the total mass of plastic material alternatives.[13] This is due to glass's extensive use in the packaging of food, drinks, personal products and medication. As of 2022, the glass product manufacturing industry is composed of 4,193 businesses that employ 100,024 people and contributes approximately $31.6 billion in value-added to the United States economy.[14]

Glass is not only more expensive to ship due to its weight and fragility, but it is also more expensive to produce, due to the large amount of heat required during the manufacturing process. According to the Energy Information Administration survey of the manufacturing sector, glass manufacturing is energy-intensive and consumes approximately 200 trillion British thermal units of energy per year, or 1 percent of total industrial energy consumption.[15]

Figure 1 — Energy Consumption in Glass Manufacturing by Fuel (trillion Btu)



Metals – Steel and Tin Plate, Aluminum

Metals are commonly used alternatives to plastics because, yet come at a higher cost. The increased cost of metals is due primarily to the increased quantity of material needed to perform the same function, relative to plastics. For example, the American Chemistry Council ("ACC") estimated that metal soft drink containers require 7.3 times as much material to produce as plastic containers and increase environmental costs by a factor of 5.2.[16] Metals are also subject to wear and corrosion, further increasing the costs incurred when creating and maintaining products and packaging.[17]

13 Ibid.
14 https://www.ibisworld.com/industry-statistics/number-of-businesses/glass-product-manufacturing-united-states/
15 https://www.eia.gov/todayinenergy/detail.php?id=12631
16 https://www.americanchemistry.com/content/download/6921/file/Plastics-and-Sustainability-A-Valuation-of-Environmental-Benefits-Costs-and-Opportunities-for-Continuous-Improvement.pdf
17 https://www.mpo-mag.com/contents/view_online-exclusives/2017-10-09/5-ways-plastics-revolutionized-the-healthcare-industry/#:~:text=Plastics%20have%20been%20used%20widely,and%20re%2Duse%20a%20device.

Paper and Wood

Paper products necessitate significant resources to manufacture. Manufacturing of paper requires arable land dedicated to trees, water, energy and other chemical inputs. Additionally, paper products are often more expensive than plastics. For example, the cost of one paper straw is 2.5 cents compared to 0.5 cents for a plastic straw.[18]

In addition to paper products being more expensive than plastic, they are also less durable. Paper products are typically porous and need to be replaced more frequently. According to a study done by the Environment Agency, paper bags would need to be used four times or more to reduce their global warming potential to that of the conventional plastic bag.[19] The same study also found that the human toxicity and terrestrial ecotoxicity impacts were significantly worse for paper production. Due to their low durability, paper bags are unlikely to be reused enough times on a regular basis to overcome these shortcomings relative to plastic bags.[20]

The manufacturing of certain wood products can have a lower carbon footprint than plastics[21] ; however, due to wood's significant weight, it is more expensive to transport. In addition, wood has limited use-cases relative to plastic, such as rigid bulk packaging applications including drums, pails, bulk boxes and rigid intermediate bulk containers.[22]

Taken together, these examples indicate that plastic is lighter and stronger than current alternatives, which lowers the overall environmental and economic impact. Table 2 provides a comparison of utilizing plastics versus alternatives by use case and accounting for environmental costs.

Table 2 — Environmental Costs, Intensity per Million of Sector Revenue and Sector Share of Total Environmental Costs

		BUSINESS AS USUAL				PLASTIC ALTERNATIVES			
CONSUMER GOODS SECTOR	AVERAGE SECTOR PROFIT MARGIN (%)	COST PER MILLION REVENUE (US$)	% TOTAL COSTS	% REVENUE AT RISK DUE TO ENVIRONMENTAL COSTS	% PROFIT MARGIN AFTER ENVIRONMENTAL COSTS	COST PER MILLION REVENUE (US$)	% TOTAL COSTS	% REVENUE AT RISK DUE TO ENVIRONMENTAL COSTS	% PROFIT MARGIN AFTER ENVIRONMENTAL COSTS
Automobiles	4.4%	$7,873	10.4%	0.8%	3.6%	$20,698	7.1%	2.1%	2.3%
Soft drinks and ice	10.5%	$20,392	9.9%	2.0%	8.5%	$106,527	13.5%	10.7%	-0.2%
Clothing and accessories	6.3%	$7,099	6.9%	0.7%	5.6%	$13,838	3.5%	1.4%	4.9%
Consumer electronics	8.6%	$7,362	1.7%	0.7%	7.9%	$36,288	2.2%	3.6%	5.0%
Durable household goods	4.5%	$24,422	5.5%	2.4%	2.0%	$120,174	7.1%	12.0%	-7.5%
Food	3.3%	$4,617	23.7%	0.5%	2.9%	$19,281	25.8%	1.9%	1.4%
Personal products	6.7%	$13,278	5.7%	1.3%	5.3%	$51,893	5.8%	5.2%	1.5%
Athletic goods	6.3%	$22,074	1.2%	2.2%	4.1%	$95,044	1.3%	9.5%	-3.2%
Toys	4.6%	$46,477	3.2%	4.6%	-0.1%	$293,613	5.3%	29.4%	-24.8%
Tobacco	24.9%	$2,241	1.5%	0.2%	24.7%	$2,695	0.5%	0.3%	24.6%
Furniture	4.5%	$25,699	8.9%	2.6%	1.9%	$62,180	5.6%	6.2%	-1.7%
Non-durable household goods	6.7%	$12,233	7.1%	1.2%	5.4%	$57,606	8.7%	5.8%	0.9%
Footwear	10.0%	$22,417	4.6%	2.2%	7.7%	$87,442	4.7%	8.7%	1.2%
Medical and pharmaceutical products	8.4%	$4,013	0.4%	0.4%	8.0%	$17,733	0.5%	1.8%	6.6%
Retail	3.9%	$894	8.0%	0.1%	3.8%	$3,144	7.3%	0.3%	3.6%
Restaurants and bars	9.0%	$1,707	1.2%	0.2%	8.8%	$6,436	1.2%	0.6%	8.3%
All Sectors	**6.4%**	**$4,886**	**100.0%**	**0.5%**	**5.9%**	**$18,773**	**100.0%**	**1.9%**	**4.5%**

18 https://www.cnbc.com/2018/07/09/paper-straws-are-better-for-the-environment-but-they-will-cost-you.html
19 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291023/scho0711buan-e-e.pdf
20 https://bioresources.cnr.ncsu.edu/resources/paper-based-products-as-promising-substitutes-for-plastics-in-the-context-of-bans-on-non-biodegradables/
21 https://www.e3s-conferences.org/articles/e3sconf/pdf/2020/18/e3sconf_icepp2020_03001.pdf
22 https://www.americanchemistry.com/better-policy-regulation/plastics/resources/impact-of-plastics-packaging-on-life-cycle-energy-consumption-greenhouse-gas-emissions-in-the-united-states-and-canada-substitution-analysis

Macroeconomic Impacts of Proposed GSA Rule

This section describes the key inputs and assumptions, methodology, and the resulting macroeconomic results of the proposed GSA rule. PLASTICS's analysis involved a three-step process:

1. Quantifying the scope of the purchases made by GSA on behalf of the federal government by sector as delineated by North American Industry Classification System ("NAICS") codes
2. Modeling the economic activity "at risk" from the proposed GSA rule in the single-use plastics sector as well as through its suppliers and employee spending
3. Modeling the "net" impact of the proposed rule by reducing purchase of plastics, increasing purchase of alternative materials, and higher costs for taxpayers

Quantifying GSA Expenditures

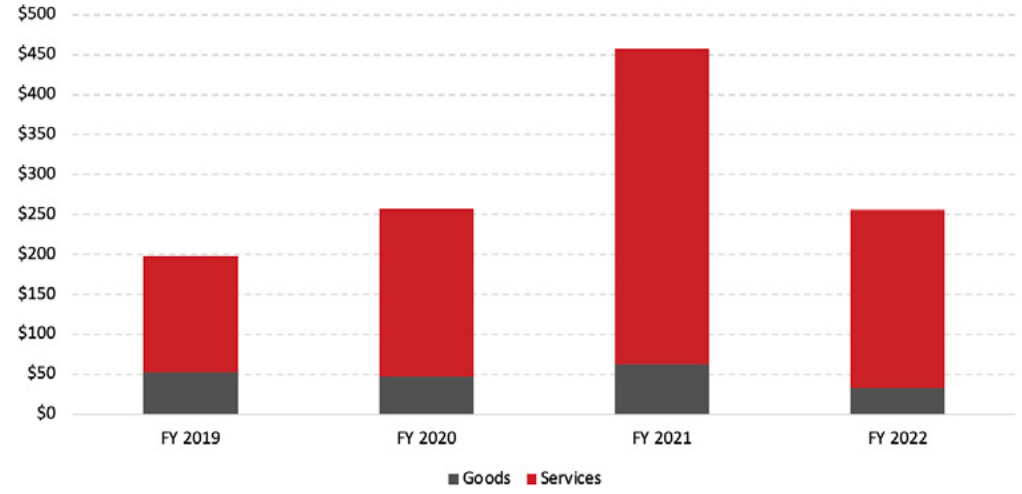
The main data source for the GSA spending examined in this report was USAspending.[23] USAspending "is the official source for spending data for the U.S. government" as well as "its mission is to show the American public what the federal government spends every year and how it spends the money."[24] The database included fiscal year ("FY") 2008 through FY 2022. This report analyzed FY 2019 through FY 2022 for GSA, which produced approximately 4.9 million records of purchases.

The most relevant results were those for total obligations in dollars, NAICS code, and "U.S. state of performance." Both latter terms require more explanation. NAICS is the standardized system in the U.S., Canada, and Mexico for defining the businesses competing against each other in the same sector.[25] For example, NAICS 3351 is the code for "electric lighting equipment manufacturing."[26] That code includes all the U.S. businesses producing lighting equipment.

The "U.S. state of performance" clarifies where the goods and services were produced or performed. The U.S. state of performance may contrast with the location of a headquarters. For example, this would be the case for a manufacturing company headquartered in northern Virginia with factories across the country. PLASTICS's analysis considers the state of performance, though the mid-Atlantic region (and especially Maryland and Virginia) is disproportionally represented when considering GSA spending by state because of those Maryland's and Virginia's proximity to most federal agencies.

Figure 2 shows GSA expenditures from FY 2019 to FY 2022 categorized as goods or as a service.[27] For FY 2019, FY 2020, and FY 2022, GSA expenditures ranged between $200 billion and $250 billion. FY 2021 experienced a one-year spike to nearly $450 billion with COVID relief spending.

Figure 2 – GSA expenditures from FY 2019 to FY 2022 by category (nominal $ billions)



23 https://www.usaspending.gov/search
24 https://www.usaspending.gov/about
25 https://www.census.gov/naics/
26 https://www.census.gov/naics/?input=3351&year=2017&details=3351
27 Agriculture to manufacturing NAICS counted as "goods," wholesale to government NAICS counted as "services"
28 "Commercial structures" include government buildings, such as courthouses or administrative offices.

The USAspending data includes thousands of NAICS codes. These codes were mapped into the 546 aggregated economic sectors represented in the IMPLAN model, explained in more detail in the following section. Table 3 lists the IMPLAN sectors with the largest GSA purchases for FY 2022 starting with $81.7 billion of the "computer systems design services" sector:

Table 3 - IMPLAN sectors with GSA expenditures over $1 billion (nominal) for FY 2022

Rank	IMPLAN Sector	GSA Expenditure
1	Computer systems design services	$81.7
2	Architectural, engineering, and related services	$62.7
3	Scientific research and development services	$41.8
4	Construction of new commercial structures[28]	$29.0
5	Management consulting services	$6.2
6	Custom computer programming services	$6.2
7	Other computer related services, including facilities management	$3.5
8	Individual and family services	$2.5
9	Business support services	$2.4
10	Software publishers	$2.4
11	Facilities support services	$1.7
12	Automobile manufacturing	$1.6

Table 3 shows the sectors with the largest amounts of GSA purchases are those related to computer systems; the design, construction and maintenance of buildings; and scientific research. Given the mission of the GSA is supporting other federal agencies through the central procurement of certain goods and services, the ordering of the data in Table 3 verifies the mapping.[29]

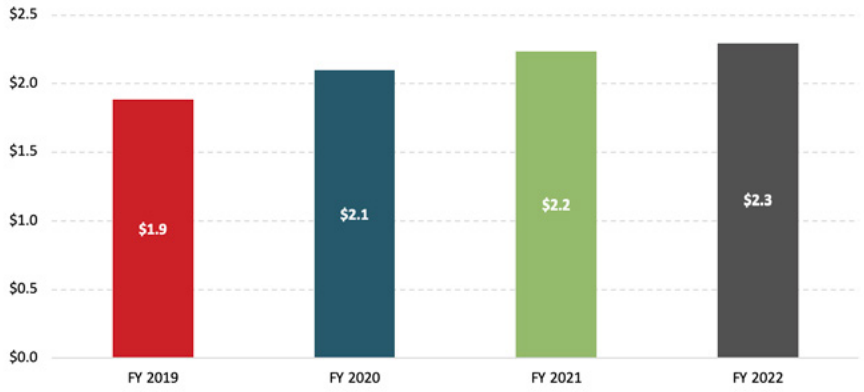
In the fiscal years examined, GSA directly purchased between $1.9 million and $2.3 million per year in single-use plastics. For the purposes of the economic impact analysis, "single-use plastics" includes three IMPLAN sectors and, by extension, the NAICS codes under them:

1. Plastics packaging materials and unlaminated film and sheet manufacturing
2. Polystyrene foam product manufacturing
3. Plastics bottle manufacturing

Figure 3 shows the specific amount of direct GSA purchases of single-use plastics for each year. While such figures might appear small, direct purchases only account for GSA purchase of single-use plastics as a standalone product for the internal use of a federal agency (e.g., to wrap books or paper dollars printed by the Government Publishing Office or the Bureau of Engraving and Printing). The rule under consideration is expected to affect the purchases made by GSA vendors and service providers including the packaging to deliver items to federal agencies and their operations.

Studying the full scope of the economic impacts, including purchases by GSA's suppliers, requires further modeling of the macroeconomic impacts.

Figure 3 – Direct GSA purchase of single-use plastics from FY 2019 to FY 2022 (nominal $ millions)



28 "Commercial structures" include government buildings, such as courthouses or administrative offices.

29 https://support.implan.com/hc/en-us/articles/115009674428-IMPLAN-Industries-NAICS-Correspondences

IMPLAN Model Overview

IMPLAN is a computerized model of the U.S. and its regional economies. IMPLAN is widely used by federal, state, and local governments, as well as academic institutions and consulting firms. The input-output ("IO") methodology underlying IMPLAN's structure and its applications to supply chains won its forebearer, Wassily Leontief, the Nobel Prize in economics in 1973.[30]

IO models work by transforming initial, or "direct," expenditures or employment into "total" impacts on the economy. The difference between the direct and total impact includes the "indirect" effect as well as the "induced" effects," which follow the following intuition:

- **Indirect Effect** – The indirect effect is the connection between direct expenditures or direct employment and their supply chain. For most goods and services, an initial quantity for the dollars spent stimulates economic activity in other economic sectors to produce various components, materials or parts; or to provide support services.

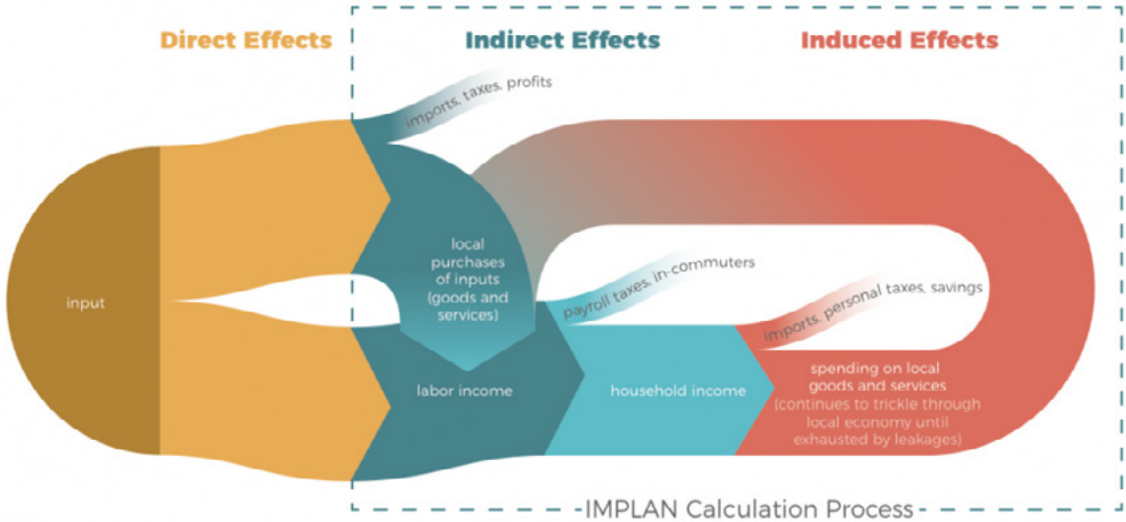
  For example, an automobile manufacturer supports supplier companies through the indirect purchase of parts and materials (e.g., tires and glass for windows) to contribute to the final production of cars. The automobile manufacturer might also require certain services, such as catering from local restaurants or legal services from law firms to manage the intellectual property and address litigation. These linkages make up an economic sectors' indirect supply chain, which would be affected by the proposed rule for the GSA.

- **Induced Effect** – The induced effect includes expenditures made by the employees of direct employers and of the indirect suppliers. To return to the prior example, workers earn paychecks, take them home, and spend them on their everyday needs. Those needs would include such goods and services as a home, healthcare, education, food, fuel, transportation, various forms of live and electronic entertainment and tax payments. These purchases collectively support the consumer-based portion of the U.S. economy and government.

While households consume many of the products utilizing single-use plastics, such as food at grocery stores, the proposed GSA rule would not have a strong influence on the behavior of individual consumers buying on the private market. Therefore, this analysis concentrates on indirect single-use plastics when modeling the GSA expenditures alone.

Figure 4 shows a flowchart summarizing the internal workings of IMPLAN. The direct expenditures, colored yellow on the left, feed into the indirect effect in blue in the middle. Labor is an important input in the production of nearly all goods and services, and hence the direct and indirect effects create labor income, which feeds into household income, and then into the induced effect colored using a red color at the rightmost end of Figure 4's illustration.

Figure 4 – IMPLAN flowchart and calculation process



30 https://www.nobelprize.org/prizes/economic-sciences/1973/leontief/facts/

Impact of GSA Expenditures on the Single-Use Plastics Sector

As per Figure 2, between FY 2019 and FY 2022, GSA expenditures totaled between $198 billion and $453 billion per year on the purchase of goods and services for federal agencies. Once mapped from NAICS to the corresponding IMPLAN sectors by state[31], these purchases were run through IMPLAN to show indirect impacts in addition to direct impacts.

The modeling required two simulations in IMPLAN, which covered these effects:

1. Running the total described in Figure 2 through IMPLAN to estimate the effect GSA spending has on the U.S. economy and specifically the three sectors under single-use plastics[32]

2. Running a second simulation to show the impact the lost single-use plastics employment and output has on the U.S. economy when accounting for its supply chain and induced effects

The two-step process allowed for isolation of how the proposed rule would have affected the single-use plastics sectors and how it would have affected single-use plastics' indirect suppliers and sectors depending on consumer expenditures made by employees. Examples of important suppliers for single-use packaging manufacturing include chemicals and machinery.

Table 4 – U.S. employment "at risk" from proposed GSA rule(# of jobs)

IMPLAN Sector	Effect	FY 2019	FY 2020	FY 2021	FY 2022	Average
Packaging, film, and sheet	Direct	430	510	800	430	**540**
Packaging, film, and sheet	Indirect	670	800	1,250	670	**850**
Packaging, film, and sheet	Induced	670	810	1,270	670	**860**
Packaging, film, and sheet	Total	1,770	2,120	3,320	1,770	**2,250**
Polystyrene foam	Direct	470	570	920	450	**600**
Polystyrene foam	Indirect	750	920	1,480	730	**970**
Polystyrene foam	Induced	690	840	1,350	670	**890**
Polystyrene foam	Total	1,910	2,330	3,750	1,850	**2,460**
Plastics bottles	Direct	40	50	80	40	**50**
Plastics bottles	Indirect	60	80	130	70	**90**
Plastics bottles	Induced	60	80	130	70	**90**
Plastics bottles	Total	160	210	340	180	**220**
TOTAL >>	Direct	940	1,130	1,800	920	**1,200**
TOTAL >>	Indirect	1,480	1,800	2,860	1,470	**1,900**
TOTAL >>	Induced	1,420	1,730	2,750	1,410	**1,830**
TOTAL >>	Total	3,840	4,660	7,410	3,800	**4,930**

As illustrated in Table 4, GSA expenditures on single-use plastics and the spending of GSA vendors on single-use plastics supports around a thousand U.S. jobs in the sector. The data indicates this can oscillate from year to year, and FY 2021 is an outlier with COVID relief.

31 While not formally a state, IMPLAN considers the District of Columbia a de facto state economy
32 "Plastics packaging materials and unlaminated film and sheet manufacturing," "Polystyrene foam product manufacturing," and "Plastics bottle manufacturing"

33 The row for "TOTAL and "Direct"
34 The row for "TOTAL" and "Total"

The direct employment "at risk" in Table 4 – which is the sum of direct and indirect employment in the simulation of the aggregate impact of GSA expenditures – has an associated indirect effect and induced effect on the economy. When including those impacts on the suppliers and induced spending of the associated workers, the U.S. jobs "at risk" is roughly 4,000 as seen in Table 4.

Table 5 reformulates the results from Table 4 in terms of the U.S. sales output "at risk," which is the measurement of the total volume of business sales from the IMPLAN results. The proposed GSA rule would put approximately $400 million in U.S. sales output at risk,[35] with most of this concentrated within the plastics packaging sector and polystyrene foam sector with a comparatively diminutive amount from the manufacture of plastic bottles. This is intuitive because according to IMPLAN most plastic bottle consumption comes from households and not from government.

Table 5 – U.S. output "at risk" from proposed GSA rule (2022 $ millions)

IMPLAN Sector	Effect	FY 2019	FY 2020	FY 2021	FY 2022	Average
Packaging, film, and sheet	Direct	$187.5	$225.3	$352.7	$187.3	**$238.2**
Packaging, film, and sheet	Indirect	$245.9	$295.6	$462.7	$245.7	**$312.5**
Packaging, film, and sheet	Induced	$121.5	$146.0	$228.5	$121.4	**$154.3**
Packaging, film, and sheet	Total	$554.8	$666.9	$1,043.8	$554.4	**$705.0**
Polystyrene foam	Direct	$183.9	$224.2	$360.8	$178.4	**$236.8**
Polystyrene foam	Indirect	$241.7	$294.8	$474.4	$234.6	**$311.4**
Polystyrene foam	Induced	$123.9	$151.2	$243.2	$120.3	**$159.7**
Polystyrene foam	Total	$549.5	$670.2	$1,078.5	$533.3	**$707.9**
Plastics bottles	Direct	$17.4	$21.8	$35.7	$19.4	**$23.6**
Plastics bottles	Indirect	$24.2	$30.2	$49.5	$26.9	**$32.7**
Plastics bottles	Induced	$11.2	$14.1	$23.0	$12.5	**$15.2**
Plastics bottles	Total	$52.8	$66.1	$108.3	$58.7	**$71.5**
TOTAL >>	Direct	$388.7	$471.3	$749.2	$385.1	**$498.6**
TOTAL >>	Indirect	$511.8	$620.6	$986.6	$507.2	**$656.6**
TOTAL >>	Induced	$256.6	$311.2	$494.8	$254.2	**$329.2**
TOTAL >>	Total	$1,157.2	$1,403.2	$2,230.6	$1,146.5	**$1,484.4**

Economic activity "at risk" would increase further after accounting for the potential effect on plastics manufacturers' suppliers and induced expenditures of their employees. Table 5 shows output "at risk" to be between $1.15 billion (in FY 2019 and FY 2022) and $2.23 billion (if the COVID heights of FY 2021 were to replicate) with most of the impact being direct or indirect.

35 The row for "TOTAL' and "Direct"

Net Impact of the Proposed GSA Rule

While the results in Table 4 and Table 5 show the economic activity "at risk" for plastics and for the U.S. economy more generally, those tables do not yet account for the "offsetting" positive economic impacts of increased spending in other sectors. For example, if the GSA were to shift its expenditures through its vendors into alternative materials like glass, metal and paper, then economic sectors associated with those products would experience a boost in their sales orders and output.

To address this point and further advance the analysis, this subsection builds on the "at risk" analysis from the previous subsection to include impacts on the manufacturing sectors for plastic alternatives. It accounts for three countervailing factors:

1. **Alternative Gains** – Gained sales and employment for single-use plastics manufacturers
2. **Plastics Losses** – Lost sales and employment for single-use plastics manufacturers
3. **Taxpayer Impact** – To account for any difference in costs for the GSA between #1 and #2, a decrease in consumer expenditures representing higher taxes

Including the taxpayer impact is important to create a fair representation of the "net" impact of the proposed GSA rule in economic terms. Losses in the plastics sector and gains in the alternative sectors may offset one another or might even show a positive impact under a scenario where GSA increases total expenditures to cover the incremental costs of alternative materials.

Figure 5 – Example of the three offsetting IMPLAN input factors included in the "net" analysis (2022 $ millions)

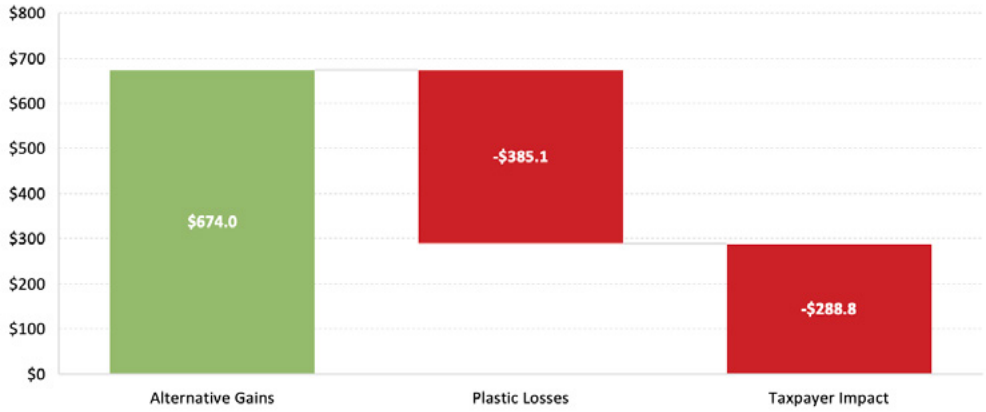


Figure 5 depicts a waterfall example of this logic. As previously shown in Table 5, GSA directly and indirectly purchased $385.1 million in single-use plastics in FY 2022. Using an assumption that alternatives would cost 75 percent more than plastics would translate into an output gain of approximately $674.0 million for sectors that produce these alternatives ($385.1 million x 1.75). We derived this assumption by taking the middle of a range of cost increase estimates found in our literature survey.[36] Lastly, the difference between the two, which is approximately $288.8 million, reflects costs to taxpayers.

36 Studies reviewed: http://www.ifo.state.pa.us/download.cfm?file=Resources/Documents/Single-Use%20Plastics%20Report-2020_06.pdf and https://www.plasticfoodservicefacts.com/wp-content/uploads/2017/10/NYC-Foodservice-Impact-Study.pdf

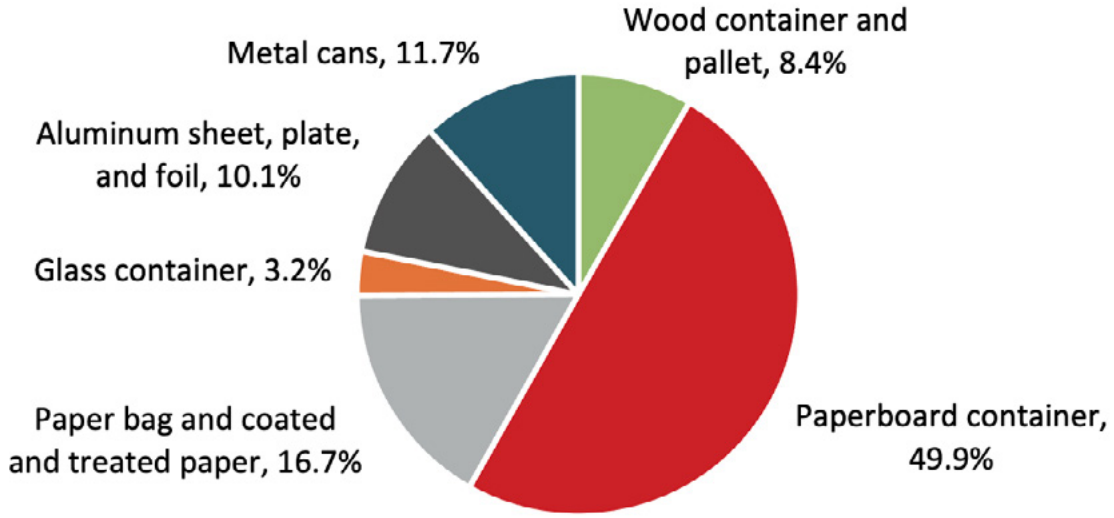
After performing the analysis on the inputs described in Figure 5, PLASTICS distributed the gains across sectors that produce alternatives to plastics in IMPLAN. These sectors include:

1. Wood container and pallet manufacturing
2. Paperboard container manufacturing
3. Paper bag and coated and treated paper manufacturing
4. Glass container manufacturing
5. Aluminum sheet, plate and foil manufacturing
6. Metal cans manufacturing

Within the U.S., these sectors collectively have and output of $152.9 billion per IMPLAN data. To distribute the alternative gains between these six sectors, their individual output was divided by $152.9 billion to produce their share of the group's total. While an estimate, this approach is reasonable because most of gains (74.9 percent) would accrue in three sectors covering wood and paper products. Given most of the activity "at risk" in Table 4 and Table 5 is associated with plastic packaging material, film and sheet and polystyrene, it makes sense much of the alternative gains would be in sectors producing paper products used for packaging.

Figure 6 shows the distribution of the gains across the six sectors:

Figure 6 – Distribution of the alternative gains across the six candidate sectors (percent)



Macroeconomic Results of Net Analysis

Table 6 shows a summary of the net macroeconomic impacts if the proposed rule were in effect from FY 2019 through FY 2022 and that alternative materials would have cost 75 percent more than the current suite of single-use plastics. On average, the switch to alternative materials would result in an average gain of 8,210 U.S. jobs in the alternative materials industries, though this would be offset by an average loss of 4,930 U.S. jobs in the single-use plastics industry and an average loss of 3,850 U.S. jobs from lower consumer expenditures after households dedicate more income to pay for GSA's higher costs.

Added together, the average net impact of the proposed rule would be approximately 560 U.S. jobs lost, depending on the level of GSA expenditures in a year and the relationship between GSA spending and single-use plastics demand. While the estimated job impacts in Table 6 may be small compared to the scale of GSA spending and the U.S. economy, they show that additional spending on alternatives to would not necessarily be adequate to replace losses occurring due to lower GSA spending on single-use plastics, meaning the proposed rule would likely result in a net negative impact on U.S. employment.

Table 6 – Net U.S. employment impact of proposed GSA rule (# of jobs)

Category	FY 2019	FY 2020	FY 2021	FY 2022	Average
Alternative Gains	6,400	7,760	12,330	6,340	**8,210**
Plastics Losses	-3,840	-4,660	-7,400	-3,800	**-4,930**
Taxpayer Impact	-3,000	-3,630	-5,780	-2,970	**-3,850**
TOTAL >>	-440	-530	-850	-430	**-560**

In conclusion, the main takeaways of the macroeconomic impact analysis include:

- GSA expenditures total hundreds of billions of dollars every fiscal year. Direct GSA spending on single-use plastics is relatively limited (around $2 million per year), but its indirect spending through vendors and suppliers is more extensive. According to this research, spending through GSA supports more than $400 million in plastic sales each year.
- The economic activity "at risk" in the plastics sector, its suppliers (e.g., other types of material and chemical manufacturers and "support" sectors such as transportation, information and business and professional services), and related induced expenditures would be larger still. According to Table 4, the average U.S. employment "at risk" between FY 2019 and FY 2022, assuming the proposed rule had been in effect, was 4,930. Translated into output or sales revenue terms, the average economic activity "at risk" over this period would have been $1.5 billion.
- This analysis addresses the position that fewer dollars spent on single-use plastics would mean more dollars spent on alternative materials, most likely paper and wood based on the pattern of direct and indirect GSA expenditures from Table 5. Additional expenditures on any alternative single-use plastics materials would be offset from lost sales and employment in the plastics sector as well as higher taxes on U.S. households, reducing overall household expenditures.
- Accounting for these three factors, the average net U.S. employment "at risk" from the rule being enforced between FY 2019 and FY 2022 would have been 560 jobs. The alternative materials, which would be mostly paper packaging, would have upwards of 8,200 more U.S. jobs, though that would be offset by 4,900 fewer jobs related to the plastics sector and its supply chain and 3,850 fewer jobs associated with lower after-tax incomes.
- The analysis assumes that increased federal expenditures must have some offsetting and negative impact. In other words, we assume the federal budget must balance over that long term and any increase in GSA expenditures would ultimately be passed on to U.S. taxpayers. Assuming borrowed money is entirely free would bias any economic impact analysis towards higher expenditures.

37 The same results as the "TOTAL" and "Total" row in Table 4

Benefits of Single Use Plastics Relative to Alternatives

In this section we describe the findings of our third-party literature review of the qualitative benefits of single-use plastics relative to alternatives.

Economic

Single-use plastics are generally a low-cost option compared to alternatives. For instance, a study by MB Public Affairs on behalf of the ACC found a ban on polystyrene foam for foodservice, drink containers and trays in New York City would cost $97.1 million per year.[38] New York has a population of 8.47 million, which is approximately 2.6 percent of the U.S. population of 331.89 million.[39,40] Scaling these results up would imply $3.8 billion more in costs nationwide for the economy.[41]

The same study found that New York consumers and businesses would need to spend at least 94 percent more on replacements, which would effectively double the cost. This 94 percent increase is effectively an "environmental tax" that is more costly than any other sales tax or import duty on consumer goods.[42]

A study conducted by the Pennsylvania Independent Fiscal Office concluded a ban on expanded polystyrene ("EPS") foam foodservice products would impact consumers, retailers and manufacturers, along with other firms in the supply chain. A negative economic impact would be driven by $159 million in higher costs for consumers forced to use more expensive alternative products and by reduced EPS production in Pennsylvania.[43]

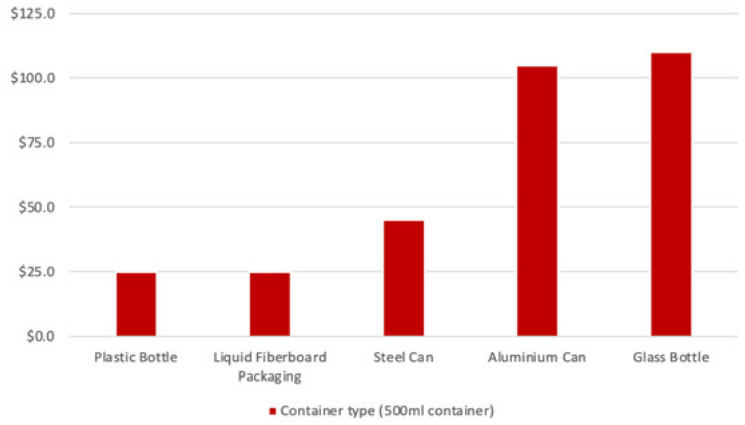
Requiring the GSA to eliminate single-use plastics would increase its costs and, therefore, reduce the financial resources available to support itself or other federal agencies. Higher appropriations from Congress would then require either more taxes or more federal debt.[44]

Environmental

According to the World Economic Forum, plastics packaging helps protect and preserve goods, reduces deadweight and increases payloads during shipment. This reduces the energy required to preserve and distribute products, which saves fuel and reduces greenhouse gas emissions.[45]

A study conducted by the Imperial College of London supports this conclusion. This study found that replacing plastic bottles globally with glass ones would result in additional carbon emission equivalent to powering around 22 large coal-fired power plants.[46] Further, the study noted that "this is equivalent to the electricity consumed by a third of the United Kingdom."[47] Figure 7 illustrates the greenhouse gas emissions created during the production process of different types of containers.

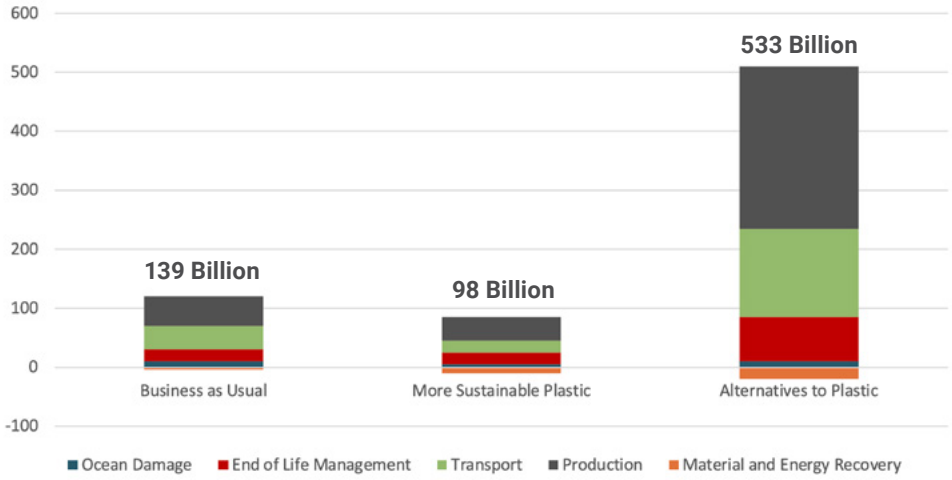
Figure 7 —Greenhouse Gas Emissions for Producing all 500ml Containers in 2016 from Alternative Materials[48]



38 https://www.plasticfoodservicefacts.com/wp-content/uploads/2017/10/NYC-Foodservice-Impact-Study.pdf
39 https://www.census.gov/quickfacts/newyorkcitynewyork
40 https://www.census.gov/quickfacts/fact/table/US/PST045221
41 $97.1 million * (331.89 million / 8.47 million) = $3.8 billion
42 https://www.plasticfoodservicefacts.com/wp-content/uploads/2017/10/NYC-Foodservice-Impact-Study.pdf
43 http://www.ifo.state.pa.us/download.cfm?file=Resources/Documents/Single-Use%20Plastics%20Report-2020_06.pdf
44 https://www.pgpf.org/the-fiscal-and-economic-challenge/fiscal-and-economic-impact
45 https://www.weforum.org/agenda/2019/10/plastics-what-are-they-explainer/
46 https://www.imperial.ac.uk/media/imperial-college/faculty-of-natural-sciences/centre-for-environmental-policy/public/Veolia-Plastic-Whitepaper.pdf
47 Ibid.
48 Ibid.

These findings are further supported by a study conducted by the ACC, which found that global replacement of consumer products using plastics packaging with alternatives like aluminum and glass would increase the environmental cost of packaging fourfold.[49] The ACC research estimates substituting plastics in consumer products and packaging with alternatives performing the same function would increase environmental costs by $394 billion, as illustrated in Figure 8.

Figure 8 — The Global Environmental Cost of Business-as-Usual Plastic, Alternatives to Plastic and a More Sustainable Plastic in Consumer Goods [50]



Health and Safety

Plastic shopping bags do not pose the same risk to human health as reusable cloth shopping bags. For example, a study by the University of Arizona found 51 percent of all reusable cloth shopping bags contained coliform bacteria and 12 percent contained E. coli, indicating the presence of fecal matter and pathogens.[51] A study from the *New England Journal of Medicine* found COVID-19 can live up to three days on polypropylene, a common material used in reusable bags as an alternative to single-use plastic.[52]

In 2012, health inspectors in Sacramento County, California performed a controlled experiment where they swabbed nearly 300 single-use and multiuse cups, plates, bowls and cutlery in restaurants. Their findings were such that single-use items were shown to be more sanitary with statistically significant lower bacteria counts compared to reusable items.[53] One-third of reusable plates and bowls tested had higher than recommended microbial levels compared to 9 percent of single-use items. One-quarter of the reusable forks, knives and spoons tested had higher than recommended microbial levels compared to approximately 10 percent of the same dining implements as single-use versions.

Because of the durability of plastics, they can be used to make medical safety devices such as tamper-proof caps on medical packaging, blister packs and various medical waste disposal bags. Plastics are also shatter-proof, making them an ideal material for storage and transportation. Furthermore, by using protective coatings, plastics can be used to effectively preserve the integrity of other materials. Plastics are also widely used to make non-permeable biohazard bags for transporting materials, eliminating the need to sterilize and reuse the device, thus helping prevent the spread of dangerous diseases.[54]

49 https://www.americanchemistry.com/content/download/6921/file/Plastics-and-Sustainability-A-Valuation-of-Environmental-Benefits-Costs-and-Opportunities-for-Continuous-Improvement.pdf
50 Ibid.
51 https://lluh.org/sites/lluh.org/files/docs/LIVE-IT-Sinclair-Article-Cross-Contamination-Reusable-Shopping-Bags.pdf?rsource=medical-center.lomalindahealth.org/sites/medical-center.lomalindahealth.org/files/docs/LIVE-IT-Sin
52 https://www.businessinsider.com/coronavirus-lifespan-on-surfaces-graphic-2020-3
53 https://fpi.org/resource-type/sanitation/
54 https://www.mpo-mag.com/contents/view_online-exclusives/2017-10-09/5-ways-plastics-revolutionized-the-healthcare-industry/#:~:text=Plastics%20have%20been%20used%20widely,and%20re%2Duse%20a%20device.