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Quantifying the Potential Economic Impacts of a Ban on Polystyrene foam Foodservice Products in California

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Executive Summary

For more than half a century, the foodservice industry has used food containers made from polystyrene (PS) foam. Despite the fact that PS foam foodservice products are generally much more affordable and have superior physical properties as compared to similar products made from other materials, legislators in California at both the state and local levels are considering banning the use of PS foam foodservice products by food vendors in the state.

In order to inform the public policy debate in California, this analysis provides a macroeconomic assessment of the impact that a PS foam foodservice product ban would have on the state, including direct and indirect effects on jobs, earnings, and output. Direct effects of the ban were calculated as the total losses and gains in output, earnings, and jobs resulting from decreased demand for California-made PS foam foodservice products and increased demand for California-made substitutes for PS foam foodservice products. Estimated direct effects also include losses in consumer purchasing power for other goods and services, as a result of consumers having to pay more for higher priced alternatives to PS foam foodservice products. Direct impacts on PS foam foodservice product manufacturers were based on confidential data provided to Keybridge Research by the operators of all PS foam foodservice product manufacturing facilities in California. Other direct impacts were based on manufacturing data provided by the U.S. Census Bureau and foodservice product price data from various sources.

Indirect economic impacts include the ripple effects that these initial direct economic impacts have throughout the state economy. These include impacts resulting from changes in demand for material and labor inputs used during the manufacture of PS foam foodservice products and their substitutes, as well as changes in the purchasing power of employees working in those facilities. These indirect impacts were estimated using California-specific economic multipliers provided by the U.S. Department of Commerce's Bureau of Economic Analysis.

The overall impacts are the combined direct and indirect impacts. The main findings of the analysis include:

- Reduced demand for PS foam foodservice products in California and the resulting plant closures are estimated to bring about losses of more than $1 billion in California output, $222 million in California earnings, and 4,800 California jobs.
- Increased demand for PS foam product substitutes that are made in California is estimated to result in gains of just over $250 million in California output, $50 million in California earnings, and 1,200 California jobs.
- Reduced purchasing power of foodservice product consumers is estimated to reduce California output by about $600 million, California earnings by $169 million, and California employment by nearly 4,400 jobs.

Combining all of these effects, the study estimates the overall economic impact on the California economy, estimating overall losses of nearly $1.4 billion in output, $335 million in earnings, and almost 8,000 jobs. Furthermore, a supplementary analysis included in this report estimates that losses of tax revenue and the added cost of foodservice products for state-funded agencies will have significant and negative fiscal impacts on state budgets.

I. INTRODUCTION

Polystyrene (PS) foam has emerged in the past half century as a key building block of common consumer products and as a staple of modern societies. PS foam is a petroleum-based plastic resin that is remarkable for its affordability, light weight, resistance to moisture, and insulating properties. Although PS foam has a wide variety of applications throughout the economy, the foodservices industry in particular has benefited from its superior performance as a highly functional and low cost foodservices packaging material. Indeed, PS foam -based products, such as hot and cold beverage cups, plates, trays, containers, and hinged take-out boxes (clamshells), are used throughout the foodservices industry to increase efficiency, reduce costs, and maintain food freshness and quality.

The same properties that make PS foam products well-suited as a food packaging material, however, also make them a particularly challenging and highly visible form of litter when disposed of improperly, especially in marine environments. This creates an unfortunate situation in which popular perceptions of PS foam foodservice products are largely based on the highly visible and localized costs associated with their improper disposal, rather than the less visible and diffuse benefits associated with their production, use, and proper disposal.

Primarily due to such perceptions, some policymakers contend that a legislative ban on PS foam products in the foodservice industry is appropriate. However, an outright product ban is an exceptionally blunt policy instrument that must be wielded with extreme care. Public policies should be based on a balanced accounting of the intended costs and benefits, as well as recognition of potential negative unintended consequences. The extreme nature of a product ban heightens the policymaker's duty to perform due diligence including comparison of all the life cycle impacts of these products with possible substitutes and to search for alternative instruments that can achieve the same policy objectives at a lower cost. Otherwise a ban may simply solve one public policy problem while unintentionally creating another.

Given these considerations and recognizing that such legislation is currently under debate, the following analysis aims to quantify the potential economic impacts associated with banning the use of PS foam foodservice products in California. The goal of the analysis is to inform the public policy debate in California by evaluating how a ban may impact economic outcomes for a variety of stakeholders and the California economy as a whole.[1]

With this goal in mind, the analysis provides a macroeconomic assessment of the impact that a ban on PS foam foodservice products would have on California, including the direct and indirect impacts on jobs, earnings, and output associated with:

- Decreased production in the California PS foam industry,

[1] The analysis does not consider or attempt to quantify non-market outcomes, such as changes in energy or environmental outcomes, associated with such a ban.

- Increased production in California industries that manufacture replacement products, and
- Increased consumer costs due to the higher prices associated with replacement products.

A supplementary analysis included in Appendix C examines the impacts that increased foodservice product costs resulting from a PS foam foodservice product ban could have on state and local government budgets, including state agencies, school districts, and public universities.

II. BACKGROUND: POLYSTYRENE FOAM

Polystyrene is a commonly used petroleum-based plastic resin. At its most basic level, polystyrene is a polymer – that is, a macro molecule comprised of a long chain of styrene hydrocarbons that are linked together during a process called polymerization. Produced commercially for the first time in the 1930s, polystyrene has become one of the most popular types of plastic with a wide variety of applications, including toys, appliance casings, packaging materials, and office supplies.

Polystyrene foam has also been produced commercially for several decades. There are three types of processes used to make PS foam products:

1. Extrusion and thermoforming is a two-step process in which molten polystyrene and an expansion (blowing) agent are mixed to create foam material, which is extruded into sheets. The sheets are then thermoformed into the shape of the packaging product, then die-cut into commonly manufactured PS foam foodservice products like egg cartons, hinged containers (clamshells), dinnerware, and meat, poultry and produce trays;
2. Steam chest molding which involves the use of expanded polystyrene (EPS) beads. EPS contains an expansion agent, which is added to the beads either in the polymerization plant or in a separate impregnation process. This process is used to make most PS foam cups, as well as protective (cushion/transport) shape-molded PS foam products; and
3. Extruded board insulation involves expanding the polystyrene using an expansion agent, and extruding the polystyrene boards into a final product. Examples of this process are the Dow Styrofoam™ blue board insulation product used in building and construction applications.

PS foam is remarkable for its affordability, light weight, resistance to moisture, and superior ability to provide insulation. These unique properties lend themselves to several niche applications, including as insulation for heating systems, walls, or ceilings; protective packaging for electronics or as loose fill ("packing peanuts.") PS foam has also been deemed safe for use in contact with food by regulatory agencies including U.S. Food and Drug Administration (FDA) and has been used in foodservice products – cups, plates, takeout containers, trays, etc… – for more than five decades. For a variety of reasons, it is a uniquely well-suited material for use in these disposable foodservice containers:

- PS foam cups are significantly sturdier and more heat-resistant than either paper or hard plastic alternatives, and they do not conduct heat or lose their shape when holding hot beverages. This prevents the need to "double-cup" or use paperboard or corrugated sleeves, reducing waste and reducing costs.
- Food trays made from foam are light but sufficiently sturdy to hold heavy and even oily food products without tearing or leaking.
- Prepared hot and cold foods for sale by many food vendors are stored and sold in lidded foam containers that insure insulation and block air exposure, prolonging the life of foods and eliminating spoilage and waste.
- PS foam is inert and very stable, which are critical requirements in sanitary applications. Also, PS foam's chemical composition is not conducive to bacterial growth, which provides hygienic benefits to perishable foods stored in PS foam containers. These benefits are a major reason why PS foam foodservice products are so frequently used in hospitals, schools, nursing homes, cafeterias and restaurants where it is critical that the foodservice ware in contact with food be clean and hygienic.
- Polystyrene foam products are more affordable than both competing disposable food packaging materials and reusable dishes. Polystyrene foam cuts costs and increases operating efficiency when factoring in the additional resources required by "permanent ware", including equipment, labor, detergents, water and electricity resources to run dishwashers, and wastewater management.

III. Estimating Macroeconomic Impacts

The economic impact of a ban on PS foam foodservice products in California depends on a variety of factors, including:

- The extent to which PS foam product inputs are produced within the state,
- The ability of California's polystyrene foam industry to export its product or retool its factories to manufacture other products,
- The extent to which PS foam foodservice product substitutes can be manufactured within the state, and
- The cost differential between PS foam products subject to the ban and their substitutes.

The economic impact of a legislative ban on PS foam can be disaggregated into three effects: direct, indirect, and induced effects. The direct effects of a ban will include changes in output, earnings, and employment at PS foam product manufacturing facilities within the state and at manufacturing facilities that make alternative products. The resulting changes in production will lead to changes in demand for inputs used in those facilities, such as plastic resins, electric power generation, and engineering services. As a result there will be a number of indirect effects, including decreased output, earnings, and employment in upstream industries. Finally, changes in the earnings of employees working at affected facilities will impact their consumption of goods and services in the local community. These impacts are referred to as induced effects.

Furthermore, in addition to the direct, indirect, and induced impacts resulting from changes in demand for PS foam foodservice products and substitute products, a ban is likely to result in increased costs for downstream businesses and institutions, which will ultimately be passed through to consumers in the form of higher prices. Although the increased costs are likely to appear small on a per unit basis, the collective costs throughout California would likely be substantial – reducing the purchasing power of California households and decreasing demand throughout the broader economy.

The current study quantifies direct, indirect, and induced effects by performing three separate analyses:

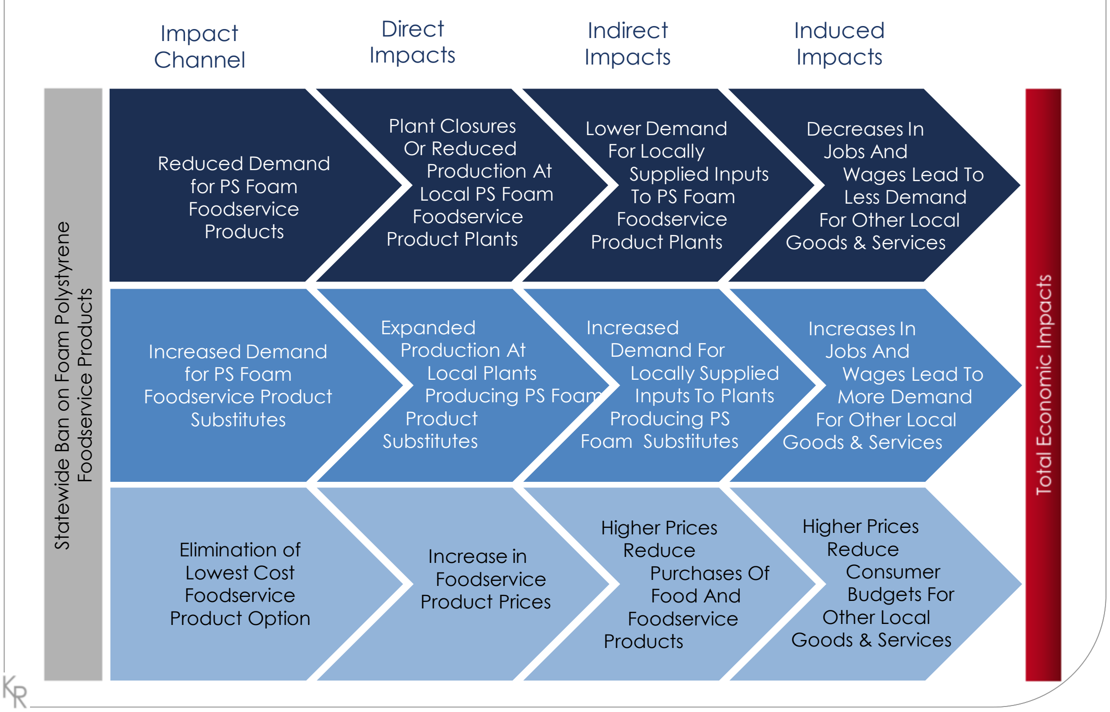
(1) An analysis of the impact of decreased final demand for PS foam products on the California polystyrene manufacturing industry and dependent industries within the state.

(2) An analysis of the impact of increased final demand for alternative products on competing California industries and dependent industries within the state.

(3) An analysis of the impact on the overall California economy due to increased costs associated with switching from PS foam products to alternative products.

The overall estimated impact on the California economy of a PS foam product ban is represented by the sum of these individual effects.

Figure 3.1: Both Positive and Negative Effects Of A Statewide Ban On PS Foam Foodservice Products Will Ripple Through the California Economy.



3.1 The Impact of Changes in Final Demand for Foam PS Products

3.1.1 Methodology

A state-wide ban on PS foam foodservice products is likely to result in either closure or significant downsizing of California-based PS foam product manufacturing facilities. This analysis assumes that a ban on PS foam foodservice products will result in the closure of facilities. The assumption is supported by a variety of economic realities:

- The cost per unit of PS foam foodservice products increases significantly when shipped over long distances. Consequently, PS foam product manufacturers tend to locate close to demand centers and most PS foam products manufactured in California are also distributed in California. If the California consumer base were diminished, existing California facilities are unlikely to competitively sell their PS foam products outside of the state.
- PS foam foodservice products constitute the majority of the output in the PS foam product manufacturing facilities, and the loss of such an important revenue stream would likely require plants to terminate all operations and product lines.
- Equipment used to produce PS foam foodservice products is highly specialized and efforts to retool facilities to produce products not subject to the ban would likely require full recapitalization.

To estimate the impact of plant closings, proprietary data was collected for California plants that would be affected by a ban on PS foam foodservice products. Assuming that these facilities would be forced to entirely terminate operation, the direct impact of the product ban is calculated as the loss of the direct output, earnings, and employment contributions made by these PS foam facilities to the California economy. Table 3.1 shows these estimated direct impacts.

Table 3.1 - Direct Impacts on PS Foam Foodservice Product Ban

Number of Severely Impacted California Facilities	6
Number of Employees	1578
Full Time	1408
Part Time	170
Household Earnings	$74,679,558
Output (Including some non PS Foam products)	$427,490,194

Source: Company Data

The ultimate impact of the ban, however, would extend much further than PS foam product manufacturing facilities. These facilities rely on a variety of inputs, the majority of which are supplied from other businesses within the California economy. As a result, the direct impact of plant closings would "ripple" throughout the economy, indirectly impacting upstream suppliers, downstream consumers, and the local communities that rely on those industries.

These indirect and induced impacts are estimated using "economic multipliers." The Regional Input-Output Modeling Systems II (RIMS II) from the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) provides economic multipliers for output, employment, and earnings of nearly 500 different U.S. industries, including the polystyrene foam manufacturing industry. This study uses California-specific multipliers based on the RIMS II model.[2] These economic multipliers account for both indirect and induced impacts without distinguishing between them. Hence, this analysis also does not distinguish between indirect and induced and instead uses the term "indirect" to refer to both.

In instances in which sufficient data is available, the so-called "bill of goods" approach is the preferred method to calculate the overall impacts on output, earnings, and jobs.[3] This approach requires the decomposition of plant expenditures into key categories – such as compensation, healthcare benefits, electricity, real estate, truck transportation, and polystyrene resin – and a breakdown of the extent to which each of these inputs is purchased inside or outside the state.

Data on the decomposition of plant expenditures and the proportion of in-state and out-of-state purchases was provided directly by those companies with PS foam product manufacturing facilities within the state. When combined with the appropriate economic multipliers, such data allows for the quantification of the indirect impacts created as a result of spending in each individual expenditure category. These impacts are then summed to estimate total indirect economic impacts associated with PS foam plant closings.

To illustrate, of the $427 million in total revenue earned by the six foodservice product manufacturing facilities, about $311 million was spent on plant inputs that were sourced in California. These include labor, polystyrene resin, machinery, and electric power among others. The closure of the California PS foam foodservice product manufacturing facilities would not just peril the jobs and economic output of those plants. They would also lead to an approximate $311 million decrease in demand for inputs sourced in California, causing further job and output losses that will have their own indirect effects. The sum of all indirect effects is estimated by multiplying the initial decrease in demand in each of the expenditure categories by multipliers that are specific to those categories. Table 3.1 below shows a disaggregated breakdown of indirect impacts resulting from each category of reduced expenditures. Overall, the indirect impacts of the reduced demand for PS foam foodservice products on the California economy include about $600 million in reduced output, nearly $150 million in reduced earnings, and the loss of about 3,200 jobs.

[2] See Appendix A for a more thorough description of the RIMS II model and multipliers.

[3] U.S. Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997.

Table 3.2: Detailed Expenditure Data and Indirect Economic Impacts of Reduced PS Foam Foodservice Manufacturing

NAICS code	**Supplying Industry**	**California Expenditures**	Output Multipliers	Indirect Output Impacts	Earnings Multipliers	Indirect Earnings Impacts	Jobs Multipliers	Indirect Jobs Impacts
H00000	Compensation of employees	$74,679,558	1.59	$118,792,772	0.450	$33,583,397	11.60	826
2211A0	Electric power generation, transmission, and distribution	$11,954,714	1.78	$21,308,082	0.416	$4,976,747	6.79	77
722000	Food services and drinking places	$215,000	2.44	$525,632	0.772	$165,894	32.97	7
525000	Funds, trusts, and other financial vehicles (proxy for pension contributions)	$2,183,755	3.16	$6,898,044	0.884	$1,929,784	15.26	32
622000	Hospitals (proxy for health insurance)	$7,084,690	2.53	$17,900,885	0.893	$6,329,462	19.34	131
7211A0	Hotels and motels	$671,134	2.15	$1,443,207	0.686	$460,532	19.70	13
221200	Natural gas distribution	$6,799,436	2.02	$13,736,221	0.392	$2,663,339	6.19	40
333220	Plastics and rubber industry machinery (proxy for depreciation)	$7,643,341	2.01	$15,385,281	0.518	$3,960,015	11.12	81
3221A0	Pulp, paper, and paperboard mills	$5,142,388	1.94	$9,991,146	0.400	$2,055,927	7.82	38
531000	Real estate	$3,147,886	1.75	$5,507,227	0.315	$990,640	9.39	28
H00000	Taxes on production and imports, less subsidies	$3,451,691	1.59	$5,490,605	0.450	$1,552,225	12.17	38
484000	Truck Transportation	$29,291,918	2.32	$67,869,374	0.647	$18,948,942	15.61	415
493000	Warehousing and storage	$8,322,434	2.28	$18,964,330	0.816	$6,793,603	21.73	164
221300	Water, sewage and other systems	$769,467	2.08	$1,604,031	0.572	$440,443	11.76	8
	Foam products manufacturing*	$149,795,730	1.99	$297,804,813	0.416	$62,380,900	8.70	1,303
	Total	$311,153,141		$603,221,650		$147,231,850		3,201

*The companies submitting data were unable to disaggregate all of their expenses. Any expenses that were not specifically assigned to other categories were included in the "Foam products manufacturing" category and the indirect impacts of those expenditures were estimated using multipliers for the "Foam products manufacturing" industry (NAICS 3261A0). The v alue shown in this table include those expenditures as well as expenditures in categories for which v alues were obtained from just one of the three companies. These v alues were lumped together in this table in order to protect company confidentiality. The multipliers shown for this category are weighted av erages of the actual multipliers

3.1.2 Results: The Direct & Indirect Impacts of Decreased Final Demand for PS foam Products

Aggregating both the direct and indirect impacts, the results indicate that the closure of the six plants involving three manufacturers that produce PS foam products in California would result in a decrease of more than $1 billion in California output, a decrease of $222 million in California earnings, and the loss of about 4,800 California jobs. Table 3.3 summarizes these impacts.

Table 3.3: The Direct and Indirect Negative Impacts of Decreased Final Demand for PS Foam Foodservice Products

	Direct Impacts	Indirect Impacts	Total Impacts
Output	$427,490,194	$603,221,650	$1,030,711,844
Earnings	$74,679,558	$147,231,850	$221,911,407
Employment	1,578	3,201	4,779

3.2 The Impact of Increased Final Demand for PS foam Product Substitutes

3.2.1 Methodology

Although a statewide ban on the use of PS foam foodservice products is likely to eliminate the manufacturing of those products in California, it will also likely increase the demand for alternative products and potentially increase production of alternative products within the state. Specifically, the ban may result in direct effects that include an increase in output, earnings, and employment at facilities in California that are manufacturing alternatives to PS foam foodservice products. These impacts will be determined by the overall increase in demand for those products and the ability of Californian industries to scale up production to meet an increase in demand.

Estimating Demand for Various PS foam Foodservice Product Substitutes

Three factors that will determine the value of new demand for PS foam product substitutes include:

(1) How demand for PS foam foodservice products will be redistributed among alternative products in the event of a ban,

(2) The price differential between PS foam products that are currently being consumed and substitute goods, and

(3) The demand price elasticity of the disposable foodservice products.

The first task is to estimate how demand for PS foam foodservice products will be redistributed among alternative products in the event of a ban. PS foam has a host of qualities that make it well-suited for use in a variety of foodservice needs. No other material suitable for use in single-use foodservice containers meets all of the needs that PS foam products meet. For example, rigid plastic containers lack the insulation properties of PS foam containers making them a poor substitute for PS foam hot beverage cups; coated paper is not rigid enough to be used in cafeteria trays; many PLA/starch materials melt when exposed to temperatures that are considered normal for hot foods and beverages. For these reasons and many others, a ban on PS foam would mean that a combination of alternative materials will be required to meet the functional needs of the foodservice industry.

This analysis assumes that the demand for PS foam foodservice products will be redistributed among alternative products in the following manner:

Table 3.4: Assumed Proportions of PS Foam Product Replacement Under an PS Foam Ban

	Other Plastics (Rigid PS, PP, APET)	Bagasse/Wheat Straw/Molded Fiber	Coated Paper	Aluminum	PLA/Starch/ Compostables
Cups	20%	…	70%	…	10%
Plates/Bowls	10%	40%	40%	…	10%
Clam Shells	30%	50%	10%	…	10%
School trays	…	60%	…	…	40%
Meat trays	10%	20%	10%	…	60%
Other 1pc/2pc containers	40%	20%	20%	10%	10%

Source: Estimates provide by Pactiv Corporation

The second task in estimating the impact of a shift in demand toward alternative products is to estimate the relative cost differences between existing PS foam foodservice products and their likely substitutes. Prices for PS foam foodservice products and substitute products were collected from multiple sources, including contracts between state agencies and foodservice supply vendors and PJP Marketplace (an online wholesaler of foodservice supplies). In all instances, price data for a particular PS foam product and its non-PS foam substitute were taken from the same source. The price differentials are given in Table 3.5. Prices for PS foam product substitutes are expressed as percentage markups from the price of the PS foam products that they would replace.[4]

Table 3.5: Relative Price Increases from PS Foam Product Substitutes

(Percentage Markup as Compared to PS Foam Alternative)

	Other Plastics (Rigid PS, PP, APET)	Bagasse/Wheat Straw/Molded Fiber	Coated Paper	Aluminum	PLA/Starch/ Compostables
Cups	131%	…	128%	…	259%
Plates/Bowls	90%	131%	44%	…	11%
Clam Shells	140%	214%	337%	…	279%
School trays	…	86%	…	…	292%
Meat trays	117%	115%	19%	…	205%
Other 1pc/2pc containers	108%	70%	132%	179%	182%

Source: Various contracts between state agencies and food service supply vendors and PJP Marketplace

The third task in estimating demand for PS foam product substitutes is to determine the price elasticity of demand for disposable foodservice products. In general, the cost of disposable food containers represents a small fraction of the overall cost of food and beverages. Therefore,

[4] A price markup of 100% means that the substitute product costs twice as much as an equally-sized PS foam product.

even a substantial increase in the price of disposable food containers is likely to only slightly impact the full price of a meal. This increase will reduce consumption to some extent as consumers on the margin will decide to reduce their consumption of meals whose prices are impacted by the ban, but disposable food container demand will be only marginally affected, indicating low demand elasticity.

The price elasticity of demand for these containers is also likely to be low at the institutional level. Restaurants and cafeterias need to serve take-out food and fast food in some kind of container. The majority of foodservice vendors who currently serve food in single-use PS foam containers are likely to react to a ban by switching to alternative single-use containers, as a more dramatic shift toward reusable dishes would have a much greater impact on their operations and their costs. Hence, at both the institutional and the consumer levels, it is likely that the price elasticity of demand is low. This study assumes a price elasticity of -0.1 meaning that a 100% price markup from a PS foam product to the substitute product would lead to a 10% reduction in the consumption (in units) of that item.[5]

Estimating California's Capacity to Produce PS foam Product Substitutes

To the extent that California can increase its production of PS foam substitutes in order to meet demand, some of the negative impacts on California's PS foam product manufacturing industry may be offset with positive impacts to California's manufacturers of PS foam product substitutes. However, California will not be able to simply scale up production in these industries. While there will be some ability to increase production at existing facilities if they are currently producing at less than full capacity, without significant investments in new manufacturing facilities – a prospect that California should not rely upon – it is likely that much of the increase in demand will be met by imports. Accordingly, this study does not assume that new facilities to produce PS foam substitutes will be built. It does make the assumption that existing California facilities that produce alternatives to PS foam foodservice products will be able to scale up production by 20%. Sensitivity analysis was conducted using the even more conservative assumptions, including the assumption that California could increase its production of PS foam alternatives by 50% and even 100% in order to meet increased demand.[6] The results of this sensitivity analysis are shown in Appendix B.

In order to estimate the change in output required to scale up PS foam substitute industries by 20% (or 50% or 100%), it is essential to know or estimate the current output of those industries in California. Such estimates were derived from a combination of reports and data published by the U.S. Census Bureau. The Census' *Industry Series* provides detailed manufacturing data for specific products (e.g. "pressed paperboard plates, dishes, spoons, & similar products") that are broken down at the state level. The *2007 Economic Census* provides detailed 2007 manufacturing data for specific products, but only at a national level. California's share of

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[5] The sensitivity of this assumption was tested using elasticities of 0 and -0.2 and the results are shown in Appendix B.

[6] A conservative assumption is defined here as an assumption that is likely to reduce the overall negative economic impact estimated in this study.

national production was derived from various *Industry Series* reports and extrapolated onto the *2007 Economic Census* data. Data were then adjusted for inflation and an assumed annual industry growth rate of 1% in order to reflect California's 2008 production of these products. Table 3.6 shows the resulting estimates of California's 2008 production of PS foam substitute products.

Table 3.6: Estimated Current California Production of PS Foam Product Substitutes

Plastic	
Trays/containers/clamshell	$45,072,404
Dinnerware/Tableware	$317,834,294
Plastic cups	$480,837,130
Molded Fiber	
Trays/containers/clamshell/ plates/bowls	$49,822,226
Coated Paper	
Plates/bowls	$31,030,814
Paper cups	$130,557,931
Containers	$339,665
Clamshells	$34,815,872
Aluminum	
Containers	$21,008,409
PLA	
Plates/bowls	$0
Paper cups	$0
Containers	$0
Clamshells	$0

Source: Keybridge calculations based on U.S. Census Bureau data.

The increased estimates of output, earnings, and employment in California facilities that produce PS foam product substitutes represent positive direct impacts of a ban on PS foam foodservice products. The ripple or indirect effects of those positive impacts were estimated using a simpler approach than the "bill of goods" approach outlined in the previous section.[7] This simpler approach involves multiplying the estimated increase in output for each type of substitute good by an appropriate set of output, earnings, and jobs multipliers and then summing the effects.

3.2.2 Results: The Direct and Indirect Positive Impacts of Increased Final Demand for Polystyrene foam Product Substitutes

[7] This approach is recommended by the U.S. Bureau of Economic Analysis when data on plant expenses are unavailable. PS FOAM prospect substitute plant expenditure data is in fact unavailable and thus this simpler approach was used.

Under the assumption that California's manufacturing capacity for PS foam product substitutes could increase by 20%, the study concludes that paper cups, plates, and bowls are the only products for which increases in demand can be met through increased production in California. Increases in demand for other PS foam foodservice product substitutes would need to be met, at least in part, by an increase in imports (shipments to California from other states or foreign countries).

Using the simpler multiplier approach described above, the estimated additional output of California-made substitutes for PS foam products were multiplied by material-specific and California-specific final demand multipliers, ranging from 1.87 for coated paper to 2.05 for aluminum. The analogous earnings and employment multipliers were applied for earnings and jobs. The total positive impacts of increased demand for PS foam product substitutes include increases of more than $250 million in output, more than $50 million in earnings, and more than 1,200 jobs. The results of these impacts are summarized in Table 3.7.

Table 3.7: The Positive Impacts of Increased Final Demand for PS Foam Foodservice Product Substitutes

	Other Plastics (Rigid PS, PP, APET)	Bagasse/Wheat Straw/Molded Fiber	Coated Paper	Aluminum	PLA/Starch/ Compostables	Total
New Demand for Alternatives	$186,092,026	$220,578,355	$303,860,557	$18,615,087	$135,521,847	
Increase in California Production	$80,921,598	$9,964,445	$39,348,856	$4,201,682	$0	$134,436,582
Output Multipliers	*1.94*	*1.98*	*1.87*	*2.05*	*1.97*	
Total Increase in Output	**$156,874,611**	**$19,721,630**	**$73,664,994**	**$8,596,221**	**$0**	**$258,857,455**
Earnings Multipliers (per $ output)	*0.41*	*0.41*	*0.41*	*0.41*	*0.41*	
Total Increase in Earnings	**$33,153,579**	**$4,742,079**	**$16,994,771**	**$1,621,849**	**$0**	**$56,512,279**
Jobs Multipliers (per million $ output)	*9.12*	*10.24*	*8.59*	*7.85*	*9.81*	
Total Increase in Employment	**738**	**102**	**338**	**33**	**0**	**1,211**

Source: Keybridge calculations based on data from the U.S. Census Bureau data and the Foodservice Packaging Institute. Economic multipliers come from the U.S. Bureau of Economic Analysis RIMS II model.

3.3 The Impact of Increased Costs on Consumer Purchasing Power

Alternatives to PS foam products in California cost, on average, more than twice as much as their PS foam counterparts. As the cost of packaging materials are inevitably passed to final consumers, a ban on PS foam products would result in significant impacts on the purchasing power of California consumers. While consumers may only see a $0.10 or $0.20 increase in the price of a takeout meal, the cumulative costs will cause consumers, in aggregate, to have less money to spend on all other goods and services. Lost purchasing power not only lowers spending in other areas of the economy, but like demand for PS foam products and their alternatives, consumer spending has ripple effects throughout the economy.

3.3.1 Methodology

The key factors determining the direct impact of a PS foam ban on consumer purchases in other areas of the economy include the current consumption of PS foam products, the relative prices of PS foam products and their alternatives, and the price elasticity of demand for single-use foodservice products. Estimates of California consumption are based on the Foodservice Packaging Institute's 2004 Market Research Study on Foodservice Packaging Products. The study provided national consumption data in units for 2004. The data was scaled up to account for assumed growth of 1% per year since 2004 and California was assumed to represent a share of that consumption that is proportional with its share of the nation's population. Overall, the study estimates that Californians consumed about 7 billion polystyrene foam cups, plates, bowls, and other foodservice containers in 2008.

California PS foam consumption in dollars was calculated by multiplying consumption of each product type (e.g., cups) by the average prices for PS foam cups, bowls, plates and other containers as given on PJP Marketplace's website. Overall consumption of PS foam products in California is estimated to equal $320 million. Using the average price markups discussed in section 3.2 and an assumed price elasticity of -0.1, the increased consumption of PS foam substitute products that would occur under a ban was calculated to be almost $700 million. The difference between what is currently spent on PS foam products and what would be spent on PS foam substitutes represents the direct loss to consumers of having to pay more for a product that arguably has no additional value to them. The estimation of this direct loss is shown in Table 3.8.

Table 3.8: Estimating the Direct Consumer Impacts of Increased Costs of PS Foam Foodservice Product Substitutes

		Cups	Plates, Platters or Bowls	Hinged Containers	Cafeteria Trays	Total
Foam Polystyrene Foodservice Products						
2004 U.S. Consumption	million units	32,455	10,716	10,699	2,864	56,734
2008 U.S. Consumption	million units	33,773	11,151	11,133	2,980	59,037
2008 California Consumption	million units	4,053	1,338	1,336	358	7,084
Average Prices	cents per unit	3.7	2.5	8.7	5.5	
2008 California Consumption	million $	$150	$33	$116	$20	$319
Substitute Foodservice Products						
Average Prices	cents per unit	8.9	4.5	27.0	14.8	-
Price Elasticity		-0.10	-0.10	-0.10	-0.10	-
2008 California Consumption of Substitutes Under PS Foam Product Ban	million units	3,479	1,231	1,055	297	6,061
Cost of Alternatives	million $	$311	$55	$285	$44	$695
Loss of Consumer Purchasing Power	**million $**	**$161**	**$22**	**$169**	**$24**	**$376**

This direct impact on consumer purchasing power was then multiplied by California-specific RIMS II multipliers for household income in order to calculate the overall negative impacts that higher prices for disposable foodservice products would have on the California economy.

3.3.2 Results

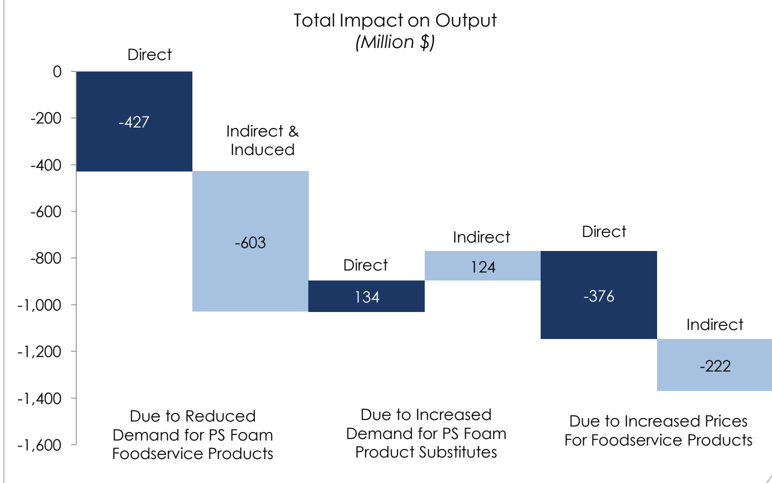
A ban on PS foam foodservice products in California is estimated to increase consumer spending on disposable foodservice products by about $376 million. That $376 million is disposable income that can no longer be spent on other consumer goods and services. As demand for those other goods is reduced, the California economy will suffer reductions in income, earnings, and employment. Like the negative and positive impacts of the ban discussed in previous sections, the direct impacts from reduced consumption of other goods have indirect or ripple effects that further reduce output, earnings, and employment. Overall, the reduced purchasing power of consumers is estimated to reduce California output by about $600 million, earnings by $169 million, and employment by nearly 4,400 jobs. Table 3.9 summarizes these results.

Table 3.9: The Total Negative Impacts of the Increased Cost of Disposable Foodservice Products

	Direct Impacts	Indirect Impacts	Total Impacts
Output	$376,105,356	$222,165,434	$598,270,789
Earnings	$106,327,138	$62,807,440	$169,134,578
Employment	2,743	1,620	4,363

3.4 Combined Macroeconomic Impacts

Figure 3.2: Estimated Macroeconomic Impact Of A State-wide Ban On PS Foam Foodservice Products



Source: Keybridge Research Calculations

The estimated macroeconomic impacts of banning PS foam foodservice products on the overall California economy is the sum of all of the components discussed above: the negative impact of decreased final demand for PS foam products, the positive impact of increased final demand for alternative products, and the negative impacts on California consumers due to the increased costs associated with switching from PS foam products to alternative products. These summed impacts on output in California are estimated at nearly $1.4 billion. The impacts on earnings are estimated to be $335 million and it is estimated that nearly 8,000 jobs would be lost as a result of such a ban. The results are summarized in table 3.10.

Table 3.10: Estimated Macroeconomic Impacts Resulting from a State-wide Ban on PS Foam Foodservice Products

	Output	Earnings	Employment
Negative Impacts Associated with Decreased Final Demand for FPS Foodservice Products	$1,030,711,844	$221,911,407	4,779
Positive Impacts Associated with Increased Final Demand for FPS Product Substitutes	$258,857,455	$56,512,279	1,211
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	$598,270,789	$169,134,578	4,363
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	**$1,370,125,178**	**$334,533,707**	**7,932**

3.5 Fiscal Impacts of a Ban on PS Foam Foodservice Products

The California state government and various governmental entities that it funds (e.g., school districts and public universities) will be significantly impacted by a statewide ban on PS foam foodservice products. The ban is likely to result in two types of fiscal impacts that will negatively affect the state government's budget. The first is the loss of tax revenues that would accompany any downsizing or disappearance of the state's polystyrene manufacturing facilities. In 2008, the operations of these six PS foam foodservice product manufacturing facilities contributed at least $6 million to the state in tax revenues. This includes direct taxes and fees paid to the state by the company as well as state income taxes withheld from employees who work at those facilities.[8] This estimate is likely to be a conservative one because not all of the companies were able to provide information for all of the different taxes that they paid and because not all employees have taxes withheld, particularly independent consultants working for the plants.[9] The significant downsizing or closure of these facilities would likely result in the loss of most of this revenue. Additionally, as the impact of the plant downsizings or closures ripple through the economy, the negative impacts on tax revenue are likely to be amplified as tax revenue losses from upstream and downstream industries are likely to outweigh increases in tax revenue collected from manufacturers of substitutes for PS foam foodservice products.

The second negative type of fiscal impact that a PS foam foodservice product ban is likely to have is due to the additional cost of foodservice products that public entities funded by the state will have to pay. As discussed earlier in the analysis, substitutes for PS foam foodservice products generally cost two to three times more than analogous PS foam products. This means that, like all California consumers of PS foam foodservice products, school districts, state agencies, and other state-funded entities that consume PS foam foodservice products will have to pay thousands or hundreds of thousands of dollars more for foodservice products. For example, in 2006, MB Public Affairs estimated the collective impact on the state's budget of higher foodservice product prices as a result of a PS foam ban to be approximately $59 million.[10] Appendix C includes an analysis that uses a similar methodology to the one used by MB Public Affairs in order to estimate the impact on state-funded entities for which data is available.[11] Looking at just four of the state-funded entities that responded to foodservice product purchase order requests, the estimated annual budgetary impact of increased foodservice product costs will be well into the millions of dollars.

Indeed, some public establishments have already been constrained by local PS foam product bans or government edicts that essentially ban PS foam products. The increased cost of PS

[8] Direct taxes and fees paid to the state include sales and use taxes, corporate income and franchise taxes, property taxes, unemployment taxes, and licensing fees.

[9] State income taxes of employees and consultants that are not withheld are likely to far outweigh the amount of withheld taxes that get refunded to employees after filing.

[10] MB Public Affairs. 2006 Polystyrene & Replacement Cost Study for PFPG.

[11] Due to an insufficient number of responses to requests for purchasing orders and contracts from state funded entities under the California Public Records Act (CPRA), that analysis in Appendix C could not provide an updated statewide estimate of the fiscal impact that an PS foam foodservice product ban would have.

foam substitutes to those entities is already contributing to the massive budget shortfalls being experienced in the state. Between the loss of tax revenue and the added cost of foodservice products for state-funded agencies, the impact of a statewide ban on PS foam foodservice products is likely to be profound and negative.

IV. Conclusions for Policymakers

Polystyrene (PS) foam products are used in wide variety of applications and in such significant volumes because they are more affordable and because PS foam's physical properties make it more useful and efficient than competing materials in most of PS foam's applications. In addition to their widespread utility in industries such as foodservices, PS foam products are important to the California economy because PS foam products are made and used within the state. Because it is not cost effective to transport PS foam products out-of-state, the most likely result of a legislative ban on PS foam foodservice products is that California's six PS foam product-manufacturing facilities would close, leading to significant job losses and reductions in output and earnings.

The analysis shows that some of these losses can be offset through the increase in production of PS foam substitutes. However, it is likely that many of the replacement products would be manufactured outside of the state and it is unlikely that the increased production of those substitute products in California will be sufficient to offset the jobs, earnings, and output losses that would result from PS foam plant closures. Additionally, the negative impact of consumers having to pay higher prices for single-use foodservice products would virtually insure that the net macroeconomic impacts of such a ban will be negative and substantial. Included in those macroeconomic impacts are severe losses to state government budgets that are already under tremendous strain.

Overall, this study concludes that the impact of a PS foam foodservice product ban will have significant and negative net impacts on output, earnings, jobs, and consumer and government budgets in California.

Appendix A:
Description of RIMS II Multipliers

The use of multipliers is a common method for estimating the economic impacts associated with a change in public policy. This assessment uses multipliers provided by the U.S. Department of Commerce Bureau of Economic Analysis (BEA). The BEA publishes multipliers based on its Regional Input-Output Modeling Systems II (RIMS II). The RIMS II model provides multipliers for output, employment, and earnings in nearly 500 different U.S. industries.

RIMS II is based on an "input-output" accounting of the U.S. economy. Utilizing detailed data collected regularly by the Department of Commerce, the input-output matrix provides a complete picture of the inter-industry linkages within the economy. Consequently, RIMS II is well suited to estimate the impact that changes in one industry can have on other industries. The BEA can provide RIMS II multipliers for local regions (metropolitan areas, counties, or sub-state regions), individual states, or the nation. This assessment uses multipliers that are specific to California.

Appendix B:
Sensitivity Analysis Results for Macroeconomic Impact Assessment

In order to determine the sensitivity of the study's conclusions to key assumptions, a sensitivity analysis was performed. The analysis included alterations of assumptions about the price elasticity of foodservice product consumption and California's ability to scale up production of alternatives to polystyrene foam foodservice products. The purpose of the sensitivity analysis is to test whether the study's primary conclusion, that the macroeconomic impact of a PS foam foodservice product ban be significant and negative, holds under alternative and more conservative assumptions than those used in the study. The analysis can also confirm that the scale of the estimated impacts on output, earnings, and jobs in California is not dependent on those assumptions.

The first round of sensitivity analysis substitutes alternative demand elasticities of '0' and '-0.2' for the study's initial assumption of '-0.1'. This study used an elasticity of '-0.1' as its primary assumption to simulate demand that increases or decreases in direct proportion to price hikes or cuts in foodservice supply products. An elasticity of '0' signals that demand is perfectly inelastic to the price of foodservice products, and that consumers will not adjust their consumption patterns in response to more expensive foodservice supplies. Under such a scenario, consumption of PS foam and alternative material foodservice supplies remains constant even at higher prices, accruing benefit and revenue to those industries. However, this pattern of consumption leaves Californians with less disposable income to spend on other goods produced and sold in the state, and the negative consumer impact outweighs the positive impact resulting from increased demand for alternative products. The change in elasticity does not change the impacts resulting from the PS foam foodservice product plant closings. The overall impact is therefore, that even more output, income, and jobs are lost in the '0' elasticity scenario than those estimated in the study when a demand elasticity of '-0.1' was assumed.

Table B.1: Estimated Macroeconomic Impacts Resulting from a State-wide Ban on FPS Foodservice Products (Demand Elasticity of 0.0)

	Output	Earnings	Employment
Negative Impacts Associated with Decreased Final Demand for FPS Foodservice Products	$1,030,711,844	$221,911,407	4,779
Positive Impacts Associated with Increased Final Demand for FPS Product Substitutes	$278,345,473	$60,630,839	1,303
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	$822,761,650	$232,599,430	6,000
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	**$1,575,128,021**	**$393,879,999**	**9,477**

An elasticity of '-0.2' would suggest that consumer behavior is more price responsive to changes in the price of foodservice supplies than was assumed in the study. Under such a scenario, consumption of foodservice containers would decrease more significantly as a result of the ban because fewer consumers are willing to pay the higher price for PS foam substitutes. Local production of those alternative products would therefore not rise by as much as it would if the price elasticity were '-0.1'. However, this more responsive pattern of consumption leaves Californians with more disposable income as they reduce consumption of foodservice products and increase spending in other sectors of the state economy. Overall, the impact on consumption is larger than the impact due to decreased demand for PS foam substitutes. The overall macroeconomic impact is thus less negative in this scenario and the analysis's estimate of overall impacts would have been less negative if a more negative price elasticity were chosen. However, even when '-0.2' was assumed (probably an unrealistically conservative assumption), the overall impact on output was still nearly $1.2 billion.

Table B.2: Estimated Macroeconomic Impacts Resulting from a State-wide Ban on FPS Foodservice Products (Demand Elasticity of -0.2)

	Output	Earnings	Employment
Negative Impacts Associated with Decreased Final Demand for FPS Foodservice Products	$1,030,711,844	$221,911,407	4,779
Positive Impacts Associated with Increased Final Demand for FPS Product Substitutes	$239,369,438	$52,393,718	1,119
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	$373,779,929	$105,669,727	2,726
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	**$1,165,122,335**	**$275,187,415**	**6,386**

Further sensitivity analysis was conducted using more conservative assumptions regarding California industry's ability to increase its production of PS foam alternatives in response to a PS foam foodservice product ban.[12] The first round of sensitivity analysis assumes that Californian producers will increase alternative materials production capacity by 50%, as compared to 20% which was assumed in the main analysis. A second round of analysis assumes California producers will increase their production of PS foam substitutes by 100%.

Altering this assumption does not change the estimates of negative impacts due to the closure of PS foam foodservice product manufacturing facilities, nor does it alter the estimated impact on consumer budgets. The only impact that this change in assumptions can have is to increase the positive impacts that result from more local production of PS foam foodservice alternatives. The result is thus that there is a lower net impact on the California state economy. However, even under these generous assumptions providing for massive scale ups of non-PS foam foodservice product manufacturing in California, the overall macroeconomic effect is still negative and very significant, with losses in output still in the range of $1 billion and job losses in the range of 6,000-7,000.

[12] A conservative assumption is defined here as an assumption that is likely to reduce the overall negative economic impact estimated in this study.

Table B.3: Estimated Macroeconomic Impacts Resulting from a State-wide Ban on FPS Foodservice Products (Additional Capacity Increased by 50%)

	Output	Earnings	Employment
Negative Impacts Associated with Decreased Final Demand for FPS Foodservice Products	$1,030,711,844	$221,911,407	4,779
Positive Impacts Associated with Increased Final Demand for FPS Product Substitutes	$438,044,932	$97,090,177	2,044
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	$598,270,789	$169,134,578	4,363
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	**$1,190,937,702**	**$293,955,808**	**7,099**

Table B.4: Estimated Macroeconomic Impacts Resulting from a State-wide Ban on FPS Foodservice Products (Additional Capacity Increased By 100%)

	Output	Earnings	Employment
Negative Impacts Associated with Decreased Final Demand for FPS Foodservice Products	$1,030,711,844	$221,911,407	4,779
Positive Impacts Associated with Increased Final Demand for FPS Product Substitutes	$710,739,689	$158,938,831	3,317
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	$598,270,789	$169,134,578	4,363
Negative Impacts Associated with Increased Cost of Disposable Foodservice Products	**$918,242,944**	**$232,107,155**	**5,826**

Appendix C:
Estimating State & Local Budget Impacts

The California state government is a major purchaser of polystyrene (PS) foam products through the organizations and agencies that it funds. Many of the numerous state agencies, 32 public universities, and more than 1,000 public school districts in California provide on-site and/or take-out foodservices that require the use of disposable foodservice supplies. PS foam foodservice containers are widely used by the cafeterias and caterers that supply foodservices to these state agencies and public schools.

It is important for policymakers to have a full awareness of the costs and benefits of PS foam foodservice product use by these agencies before formulating legislation that could restrict or ban those products. The following assessment sheds light on the potential financial impact of a state-wide ban on PS foam foodservice products on one of the industry's largest set of consumers: state-run agencies and other entities receiving state funds.

Methodology

To assess the potential impact of a ban on PS foam foodservice products on state and local government budgets, public records were collected and cost comparisons run on a variety of PS foam and non-PS foam foodservice products, simulating the likely cost of replacing PS foam foodservice products used by state-funded foodservices with non-PS foam alternatives.

Data Collection

Requests were submitted under the California Public Records Act (CPRA) for: a) foodservice purchasing orders, b) contracts with disposable foodservice supply vendors, and c) contract usage reports. Twenty-eight total requests for documents and data for the 2007/2008 fiscal year were submitted to the following state-funded entities:

- Eight public K-12 school districts
- 31 state universities – 21 California State universities and 10 University of California universities
- Six state departments, including the Department of General Services (DGS)

CPRA requests were submitted between April 27, 2009 and July 21, 2009, with a total of 15 responses received between May and the beginning of September. Of those 15 responses, only four indicated the use of polystyrene foam products by that state agency, school, or school district, and contained data pertinent to the aims of this study. These include DGS, Modesto City Schools, San Diego Unified School District, and Corona-Norco Unified School District.

Impact Analysis

Based on the information yielded by CPRA requests, the likely impact of a ban on polystyrene foam was calculated for each of the three public school districts, and the various agencies using the DGS' contract.[13] Per unit prices for PS foam foodservice products found in the school and agency purchasing orders, as well as for non-PS foam foodservice products of comparable size and function were calculated using information available on the internet.

- Contract prices tended to be lower than those quoted on the internet, as vendors were obligated to submit bids to win state contracts. Additionally, larger contracts were often able to offer cheaper prices than smaller ones; DGS would typically pay less per unit for its food packaging than would the UCD coffee house. To avoid these biases, prices for both PS foam and non-PS foam items were taken from websites. Per unit prices were then scaled to match quantities in the purchase orders, providing a uniform basis of comparison across materials and contracts.
- The majority of prices were taken from www.pjpmarketplace.com, as it was consistently found to have the lowest listed price for foodservice disposables. Other websites were used only if PJP Marketplace did not carry an item found in one of the purchasing orders.
- For bio-based bagasse and polylactide (PLA) disposables, prices were taken from www.worldcentric.org.

Price differentials between each polystyrene foam item and its internet-available alternative[14] were calculated based on per unit prices. Mark-ups and mark-downs from PS foam foodservice products are displayed below in Table 4.1. PS foam foodservice products ordered by the three state entities during the 2007-08 fiscal year were replaced with the cheapest available, similarly sized alternative to calculate the likely state budgetary impact of a PS foam foodservice product ban.

Results

The study's findings indicate that the financial impacts on state and local government budgets are likely to be negative and significant if state-funded entities are forced to replace PS foam foodservice products with non-PS foam alternatives. Interestingly, of the 12 responses received from California public universities, not one used PS foam foodservice products during the 2007-8 school year. This suggests that were a ban to be enacted, its impact would be most strongly felt in school district and state agency budgets.

With the exception of a single item, PS foam foodservice products were found to be cheaper than disposable foodservice supplies made with other materials and ordered by UCD, Modesto,

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[13] A primary function of DGS is to provide purchasing agreements and contracts to any California state agency that does not wish to conduct its own procurement. The vast majority of state departments use DGS' "Disposable Foodservice Supplies" purchasing contract, which allows information on polystyrene foam use obtained from DGS to relatively accurately reflect the rate of use and cost of polystyrene foam disposables across state agencies.

[14] Prices for several items were not able to be found on the internet. Although these items are available through disposable foodservices manufacturers, manufacturer catalogues typically do not list prices for their products. For such items, prices were either estimated using price ratios of similar items as reference points, or the price for a similar but not identically sized item that could be found on the internet was used instead.

and DGS. Table 4.1 details the overwhelming price advantage that PS foam foodservice products have over non-PS foam alternatives.

Table C.1: Relative Price Increases from FPS Product Subsitutes

	Paper	Bagasse	PLA	Plastic
Cups (hot)				
4 oz	129%	153%	229%	…
8 oz	137%	268%	289%	…
Plates				
9"	61%	213%	…	90%
Bowls				
12 oz	21%	38%	90%	314%
22 oz	-14%	…	…	…
30 oz	86%	49%	11%	…
Clam Shells				
3 compt 9x9x3		209%		136%
3 compt 7-8x8-9x3		219%		144%
School Trays				
5 compartment	…	70%	…	…
6 compartment	…	102%	…	…
Other 1pc/2pc containers				
6 oz hot/cold	…	64%	…	…
8 oz hot/cold	166%	66%	300%	…
12 oz hot/cold	123%	75%	118%	…
16 oz hot/cold	108%	73%	129%	…

Each of the four institutions included in the study showed significant increases in their individual budgets for disposable foodservice products and janitorial services when alternative products were substituted for PS foam foodservice products. DGS' budget, by far the largest in terms of quantity of supplies purchased, increased by over 200% in response to the simulated ban on PS foam foodservice products. Modesto City Schools, San Diego Unified, and Corona-Norco's foodservice budgets all increased by roughly 70%.

The cumulative budgetary impact on these four state-funded entities alone totals over one and a half million dollars – $1,509,864.34. This figure clearly demonstrates the negative financial impact that banning the use of PS foam foodservice products would have on individual state-funded institutions. If all state-funded institutions' budgets were included, the impact of a PS foam foodservice product ban on California's state budget would likely be in the tens of millions of dollars range.

Table C.2: San Diego Unified Schools District Budgetary Impact

	FPS		Substitute	
Item	Per Unit Price	Est. Cost	Markup	Est. Cost
Tray, 5-compartment	$0.047	$940,000.00	70%	$1,598,000.00
Total	……………………	$940,000.00	…………………	$1,598,000.00
Budgetary Impact:	……………………			$658,000.00

Table C.3: Modesto City Schools Budgetary Impact

	FPS		Substitute	
Item	Per Unit Price	Est. Cost	Markup	Est. Cost
Bowl, 30 oz	$0.14	$4,278.00	11%	$4,748.58
Cup, 4 oz	$0.02	$3,043.00	129%	$6,968.47
Container, 16 oz	$0.05	$1,372.00	73%	$2,380.00
Container, 8 oz	$0.03	$4,680.00	66%	$7,751.25
Tray, 5 compt	$0.05	$171,268.00	70%	$291,520.00
Total	……………………	$184,641.00	…………………	$313,368.30
Budgetary Impact:	……………………			$128,727.30

Table C.4: Corona-Norco Unified School District Budgetary Impact

	FPS		Substitute	
Item	Per Unit Price	Est. Cost	Markup	Est. Cost
Tray, 5 compartment	$0.047	$141,000.00	70%	$239,700.00
Total	……………………	$141,000.00	…………………	$239,700.00
Budgetary Impact:	……………………			$98,700.00

Table C.5: DGS Budgetary Impact

	FPS		Substitute	
Item	Per Unit Price	Est. Cost	Markup	Est. Cost
Hinged Container 9x9x3	$0.092	$285,255.20	209%	881438.568
Hinged Container 7-8x8-9x3	$0.089	$3,293.00	219%	10504.67
Tray, 5 compt	$0.047	$6,345.00	70%	10786.5
Tray, 6 compt	$0.062	$16,275.00	102%	32875.5
Total	……………………	$311,168.20	…………………	$935,605.24
Budgetary Impact:	……………………			$624,437.04

Appendix D: Project Team Members

Robert F. Wescott is President of Keybridge Research LLC. Dr. Wescott has nearly 30 years of professional experience working on macroeconomic, financial, and public policy issues. He served for four years as Special Assistant to the President for Economic Policy at the National Economic Council at the White House and as Chief Economist at the President's Council of Economic Advisers. From 1994-98 Dr. Wescott was Deputy Division Chief in the Research Department of the International Monetary Fund, where he did research on global economic risks and policy challenges. He also was an official in the Fund's European Department. From 1982-93, he was Senior Vice President and Chief U.S. Economist at WEFA Group (today IHS Global Insight), a private economic modeling and analysis firm, where he was responsible for all economic modeling, forecasting, and consulting operations. In 1989-90, he helped the University of Pennsylvania establish the International Centre for the Study of East Asian Development in Kitakyushu, Japan. Dr. Wescott holds a Ph.D. in Economics from the University of Pennsylvania.

Brendan Fitzpatrick is Senior Economist at Keybridge Research LLC. Mr. Fitzpatrick specializes in international economics and environmental policy. Prior to joining Keybridge, Mr. Fitzpatrick served in the Office of the Chief Economist of the World Bank, where he focused on development finance, aid effectiveness, environment, and the production of the 2006-08 Global Monitoring Reports. He also worked with USAID's Agriculture and Rural Enterprise Development team in Rwanda and worked in education and community development with Fundacion Rostro de Cristo in Ecuador. Mr. Fitzpatrick holds Bachelor's degrees in Bioengineering & Economics from the University of Illinois at Urbana-Champaign and a Master's degree in Public Administration in International Development from Harvard's Kennedy School of Government.

Mark W. McNulty is Director of Economic & Policy Analysis at Keybridge Research LLC. Mr. McNulty specializes in energy economics, environmental economics, and U.S. domestic policy. Before joining Keybridge, Mr. McNulty served as a consultant for U.S. financial institutions and rural development organizations, where he designed and implemented innovative financial products tailored to the needs of low-income consumers. From 2000-2001, he served as Staff Assistant for International Economics at the White House's National Economic Council, where he was responsible for research and analysis on global economic and financial risks. Mr. McNulty holds a bachelor's degree in Business Administration & Economics from Rhodes College and a Master's degree in Public Policy from Harvard's Kennedy School of Government.