U.S. GROCERY RETAIL FOOD PACKAGING TO PRODUCT RATIOS

2019

ReFED

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This report provides U.S. grocery retail food packaging to product ratios at the department and category levels and describes the methodology used to do so. ReFED has developed this dataset with data from Nielsen combined with packaging weights obtained from primary research as documented in the Appendix.

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OVERVIEW

One barrier to food waste measurement for businesses is the difficulty of removing the weight of packaging from weight-based food datasets. Many datasets critical to food waste measurement include the weight of food and packaging combined, such as the tons of food donated to food banks or the tons of food picked up by waste haulers. Before these datasets can be utilized in a comprehensive food waste measurement system, the weight of packaging must be removed, and packaging to product ratios are necessary to do so.

Packaging to product ratios are difficult for businesses to obtain because food business enterprise software systems were initially designed to track inventory cost and sales flows. Food and packaging weight, if included, is an afterthought. Some food business data systems may contain a database field that stores the total weight of food plus packaging, but they usually do not have a database field that stores the weight of packaging alone. These data systems typically include a database field that stores the weight of food alone (not including packaging), but these weights are usually not in a common unit of measurement. Instead, each item is recorded in various units such as pounds, eaches, fluid ounces, or counts and tracked accordingly. In order for businesses to quantify the weight of food, they have to convert these various units into a common unit of weight for every single item. For a business that sells thousands or millions of products, that is a time and resource intensive process. Furthermore, information maintenance at the item level is not often prioritized (e.g., the item level weight fields are often left blank or fail to get updated when the purchase or sell units change).

Therefore, in an effort to help U.S. grocery retailers overcome these barriers, ReFED has developed department and category level packaging to product ratios using data from Nielsen combined with packaging weights obtained from primary research as documented in the Appendix. Because packaging to product ratios don't vary significantly among retailers, individual retailers can safely use these ratios to estimate the weight of packaging in their individual datasets.

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[1] ReFED has also developed a report that describes the difficulty for businesses in quantifying the weight of food purchased, sold, and wasted along with a set of U.S. industry average grocery retail value-to-weight conversion factors to address this lack of food product weight data: https://www.refed.com/downloads/ReFED-U.S.-Grocery-Retail-Value-to-Weight-Conversion-Factors.pdf.

METHODOLOGY

Calculations

Because there was no publicly available data on packaging to product ratios, ReFED conducted original research to develop proxy packaging to product ratios for each grocery retail category. Appendix A describes the methodology used to develop these category-level packaging to product ratios. These category proxies were then used to develop department-level packaging to product ratios using a sales-weighted approach with Nielsen sales data. Nielsen data represents over 85% coverage of grocery retail sales in the U.S. Each year top U.S. grocery retailers report item level register sales data to Nielsen, including information about each item such as the grocery chain where it was sold, the brand name of the product, the food classification (department, category, subcategory), the weight of food, and many other attributes. The following table displays the calculations used to develop U.S. grocery retail industry average category and department-level packaging to product ratios.

Table 1. Calculations Performed to Determine Average Retail Packaging to Product Ratios

DATA	DATA SOURCE OR CALCULATION	EXAMPLE
Item Sales	Annual U.S. 50-state register sales for a single item according to Nielsen point-of-sale (POS) data	$3 Million in sales of a particular cookie product (a single UPC item)
Item Food Weight	Item weight according to Nielsen POS data	0.07 lbs of food per unit
Item Units Sold	Annual U.S. 50-state item units sold reported to Nielsen by grocery stores	1 Million units sold
Item Food Weight Sold	= Item Food Weight * Item Units Sold	= 1 Million units sold * 0.07 lbs per unit = 70,000 lbs food sold
Category Packaging to Product Ratio	See Appendix A for ReFED original research	0.0572 lbs of packaging per lb of food (5.72% packaging to product ratio)
Category Sales	= SUM of Item Sales for all items in each Category	$8.6 Billion of products sold in the Cookie Category of the Dry Goods Department (all items across various brands in the Cookie Category)
Category Food Weight Sold	= SUM of Item Food Weight Sold for all items in each Category	3.25 Billion lbs of food sold in the Cookie Category of the Dry Goods Department (all items across various brands in the Cookie Category)
Category Packaging Weight	= Category Food Weight Sold * Category Packaging to Product Ratio	= 3.25 Billion lbs * 5.72% = 186 Million lbs of packaging sold in the Cookie Category of the Dry Goods Department

DATA	DATA SOURCE OR CALCULATION	EXAMPLE
Category Industry Average Packaging Weight per Dollar Sold	= Category Packaging Weight / Category Sales	= 186 Million lbs of packaging sold / $8.6 Billion sold = 0.0216 lbs packaging per retail $ sold
Department Sales	= SUM of Item Sales for all items in each Department	$209.5 Billion of products sold in the Dry Goods Department (all items across all categories in the Dry Goods Department)
Department Food Weight Sold	= SUM of Item Food Weight Sold for all items in each Department	67.01 Billion lbs of food sold in the Dry Goods Department (all items across all categories in the Dry Goods Department)
Department Packaging Weight	= SUM of Category Packaging Weight for all Categories in each Department	10.228 Billion lbs of packaging sold in all Categories in the Dry Goods Department combined (all categories in the Dry Goods Department)
Department Industry Average Packaging to Product Ratio	= Department Packaging Weight / Department Food Weight Sold	= 10.228 Billion lbs of packaging / 67.01 Billion lbs of food sold = 15.26% industry average packaging to product ratio for the Dry Goods Department
Department Industry Average Packaging Weight per Dollar Sold	= Department Packaging Weight / Department Sales	= 10.228 Billion lbs of packaging / $209.5 Billion sold in the Dry Goods Department = 0.0488 lbs of packaging per retail $ sold for products in the Dry Goods Department

Limitations

The accuracy of these estimates is limited to the accuracy of the Nielsen sales and weight data. The weight data for UPC items comes directly from up-to-date product packaging images. For non-UPC items sold in eaches, Nielsen estimates weight using a weight conversion factor (e.g., the average weight of a lemon). For other non-UPC items, Nielsen is reliant on the retailer transaction data to provide the item sale weight units (e.g., lbs of apples sold). Because proxy categories were selected in ReFED's original research as outlined in Appendix A, the packaging to product ratios listed in this report are only rough estimates. While this approach is much more detailed and granular than other public estimates, further research and data development should be continued to capture variation within categories to more accurately quantify packaging to product ratios and to enable better measurement of food waste.

RESULTS

Table 2. Department Level Packaging to Product Ratios

FOOD DEPARTMENT	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD
All food	6.86%	7.37%	0.0346
Breads & Bakery	3.97%	4.14%	0.0185
Dairy & Eggs	3.35%	3.47%	0.0276
Deli & Prepared Foods	6.40%	6.84%	0.0123
Dry Goods	13.27%	15.30%	0.0502
Fresh Meat & Seafood	7.84%	8.51%	0.0213
Frozen	8.21%	8.94%	0.0410
Produce	1.13%	1.15%	0.0074
Ready-To-Drink Beverages	7.61%	8.24%	0.1087

How to use this data:

- **If you have the weight of food plus packaging:** Multiply the weight of food plus packaging by the Item % Packaging by Weight to get the estimated weight of packaging.

- **If you have the weight of food only:** Multiply the weight of food only by the Item Packaging to Product Ratio to get the estimated weight of packaging.

- **If you have the retail $ sold:** Multiply the retail $ sold by the lbs of packaging per retail $ sold to get the estimated weight of packaging. **CAUTION:** These industry average retail $ ratios can vary significantly among retailers due to variations in retail price per lb and should only be used for rough estimates.

Table 3. Category Level Packaging to Product Ratios

The following table lists category level packaging to product ratios based on ReFED original research as outlined in Appendix A. Some categories were assigned packaging to product ratios based on proxy categories (e.g. ratio for pita bread was used as a proxy for naan).

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
BREADS & BAKERY				
Artisan and specialty bread	2.38%	2.44%	0.0107	
Bagels	0.88%	0.88%	0.0040	
Brownies	12.58%	14.40%	0.0253	
Cake	17.83%	21.70%	0.0397	
Cheesecake	10.47%	11.69%	0.0182	
Cookies	8.23%	8.97%	0.0233	
Cupcakes	8.94%	9.81%	0.0170	
Donuts	15.06%	17.73%	0.1072	
English muffins and crumpets	6.78%	7.28%	0.0226	
Flatbreads and pizza crusts	3.93%	4.10%	0.0103	
Muffins	11.37%	12.83%	0.0403	
Naan	1.56%	1.58%	0.0029	Pita bread
Other desserts	3.97%	4.08%	0.0173	Department average
Pies, cobblers, and crisps	6.01%	6.39%	0.0183	
Pita bread	1.56%	1.58%	0.0048	
Rolls and buns	1.56%	1.59%	0.0070	
Sliced bread	1.35%	1.37%	0.0073	
Soft tortillas	1.53%	1.55%	0.0114	
Sweet goods	3.14%	3.24%	0.0122	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
DAIRY & EGGS				
Butter, margarine, and substitutes	5.46%	5.78%	0.0206	
Buttermilk	3.27%	3.38%	0.0381	
Cheese	4.91%	5.16%	0.0127	
Creams and creamers	5.07%	5.34%	0.0305	
Dairy milk	1.70%	1.73%	0.0403	
Egg nog	3.27%	3.38%	0.0256	Buttermilk
Eggs	2.54%	2.61%	0.0146	
Lactose reduced/ free milk	3.34%	3.46%	0.0348	
Liquid egg mix	4.03%	4.20%	0.0170	
Plant-based dairy alternatives	3.42%	3.55%	0.0414	
Refrigerated doughs	8.54%	9.33%	0.0369	
Sour cream	5.79%	6.14%	0.0311	
Yogurt	8.80%	9.65%	0.0437	
DELI & PREPARED FOODS				
Appetizers	6.36%	6.79%	0.0080	Deli & Prepared Foods Potatoes
Breakfast foods	5.21%	5.50%	0.0080	Prepared meals
Calzones or stromboli	5.21%	5.50%	0.0090	Prepared meals
Chilled salsa, dips, and spreads	7.90%	8.58%	0.0204	Hummus
Deli cheeses	0.00%	0.00%	0.0000	Assumed zero packaging
Deli lunchmeat	0.00%	0.00%	0.0000	Assumed zero packaging
Deli salads	7.52%	8.13%	0.0178	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
DELI & PREPARED FOODS				
Deli trays	15.63%	18.53%	0.0252	
Fully cooked beef	5.21%	5.50%	0.0087	Prepared meals
Fully cooked chicken	4.91%	5.16%	0.0112	
Fully cooked pork	5.21%	5.50%	0.0112	Prepared meals
Fully cooked turkey	5.21%	5.50%	0.0094	Prepared meals
Handheld entrees	6.36%	6.79%	0.0224	Deli & Prepared Foods Potatoes
Hummus	7.90%	8.58%	0.0167	
Lasagna	9.09%	10.00%	0.0179	Pasta
Mac and cheese	9.09%	10.00%	0.0129	Pasta
Meal kits	19.50%	24.22%	0.0473	
Meat alternatives	5.21%	5.50%	0.0167	Prepared meals
Other meat	5.21%	5.50%	0.0111	Prepared meals
Pasta	9.09%	10.00%	0.0193	
Pizza	21.41%	27.25%	0.0746	
Pot pies	5.21%	5.50%	0.0102	Prepared meals
Potatoes	6.36%	6.79%	0.0239	
Prepared fruit or vegetables	9.94%	11.03%	0.0283	Fruit or vegetable trays
Prepared meals	5.21%	5.50%	0.0084	
Rice	5.21%	5.50%	0.0119	Prepared meals
Sandwiches	8.79%	9.63%	0.0124	
Snack combos	11.32%	12.77%	0.0181	
Soups, stews, and broth	6.75%	7.24%	0.0160	
Sushi	5.84%	6.21%	0.0037	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
DRY GOODS				
Apple sauce	5.88%	6.25%	0.0397	
Baby food	8.50%	9.29%	0.0201	
Bagged or loose tea	35.23%	54.39%	0.2568	
Baking chips and chocolate	1.80%	1.83%	0.0047	
Baking cocoa	13.41%	15.48%	0.0224	
Baking coconut	2.93%	3.02%	0.0091	
Baking milks	17.02%	20.51%	0.1177	
Baking mixes	7.48%	8.09%	0.0360	
Baking nuts	4.18%	4.37%	0.0052	
Baking powder	10.90%	12.24%	0.0345	
Baking soda	5.20%	5.49%	0.0748	
Baking sprinkles	19.17%	23.71%	0.0276	
Baking yeast	15.38%	18.18%	0.0110	
Bouillon	60.87%	155.56%	0.2512	
Boxed dinners	12.68%	14.52%	0.0445	
Breakfast syrups	4.90%	5.15%	0.0214	
Broth	4.03%	4.19%	0.0238	
Canned beans	11.32%	12.77%	0.1134	
Canned fruit	12.01%	13.65%	0.0798	
Canned meat and seafood	7.59%	8.21%	0.0183	
Canned soup	12.06%	13.71%	0.0629	
Canned vegetables	11.79%	13.36%	0.0908	
Cereal	16.79%	20.18%	0.0649	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
DRY GOODS				
Cereal and granola bars	12.57%	14.38%	0.0215	
Chocolate candy	5.69%	6.04%	0.0098	
Coating mixes and crumbs	22.28%	28.67%	0.1038	
Coffee	3.91%	4.07%	0.0054	
Coffee enhancers	11.55%	13.05%	0.0524	
Coffee pods	34.46%	52.59%	0.0335	
Condiments	10.15%	11.29%	0.0411	
Cookies	5.41%	5.72%	0.0216	
Cooking oils	3.70%	3.84%	0.0219	
Cooking syrups	5.78%	6.14%	0.0191	
Cooking wine and vinegar	41.44%	70.77%	0.8033	
Corn and other food starch	11.81%	13.39%	0.0805	
Crackers	12.47%	14.25%	0.0368	
Cranberry sauce	10.91%	12.24%	0.0730	Tomato sauce and paste
Dessert toppings	11.44%	12.92%	0.0403	
Diet and nutrition	12.11%	13.78%	0.0290	
Dried fruit and vegetables	2.87%	2.95%	0.0056	
Dry beans	0.43%	0.43%	0.0035	
Edible cake decoration	45.00%	81.82%	0.0804	
Flour and meal	0.92%	0.93%	0.0133	
Frosting	6.33%	6.75%	0.0322	
Fruit snacks	14.71%	17.24%	0.0420	

Table 3. Category Level Packaging to Product Ratios Continued

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DRY GOODS				
Gift baskets	19.50%	24.22%	0.0179	Meal kits
Gnocchi and dumplings	2.80%	2.88%	0.0090	
Grits	6.33%	6.75%	0.0418	
Gum	30.37%	43.62%	0.1724	
Hard shell tortillas	22.16%	28.47%	0.0857	
Herbs, spices, and seasonings	68.75%	220.00%	0.1520	
Hot cider	19.78%	24.65%	0.0278	
Hot cocoa	13.26%	15.29%	0.0213	
Jams and jellies	31.51%	46.00%	0.2311	
Marshmallows	2.08%	2.12%	0.0105	
Milk enhancers	17.20%	20.78%	0.1138	
Mints	25.86%	34.88%	0.0539	
Nut butters	7.74%	8.39%	0.0328	
Nuts and seeds	15.18%	17.89%	0.0297	
Oatmeal and hot cereal	11.16%	12.56%	0.0519	
Other candy	1.56%	1.59%	0.0041	
Other grains	46.58%	87.18%	0.1934	
Other noodles	1.74%	1.77%	0.0054	
Other sauce, gravy, and marinades	10.71%	12.00%	0.0433	
Pasta	4.78%	5.02%	0.0237	
Pasta sauce	35.48%	55.00%	0.3147	
Pickles, olives, and pickled vegetables	30.84%	44.59%	0.1545	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
DRY GOODS				
Pie crusts	12.68%	14.53%	0.0318	
Pie filling	10.74%	12.03%	0.0631	
Pudding and gelatin	6.76%	7.25%	0.0100	
Ramen	4.78%	5.02%	0.0077	Pasta
Rice	0.66%	0.66%	0.0050	
Salad dressing	6.82%	7.32%	0.0291	
Salad toppings	20.89%	26.40%	0.0390	
Salty snacks	1.39%	1.41%	0.0029	
Sauce, soup, and seasoning mixes	9.68%	10.71%	0.0093	
Shake and smoothie mix	17.14%	20.69%	0.0517	
Shelf-stable dips and salsa	36.03%	56.33%	0.2226	
Shortening and lard	13.70%	15.87%	0.0950	
Snack cakes	11.82%	13.40%	0.0307	
Specialty wraps	3.84%	3.99%	0.0110	
Sugar and sweeteners	0.76%	0.77%	0.0049	
Toaster pastries	6.58%	7.04%	0.0260	
Tomato sauce and paste	10.91%	12.24%	0.0866	
FRESH MEAT & SEAFOOD				
Bacon	4.52%	4.73%	0.0090	
Beef ribs	6.23%	6.65%	0.0077	Beef roast
Beef roast	6.23%	6.65%	0.0064	

Table 3. Category Level Packaging to Product Ratios Continued

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FRESH MEAT & SEAFOOD				
Chicken breast	13.88%	16.11%	0.0324	
Chicken legs	10.90%	12.24%	0.1564	
Chicken thighs	6.89%	7.40%	0.0317	
Chicken wings	10.90%	12.24%	0.0356	Chicken legs
Clams and mussels	0.00%	0.00%	0.0000	Assumed zero packaging
Crab	0.00%	0.00%	0.0000	Assumed zero packaging
Fowl and exotics	4.38%	4.58%	0.0064	
Ground beef	6.86%	7.37%	0.0163	
Ground chicken	9.38%	10.35%	0.0273	Ground turkey
Ground turkey	9.38%	10.35%	0.0256	
Ham	0.88%	0.88%	0.0032	
Lamb	2.27%	2.32%	0.0032	
Lobster	0.00%	0.00%	0.0000	Assumed zero packaging
Lunchmeat	9.09%	10.00%	0.0218	
Meat alternatives	18.51%	22.71%	0.0307	
Other beef	6.86%	7.37%	0.0111	Ground beef
Other chicken	6.89%	7.40%	0.0128	Chicken thighs
Other fish	6.50%	6.95%	0.0083	Salmon
Other meat	7.84%	8.11%	0.0183	Department average
Other seafood	0.00%	0.00%	0.0000	Assumed zero packaging
Other shellfish	0.00%	0.00%	0.0000	Assumed zero packaging
Other turkey	9.38%	10.35%	0.0560	Ground turkey
Oysters	0.00%	0.00%	0.0000	Assumed zero packaging
Pork	10.32%	11.50%	0.0232	
Salmon	6.50%	6.95%	0.0039	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
FRESH MEAT & SEAFOOD				
Sausage and franks	4.32%	4.52%	0.0139	
Shrimp	0.00%	0.00%	0.0000	Assumed zero packaging
Steaks	6.54%	7.00%	0.0064	
Whole chicken	9.32%	10.28%	0.0442	
FROZEN				
Frozen appetizers	9.27%	10.22%	0.0272	
Frozen bagels	0.88%	0.88%	0.0031	Bagels
Frozen bakery desserts	10.67%	11.94%	0.0294	
Frozen beans	2.73%	2.81%	0.0128	
Frozen beef	1.07%	1.08%	0.0027	Frozen turkey
Frozen bread	14.08%	16.39%	0.0505	
Frozen breakfast foods	21.35%	27.14%	0.0677	
Frozen calzones and stromboli	14.48%	16.93%	0.0280	
Frozen chicken	1.51%	1.53%	0.0049	
Frozen dairy desserts	4.36%	4.56%	0.0311	
Frozen dessert toppings	13.43%	15.52%	0.0562	
Frozen dough and batters	1.06%	1.07%	0.0056	
Frozen fruit	2.52%	2.59%	0.0084	
Frozen fruit juice	6.61%	7.08%	0.0304	
Frozen handheld entrees	1.39%	1.41%	0.0037	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
FROZEN				
Frozen lasagna	7.90%	8.58%	0.0285	
Frozen mac and cheese	10.58%	11.83%	0.0274	
Frozen meals	24.34%	32.17%	0.0799	
Frozen meat alternatives	3.67%	3.81%	0.0062	
Frozen pasta	1.65%	1.68%	0.0047	
Frozen pie crust	9.86%	10.93%	0.0355	
Frozen pizza	15.57%	18.45%	0.0583	
Frozen pork	1.41%	1.43%	0.0050	
Frozen pot pies	9.11%	10.02%	0.0282	
Frozen potatoes	1.74%	1.77%	0.0104	
Frozen rice	0.86%	0.87%	0.0021	Other frozen vegetables
Frozen rolls and buns	3.87%	4.03%	0.0105	
Frozen sausage and franks	10.88%	12.21%	0.0348	
Frozen seafood	2.43%	2.49%	0.0036	
Frozen toaster pastries	11.08%	12.46%	0.0427	
Frozen turkey	1.07%	1.08%	0.0046	
Other frozen desserts	10.24%	11.41%	0.2023	
Other frozen meat	1.41%	1.43%	0.0044	Frozen pork
Other frozen vegetables	0.86%	0.87%	0.0036	

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
PRODUCE				
Apples	0.00%	0.00%	0.0000	Assumed zero packaging
Apricots	0.00%	0.00%	0.0000	Assumed zero packaging
Artichokes	0.00%	0.00%	0.0000	Assumed zero packaging
Asparagus	0.00%	0.00%	0.0000	Assumed zero packaging
Avocados	0.00%	0.00%	0.0000	Assumed zero packaging
Bananas	0.00%	0.00%	0.0000	Assumed zero packaging
Bell peppers	0.00%	0.00%	0.0000	Assumed zero packaging
Blackberries	10.47%	11.70%	0.0186	
Blueberries	7.27%	7.84%	0.0170	
Broccoli	1.68%	1.71%	0.0085	
Brussel sprouts	1.68%	1.71%	0.0058	Broccoli
Cabbage	0.00%	0.00%	0.0000	Assumed zero packaging
Cantaloupe	0.00%	0.00%	0.0000	Assumed zero packaging
Carrots	0.63%	0.64%	0.0052	
Cauliflower	1.68%	1.71%	0.0103	Broccoli
Celery	1.68%	1.71%	0.0085	Broccoli
Cherries	0.73%	0.74%	0.0023	Grapes
Chili peppers	0.00%	0.00%	0.0000	Assumed zero packaging
Clementines, mandarins, and tangerines	0.56%	0.56%	0.0039	
Coconut	0.00%	0.00%	0.0000	Assumed zero packaging
Cranberries	0.73%	0.74%	0.0027	Grapes
Cucumbers	0.00%	0.00%	0.0000	Assumed zero packaging
Dipped fruit	9.94%	11.03%	0.0324	Fruit or vegetable trays
Eggplant	0.00%	0.00%	0.0000	Assumed zero packaging

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
PRODUCE				
Figs	0.00%	0.00%	0.0000	Assumed zero packaging
Fruit or vegetable trays	9.94%	11.03%	0.0249	
Garlic	0.00%	0.00%	0.0000	Assumed zero packaging
Grapefruit	0.00%	0.00%	0.0000	Assumed zero packaging
Grapes	0.73%	0.74%	0.0035	
Green beans	0.00%	0.00%	0.0000	Assumed zero packaging
Greens	0.00%	0.00%	0.0000	Assumed zero packaging
Honeydew	0.00%	0.00%	0.0000	Assumed zero packaging
Kale	1.70%	1.73%	0.0085	Packaged salads
Kiwis	5.93%	6.30%	0.0298	
Leeks	0.00%	0.00%	0.0000	Assumed zero packaging
Lemons	0.00%	0.00%	0.0000	Assumed zero packaging
Lettuce	1.70%	1.73%	0.0090	Packaged salads
Limes	0.00%	0.00%	0.0000	Assumed zero packaging
Mangos	0.00%	0.00%	0.0000	Assumed zero packaging
Mixed vegetables	2.54%	2.60%	0.0094	Value added vegetables
Mushrooms	6.42%	6.85%	0.0158	
Nectarines	0.00%	0.00%	0.0000	Assumed zero packaging
Onions	0.00%	0.00%	0.0000	Assumed zero packaging
Oranges	0.00%	0.00%	0.0000	Assumed zero packaging
Other beans	0.00%	0.00%	0.0000	Assumed zero packaging
Other berries	10.47%	11.70%	0.0190	Blackberries
Other citrus	0.00%	0.00%	0.0000	Assumed zero packaging
Other fruit	0.00%	0.00%	0.0000	Assumed zero packaging
Other melons	0.00%	0.00%	0.0000	Assumed zero packaging

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
PRODUCE				
Other squash	0.00%	0.00%	0.0000	Assumed zero packaging
Other vegetables	0.00%	0.00%	0.0000	Assumed zero packaging
Packaged salads	1.70%	1.73%	0.0039	
Papayas	0.00%	0.00%	0.0000	Assumed zero packaging
Peaches	0.00%	0.00%	0.0000	Assumed zero packaging
Pears	0.00%	0.00%	0.0000	Assumed zero packaging
Peas	1.68%	1.71%	0.0032	Broccoli
Pineapples	0.00%	0.00%	0.0000	Assumed zero packaging
Plums	0.00%	0.00%	0.0000	Assumed zero packaging
Pomegranates	0.00%	0.00%	0.0000	Assumed zero packaging
Potatoes	0.59%	0.60%	0.0075	
Pumpkins	0.00%	0.00%	0.0000	Assumed zero packaging
Radishes	0.00%	0.00%	0.0000	Assumed zero packaging
Raspberries	10.47%	11.70%	0.0153	Blackberries
Root vegetables	0.00%	0.00%	0.0000	Assumed zero packaging
Spinach	1.70%	1.73%	0.0060	Packaged salads
Sprouts	1.70%	1.73%	0.0034	Packaged salads
Squash	0.00%	0.00%	0.0000	Assumed zero packaging
Strawberries	5.39%	5.69%	0.0210	
Sweet corn	0.00%	0.00%	0.0000	Assumed zero packaging
Tomatoes	6.37%	6.80%	0.0328	
Value added fruit	7.87%	8.55%	0.0240	
Value added vegetables	2.54%	2.60%	0.0081	
Watermelons	0.00%	0.00%	0.0000	Assumed zero packaging

Table 3. Category Level Packaging to Product Ratios Continued

REFED FOOD CATEGORY	PACKAGING % OF PRODUCT WEIGHT LBS PACKAGING / LBS FOOD + PACKAGING	PACKAGING TO PRODUCT RATIO LBS PACKAGING / LBS FOOD	LBS OF PACKAGING PER RETAIL $ SOLD LBS PACKAGING / RETAIL $ SOLD	PROXY CATEGORY
READY-TO-DRINK BEVERAGES				
Coffee	42.44%	73.72%	0.3062	
Fruit and vegetable juice	4.39%	4.59%	0.0686	
Other drinks	7.62%	8.12%	0.1067	Department average
Shakes and smoothies	3.88%	4.04%	0.0171	
Sparkling juice	37.60%	60.27%	1.1132	
Tea	3.75%	3.89%	0.0665	

APPENDIX

Appendix A: ReFED Primary Research for Packaging to Product Ratios

Because there was no publicly available data on packaging to product ratios, ReFED conducted original research to develop proxy packaging to product ratios for each grocery retail category. One product was selected from each grocery retail department with the intent of selecting an archetype product that most closely represents the majority of sales and the most common type of packaging for each category. The following table describes the methodology used to calculate these packaging to product ratios using scale weight measurements of (1) the total product weight and (2) the weight of packaging alone, with food removed. The research team verified the scale accuracy with calibrated weights as a test prior to collecting the measurements. The scale was also tared to zero before each use. Careful care was taken to make sure that all food was removed before weighing the packaging. Towels and a hair dryer were used to remove the weight of water when washing was necessary.

Table 4. Calculations Performed to Determine Item Packaging to Product Ratios

DATA ITEM	DATA SOURCE OR CALCULATION	EXAMPLE
Item Total Weight	Total item weight, including packaging plus food, measured with scale	Package of pita bread weighs 513 grams
Item Packaging Weight	Item packaging weight after food was removed, measured with scale	After removing the pita bread from the bag, the bag alone weighs 8 grams
Item Food Weight	= Item Total Weight - Item Packaging Weight	= 513 grams - 8 grams = 505 grams
Item % Packaging by Weight	= Item Packaging Weight / Item Total Weight	= 8 grams packaging / 513 grams food plus packaging * 100 = 1.56%
Item Packaging to Product Ratio	= Item Packaging Weight / Item Food Weight * 100	= 8 grams packaging / 505 grams food * 100 = 1.58%

Table 5. Images of Item Packaging and Product Weights

The following table displays the proxy products that ReFED selected for each grocery retail category along with the weight measurements obtained from the scale. All of the food purchased for this project was consumed by the research team or acquaintances afterwards.

Table 5. Images of Item Packaging and Product Weights

DAIRY & EGGS		
Butter, margarine, and substitutes	Buttermilk	Cheese
Creams and creamers	Dairy milk	Eggs
Lactose reduced/free milk	Liquid egg mix	Plant-based dairy alternatives
Refrigerated doughs	Sour cream	Yogurt

DELI & PREPARED FOODS		
Deli salads	Deli trays	Fully cooked chicken
Hummus	Meal kits	Pasta

Table 5. Images of Item Packaging and Product Weights

DELI & PREPARED FOODS		
Pizza	Potatoes	Prepared meals
Sandwiches	Snack combos	Soups, stews, and broth
Sushi		

DRY GOODS		
Apple sauce	Baby food	Bagged or loose tea
Baking chips and chocolate	Baking cocoa	Baking coconut
Baking milks	Baking mixes	Baking nuts

Table 5. Images of Item Packaging and Product Weights

DRY GOODS		
Baking yeast	**Bouillon**	**Boxed dinners**
Breakfast syrups	**Broth**	**Canned beans**
Canned fruit	**Canned meat and seafood**	**Canned soup**
Canned vegetables	**Cereal**	**Cereal and granola bars**
Chilled cereal	**Chocolate candy**	**Coating mixes and crumbs**
Coffee	**Coffee enhancers**	**Coffee pods**
Condiments	**Cookies**	**Cooking oils**

Table 5. Images of Item Packaging and Product Weights

DRY GOODS		
Cooking syrups	Cooking wine and vinegar	Corn and other food starch
Crackers	Dessert toppings	Diet and nutrition
Dried fruit and vegetables	Dry beans	Edible cake decoration
Flour and meal	Frosting	Fruit snacks
Gnocchi and dumplings	Grits	Gum
Hard shell tortillas	Herbs, spices, and seasonings	Hot cider
Hot cocoa	Jams and jellies	Marshmallows

Table 5. Images of Item Packaging and Product Weights

DRY GOODS		
Milk enhancers	**Mints**	**Nut butters**
Nuts and seeds	**Oatmeal and hot cereal**	**Other Candy**
Other grains	**Other noodles**	**Other sauce, gravy, and marinades**
Pasta	**Pasta sauce**	**Pickles, olives, and pickled vegetables**
Pie crusts	**Pie filling**	**Pudding and gelatin**
Rice	**Salad dressing**	**Salad toppings**
Salty snacks	**Sauce, soup, and seasoning mixes**	**Shake and smoothie mix**

Table 5. Images of Item Packaging and Product Weights

DRY GOODS		
Shelf-stable dips and salsa	Shortening and lard	Snack cakes
Specialty wraps	Sugar and sweeteners	Toaster pastries
Tomato sauce and paste		

FRESH MEAT & SEAFOOD		
Bacon	Beef roast	Chicken breast
Chicken legs	Chicken thighs	Fowl and exotics
Ground beef	Ground turkey	Ham
Lamb	Lunchmeat	Meat alternatives

Table 5. Images of Item Packaging and Product Weights

FRESH MEAT & SEAFOOD		
Pork	Salmon	Sausage and franks
Steaks	Whole chicken	

FROZEN		
Frozen appetizers	Frozen bakery desserts	Frozen beans
Frozen bread	Frozen breakfast foods	Frozen calzones and stromboli
Frozen chicken	Frozen dairy desserts	Frozen dessert toppings
Frozen dough and batters	Frozen fruit	Frozen fruit juice
Frozen handheld entrees	Frozen lasagna	Frozen mac and cheese

Table 5. Images of Item Packaging and Product Weights

FROZEN		
Frozen meals	Frozen meat alternatives	Frozen pasta
Frozen pie crust	Frozen pizza	Frozen pork
Frozen pot pies	Frozen potatoes	Frozen rolls and buns
Frozen sausage and franks	Frozen seafood	Frozen toaster pastries
Frozen turkey	Other frozen desserts	Other frozen vegetables

PRODUCE		
Blackberries	Blueberries	Broccoli
Carrots	Clementines, mandarins, and tangerines	Fruit or vegetable trays

Table 5. Images of Item Packaging and Product Weights

PRODUCE		
Grapes	Kiwis	Mushrooms
Packaged salads	Potatoes	Strawberries
Tomatoes	Value added fruit	Value added vegetables

READY-TO-DRINK BEVERAGES		
Coffee	Fruit and vegetable juice	Shakes and smoothies
Sparkling juice	Tea	