DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Technical Appendix to the Sunscreen Proposed Rule

Table of Contents

I. Overview

In this technical appendix, we describe the methods used to develop the product counts and consumption estimates in the regulatory impact analysis for the Sunscreen Proposed Rule. We conducted an extensive internet search of available sunscreen products and combined multiple data sources to develop these estimates. We also made some assumptions about the sunscreen market in our analysis. We request comment on our methodology and any assumptions made in our analysis.

First, we will discuss the methods used to develop product counts. Second, we will discuss how we estimate sales for individual formulations, which we use to estimate aggregate sales by product characteristic. Third, we will discuss how we estimate consumption from product sales.

A. Definitions

In Table 1, we define some of the key terms used in this appendix document, pulled from Table 3 in the regulatory impact analysis.

Table 1. Key Terms in the Technical Appendix

Term	Description
Sunscreen Brand	The brand of a sunscreen product is the most prominent major brand name on the sunscreen label. Some examples of sunscreen brands include Coppertone, Neutrogena, and Hawaiian Tropic
Sunscreen Manufacturer	In this analysis, a sunscreen manufacturer is the firm that would directly bear most of the costs associated with this proposed rule, if finalized. We call a firm a sunscreen manufacturer if it owns an establishment that manufactures a sunscreen product in our registration and listing database.
Sunscreen Firm	In this analysis, a sunscreen firm is a labeler or manufacturer that lists a sunscreen product in our registration and listing database. All sunscreen manufacturers are also sunscreen firms.
Sunscreen Product Line	A sunscreen product line is a set of products with similar characteristics and labeling. In our data, we identify product lines as unique combinations of brand and product category (i.e. sunscreen-only product, colorless cosmetic sunscreen product, or color cosmetic sunscreen product).
Sunscreen Product	In this analysis, sunscreen products are products marketed under the OTC monograph system and subject to 21 CFR 201.327. Unless specifically noted, references to sunscreen products do not refer to those marketed under a NDA or ANDA. We define a sunscreen product as unique on all product dimensions except for tint, scent, or size. These product dimensions include all active ingredients and label information, like SPF.
Sunscreen Formulation	A sunscreen formulation is a unique sunscreen product with a specific tint or scent.
Private Label	Private label products are also known as “store brand” products. Many grocery stores, pharmacies, department stores, and large discount retailers sell sunscreens under their own private label. A single

	manufacturer may produce sunscreens for many different private label brands.

II. Sunscreen Product Counts

A. Sunscreen Product Search

We began by searching the FDA electronic drug registration and listing system (eDRLs) for all products marketed under the sunscreen monograph. The eDRLs data contains the national drug code (NDC), proprietary names, and labels for approximately 11,000 formulations, as well as the Dun and Bradstreet DUNS numbers for associated registrants, labelers, and establishments. From the proprietary names and labels, we identify the brands of all NDCs in eDRLs. We then use this list of brands, which includes name brand and private label brands, as the starting point of our data search.[1]

We use the brands listed in eDRLs to conduct a comprehensive Internet search for information on all sunscreen products and formulations marketed under these brands. We attempt to locate the website associated with each brand. On each website, we search for all formulations with keywords such as "SPF", "sunscreen", or "sun protection". For each of these formulations, we record the following information:

- **Product Name:** a description of the product, usually the product's title on the brand's website.
- **Private label**: an indicator variable that equals 1 if the product is from a private label, or store brand, and 0 is the product is from a name brand. We treat private label and name brand products differently in our analysis.
- **Type**: a description of the formulation of the product, if the product has multiple formulations.
- **Category:** describes the product category (either "Sunscreen-Only", "Colorless Cosmetic", or "Color Cosmetic").
- **SPF:** the sun protection factor listed on the product's label. For products that do not have an SPF but do make sun protection claims, we leave this field blank.
- **Plus**: an indicator variable that equals 1 if a plus sign follows the product's SPF and 0 otherwise. For example, this variable equals 1 for an SPF 50+ product and 0 for an SPF 50 product.
- **Broad Spectrum Label**: an indicator variable indicating the presence of a broad spectrum claim on the product's label, where:
    - Broad spectrum label equals 0 if the product's label makes no broad spectrum claim.

[1] We do not use the eDRLs listing of NDCs as our primary dataset of sunscreen formulations for multiple reasons. First, the national drug code may not uniquely identify products. The first four to five digits of an NDC identify the formulation's labeler. If a formulation has multiple labelers, then that single formulation will have multiple NDCs. Second, eDRLs does not offer an up-to-date snapshot of the sunscreen industry. Firms often fail to remove listings of inactive formulations, or lag in their listing of new products. Firms may also create a new listing instead of updating an existing listing when they make changes to a formulation. Third, different firms use different standards for how they list the multiple formulations of a single product. For example, one firm may list a single NDC for a product that comes in multiple fragrances or tints, while another firm may list a different NDC for each fragrance or tint of their product.

    - Broad spectrum label equals 1 if the product's label specifically says "broad spectrum".
    - Broad spectrum label equals 1 if the product's label states that the product offers UVA/UVB protection.
    - Broad spectrum label equals 1 if the product's label states that the product offers "PA+" protection according to Japanese product standards.
    - Broad spectrum label equals 1 if the product's label states that the product offers "PA++" protection according to Japanese product standards.
    - Broad spectrum label equals 1 if the product's label states that the product offers "PA+++" protection or greater according to Japanese product standards.
- **Spray:** an indicator variable that equals 1 if the product is a spray sunscreen and 0 otherwise. We include both lotion sprays and "continuous spray" sunscreens in our definition of a spray. We do not include sunscreens with pump applicators in our definition of a spray.
- **Powder**: an indicator variable that equals 1 if the product is a powder sunscreen and 0 otherwise.
- **Avobenzone:** an indicator variable that equals one if the product's drug facts panel lists "avobenzone" or "butyl methoxydibenzoylmethane" as an active ingredient[2]
- **Ensulizole:** an indicator variable that equals one if the product's drug facts panel lists "ensulizole" or "phenylbenzimidazole sulfonic acid" as an active ingredient
- **Homosalate:** an indicator variable that equals one if the product's drug facts panel lists "homosalate" or "homomethyl salicylate" as an active ingredient
- **Meradimate:** an indicator variable that equals one if the product's drug facts panel lists "meradimate" or "menthyl anthranilate" as an active ingredient
- **Octinoxate:** an indicator variable that equals one if the product's drug facts panel lists "octinoxate" or "octyl methoxycinnamate" as an active ingredient
- **Octisalate:** an indicator variable that equals one if the product's drug facts panel lists "octisalate" or "octyl salicylate" as an active ingredient
- **Octocrylene:** an indicator variable that equals one if the product's drug facts panel lists "octocrylene" as an active ingredient
- **Oxybenzone:** an indicator variable that equals one if the product's drug facts panel lists "oxybenzone" or "benzophenone-3" as an active ingredient
- **Padimate O:** an indicator variable that equals one if the product's drug facts panel lists "padimate O" or "octyldimethyl-PABA" as an active ingredient
- **Sulisobenzone:** an indicator variable that equals one if the product's drug facts panel lists "sulisobenzone" or "benzophenone-4" as an active ingredient
- **Titanium Dioxide:** an indicator variable that equals one if the product's drug facts panel lists "titanium dioxide" as an active ingredient
- **Zinc Oxide:** an indicator variable that equals one if the product's drug facts panel lists "zinc oxide" as an active ingredient
- **Repellent**: an indicator variable that equals 1 if the product's labeling includes insect repellent claims. Repellents include both products containing mosquito repellents, like DEET, citronella, or IR3535, and products that protect against swimmer's itch.

[2] Our search of sunscreen products revealed no products containing the remaining monograph sunscreen active ingredients PABA, trolamine salicylate, cinoxate, and dioxybenzone. We therefore do not create indicator variables for these active ingredients.

- **Meets New Broad Spectrum Requirements**: an indicator variable that equals 1 if the product uses a broad spectrum label and contains either avobenzone or zinc oxide.[3]

Not all brand websites list their products' active ingredients. When active ingredient information is missing from a brand's website, we first attempt to identify a listing for the product in eDRLs. If no listing exists, then we search other websites that usually list a product's active ingredients, like drugstore.com, cvs.com, walgreens.com, target.com, walmart.com, sephora.com, ulta.com, paulaschoice.com, makeupalley.com, and dermstore.com. If we are unable to find any active ingredient information for the product using these websites, then we use the ingredients of a similar product listing from the same brand in eDRLs. Finally, if no similar product listing from the brand exists, we use the active ingredients from a similar product with a similar brand. [4]

After we completed our search for all the brands in eDRLs, we searched for brands that did not list their products with FDA. We searched the following websites for the keyword "SPF" and recorded the names of all brands with products in the search results:

- CVS.com, an online drugstore
- Walgreens.com, an online drugstore
- Target.com, an online mass-merchandiser
- Walmart.com, an online mass-merchandiser
- Sephora.com, an online cosmetics store
- Ulta.com, an online cosmetics store
- Dermstore.com, an online cosmetics store

We also collected the brand names of all products in the Environmental Working Group's sunscreen database. We then expanded our Internet search to include the list of brands without listings in eDRLs and appended the results to the rest of our data.

Finally, we created brand ID, product ID, and formulation ID variables that uniquely identify each brand, product, and formulation. We also created a product line ID, where we define a unique product line as a unique interaction of the brand ID and the product category. We began the data search in January 2016 and completed our search in May 2016. Our results therefore reflect a cross-section of the sunscreen market in early 2016.

B. Private Label Products

In our original data search to develop our listings data, we collected product and ingredient information on 25 private label brands. However, there are many more private label

[3] We assume that a product would meet the new broad spectrum requirements if it already uses the broad spectrum label and if it contains either avobenzone or zinc oxide. Our scientists expect that it is not possible to meet the new broad spectrum requirements without avobenzone or zinc oxide. However, not all sunscreens containing avobenzone or zinc oxide may meet the new broad spectrum requirements. As a result, we may overestimate of the number of sunscreens that would meet the new broad spectrum requirements without reformulating.

[4] As a result of this imputation, our data would not capture any systematic differences between sunscreens with available active ingredient information and sunscreens without available active ingredient information. Because most sunscreens consist of a combination of eight active ingredients, we do not expect that this imputation significantly affects our analysis.

brands on the market, many of which are not available for sale online. We are therefore unable to develop a full listing of every private label sunscreen product. Instead, we use the characteristics of sunscreens in our private label sample to extrapolate to the characteristics of all private label sunscreens.

We use 2014 UPC-level scanner data from IRI to develop a weight for each private label product in our sample. Our IRI scanner data includes all product categories that *may* include products with sunscreen claims. These product categories include:

- "Sun Tan", which corresponds to sunscreen-only products in our product listing data
- "Skin Care", which corresponds to colorless cosmetic products in our product listing data
- "Hand and Body Lotion," which corresponds to colorless cosmetic products in our product listing data
- "Facial Cosmetics," which corresponds to color cosmetic products in our product listing data
- "Eye Cosmetics," which corresponds to color cosmetic products in our product listing data
- "Lip Cosmetics," which corresponds to color cosmetic products in our product listing data

Private label UPCs account for 6.86% of all UPCs in these product categories. Therefore, we assume that private-label formulations should accounts for 6.86% of all formulations. Given that we identify 7,485 brand name formulations on the market, the number of private-label formulations on the market should equal:

$$F_{PL} = 7{,}485\frac{0.069}{1-0.069} = 551$$

We identify only 449 private-label formulations in our product search. Therefore, we weight private-label products so that each private-label formulation in our sample represents 1.23 formulations (551 population private-label formulations ÷ 449 sample private-label formulations).

Table 2 illustrates the use of the private label sample weight. We identify 420 private label products in our sample. These products represent 551 products in the private label population (420 sample private label products × 1.23 sample weight).

Table 2. Number of Brand Name and Private Label Formulations, Products, Product Lines, and Brands

	Brand Name Population Size	Private Label Sample Size	Expected Private Label Population Size	Expected Total Population Size
Formulations	7,485	449	551	8,036
Products	3,563	420	515	4,078
Product Lines	1,129	48	59	1,188
Brands	741	25	31	772

C. Sunscreen Firms and Manufacturers

Using eDRLs and data from Dun and Bradstreet, we determined the global ultimate of the labelers and manufacturers associated with each brand name and private label brand. A sunscreen manufacturer is the owner of an establishment that manufactures a sunscreen product in eDRLs. A sunscreen firm is a labeler or manufacturer associated with a sunscreen product.

For brand name brands, we found that 271 manufacturers were associated with 482 of the 741 brands in our listing data, indicating that there are 0.56 (271 manufacturers ÷ 482 brands) manufacturers for every brand in our registration and listing system. We did not locate manufacturer information for 259 of the brand name brands in our listing data.

For brands not in eDRLs, we assume that the ratio of brands to manufacturers in eDRLs is the same as the ratio of brands to manufacturers for those brands not found in eDRLs. Using this assumption, we estimate that there are 146 additional manufacturers of sunscreens on the market (259 brands × 0.56 manufacturers per brand). Therefore, there are 417 manufacturers of brand name products on the market.

We follow the same methodology (outlined in Table 3) to estimate the number of private label manufacturers, the number of branded firms, and the number of private label firms.

Table 3. Number of Brand Name and Sample Private Label Manufacturers and Firms

Entity[a]	Brand Name Manufacturers	Sample Private Label Manufacturers	Brand Name Firms	Sample Private Label Firms
Brands in eDRLs	482	17	482	17
Entities in eDRLs	271	17	545	41
Brands per Entity	0.56	1.00	1.13	2.41
Brands not in eDRLs	290	8	290	8
Entities not in eDRLs	163	8	328	19
Total Entities	434	25	873	60

[a]For the purposes of this table, an "entity" is a manufacturer or a firm.

We then use the private label sample weight to estimate that there are 31 total private label manufacturers in the sunscreen market (25 private label manufacturers in sample × 1.23 sample weight) and 74 total private label firms in the sunscreen market (60 private label firms in sample × 1.23 sample weight).

To estimate the total number of manufacturers, we must identify the number of manufacturers of both branded and private-label products. We find that 12 of the 17 manufacturers of private label products in eDRLs also manufacture brand name products. Therefore, we assume that 70.59% of manufacturers of private label products also manufacture brand name products. Then, there are 443 manufacturers in the sunscreen market (434 brand name manufacturers + (1 − 0.7059) × 31 private label manufacturers).

Similarly, to estimate the total number of firms, we must identify the number of firms that manufacturer or label both brand name and private label products. We find that 21 of the 41 firms that manufacture or label private label products in eDRLs also manufacture or label brand name products. Therefore, we assume that 51.22% of firms that manufacture or label private label products also manufacture or label with brand name products. Then, there are 908 firms in the sunscreen market (873 brand name firms + (1 − 0.5122) × 74 private label firms).

D. Number of Relabeled and Reformulated Units

1. Relabeled Units

In the regulatory impact analysis, we assume that manufacturers would relabel all sunscreen products in response to the proposed rule, excluding those products that manufactures would discontinue[5] in response to the proposed rule. We explain that we use the number of products (4,028) as our upper bound number of relabeled units, the number of product lines (1,181) as our primary estimate, and the number of sunscreen-only product lines (435) as our lower bound. Table 4 shows how we develop these estimates using the private label sample weight. Columns (1) and (2) are the counts from the listing data. Column (3) is the private label population estimate, obtained by multiplying column (2) by the private label sample weight (1.23). Column (4) is the sum of column (1) and column (3).

Table 4. Number of Relabeled Units

	(1) Brand Name Population	(2) Private Label Sample	(3) Private Label Population	(4) Total Population
Sunscreen-Only, Relabeled Product Lines (Lower Bound)	409	21	26	435
Relabeled Product Lines (Primary Estimate)	1,122	48	59	1,181
Relabeled Products (Upper Bound)	3,531	405	497	4,028

2. Reformulated Units

To determine which products manufacturers would reformulate in our data, we create a reformulation indicator variable. Manufacturers would reformulate any product that meets at least one of the following criteria:

- The product contains PABA, cinoxate, dioxybenzone, ensulizole, meradimate, padimate O, or trolamine salicylate.
- The product uses a broad spectrum label but would not meet the new broad spectrum requirements.
- The product has an SPF between 15 and 80 but would not meet the new broad spectrum requirements.
- The product is a spray sunscreen.
- The product is not a sunscreen-insect repellent combination.

In the regulatory impact analysis, we explain that we use the number of reformulated products as the upper bound (1,750), the number of reformulated products in our *sample* (as

[5] Specifically, in our lower, primary, and upper bound estimates, we assume that manufacturers would discontinue sunscreens with an SPF above 80 and combinations of sunscreens and insect repellents. In the lower bound, we assume that manufacturers would also discontinue all color and colorless cosmetic sunscreen products as well.

opposed to the population) as the primary estimate (1,710), and the number of reformulated sunscreen-only products in our *sample* as the lower bound (742).

Table 5 shows how we use this definition to estimate the number of reformulated units. Columns (1) and (2) are the counts from the listing data. In the lower bound and the primary estimate, we do not adjust the private label sample, so column (3) equals column (2). In the upper bound estimate, we adjust the private label sample, so column (3) equals column (2) × the private label sample weight (1.23). Column (4) is the sum of column (1) and column (3).

Table 5. Number of Reformulated Units in the 8-Ingredient Scenario

	(1) Brand Name Population	(2) Private Label Sample	(3) Private Label Population	(4) Total Population
Sunscreen-Only, Non-Duplicate Reformulated Products (Lower Bound)	605	137	137	742
Non-Duplicate Reformulated Products (Primary Estimate)	1,532	178	178	1,710
Reformulated Products (Upper Bound)	1,532	178	218	1,750

III. Sales by Product

To estimate the 2016 sales by product, we first estimate the total market sales for the three categories of sunscreen products: sunscreen-only products; colorless cosmetic products; and color cosmetic products. Next, we estimate the market share of each brand in our data. Finally, we make some assumptions about the market shares of each product and formulation to distribute sales to each formulation.

A. Total Market Sales

The Euromonitor report estimates the total sales in 2016 for the “Sun Care” market, the “Skin Care” market, and the “Color Cosmetic” market. We assume that the “Sun Care” market captures all sales of sunscreen-only products, the “Skin Care” market captures all sales of colorless cosmetic products with sunscreen claims, and that the “Color Cosmetic” market captures all sales of color cosmetic products with sunscreen claims.

For the sun care market, the Euromonitor report estimates the total sales for 2016 in the “aftersun”, “self-tanning”, and “sun protection" categories of the sun tan market. Aftersun and self-tanning products are unlikely to contain sunscreen active ingredients. We therefore assume that the total sales of sunscreen-only products in our data equals to the total sales in the sun protection category in Euromonitor.

For the skin care market, the Euromonitor sales are the total sales for all skin care products, including those without sunscreen. Because the skin care category includes a wide variety of products, including facial cleansers, acne medication, and stretch mark cream, we expect that sunscreen products make up only a small share of the total sales in the skin care market. We assume that the share of total sales made up by sunscreen products has a lower

bound of 1% a midpoint of 5.5%, and an upper bound of 10%. We ask for comment on this assumption to help us improve our sales estimates.

The Euromonitor color cosmetics sales are the total sales for all color cosmetic products, including those without sunscreen. Because the color cosmetics category includes a wide variety of products, including mascara, nail polish, and lip liners, we expect that sunscreen products make up only a small share of the total sales in the color cosmetics market. We assume that the share of total sales made up by sunscreen products has a lower bound of 1% a midpoint of 5.5%, and an upper bound of 10%. We ask for comment on this assumption.

In Table 6, we estimate the total sales of products with sunscreen claims in 2016.

Table 6. Estimated Sales of Products with Sunscreen Claims in 2016 ($ millions)

	Lower Bound	Primary Estimate	Upper Bound
Sunscreen-Only	$1,454.14	$1,454.14	$1,454.14
Colorless Cosmetics	$142.52	$783.86	$1,425.20
Color Cosmetics	$126.13	$693.70	$1,261.28
Total	$1,722.79	$2,931.71	$4,140.62

All sales estimates are in 2017 dollars.

B. Sunscreen-Only Market Shares

The Euromonitor report includes estimates of the 2014 market shares by brand for the 17 top brands in the sunscreen-only market, which represent 72.0% of the market. The Euromonitor report also estimates that private label sun care makes up 20.1% of the market. The remaining 399 brands selling sunscreen-only products make up 7.9% of the market. For these smaller brands, we assume that each brand has an equal market share of 0.02% (7.9% ÷ 399 brands). This assumption may cause us to overestimate the market-share of some brands and underestimate the market-share of other brands.

For private label brands, we assume that each private label brand in our sample has an equal market-share of 0.96% in the sunscreen-only market (20.1% market share by private label brands ÷ 21 private label brands selling sunscreen-only products in the sample).

C. Colorless and Color Cosmetic Market Shares

The Euromonitor report does not include estimates of the market shares for individual brands in the colorless or color cosmetic markets. We therefore estimate the market shares for brands using IRI scanner data from the following product categories:

- “Skin Care” includes colorless cosmetic products
- “Hand and Body Lotion” includes colorless cosmetic products
- “Facial Cosmetics” includes color cosmetic products
- “Eye Cosmetics” includes color cosmetic products
- “Lip Cosmetics” includes color cosmetic products

1. Premium and Mass-Market Market Shares

IRI data represents sales from food/grocery stores, drug stores, mass merchandisers, club stores, and dollar stores. However, the IRI data does not include sales from premium channels, like department stores, salons, or spas. We assume that a brand is a "mass-market" brand if we find it in the IRI data, and we assume that a brand is a "premium" brand if we do not find it in the IRI data. This assumption may lead us to classify some premium brands as non-premium and to classify some non-premium brands as premium. It may also lead us to underestimate the sales of any non-premium brands that appear in the IRI data that receive a large portion of their sales from non-IRI channels.

For both the colorless and color cosmetic markets, the Euromonitor report includes estimates of the total sales, the total premium sales, and the private label penetration into the market for 2016. We use this data to estimate the total market share of mass-market, premium, and private-label brands in the colorless and cosmetic markets (Table 7).

Table 7. Mass-Market, Premium, and Private Label Market Shares in Colorless and Color Cosmetic Markets

	Mass-Market	Premium	Private Label
Colorless Cosmetics	64.8%	31.2%	4.0%
Color Cosmetics	49.6%	49.5%	0.9%

2. Colorless Cosmetic Market Shares

To estimate the market share of each brand in the colorless cosmetic market, we first look at the mass-market for colorless cosmetic products. First, we create a subsample of the IRI data for the "Skin Care" and "Hand and Body Lotion" categories that includes only brands that market colorless cosmetic sunscreen products in our product listing data. Second, we calculate the total sales by all brands in this subsample, R^M. Third, for each brand i, we calculate the total sales by that brand in this subsample, r_i^M. Finally, the total market share of each mass-market brand s_i is given by:

$$s_i = \frac{r_i^M}{R^M} \times S^M$$

Where S^M is the total market share by mass-market brands in the colorless cosmetic market.

We don't have data on the market shares of premium brands. Therefore, we assume that each of the 320 premium brands that markets colorless cosmetic products has an equal market-share of 0.10% (31.2% share of premium brands in the colorless cosmetic market ÷ 320 premium brands).

For private label brands, we assume that each private label brand in our sample has an equal market share of 0.3% in the colorless cosmetic market (4.0% market-share by private label brands ÷ 15 private label brands selling colorless cosmetic products in the sample).

3. Color Cosmetic Market Shares

To estimate the market share of each brand in the color cosmetic market, we first look at the mass-market for color cosmetic products. First, we create a subsample of the IRI data for the

"Facial Cosmetics", "Eye Cosmetics", and "Lip Cosmetics" categories that includes only brands that market color cosmetic sunscreen products in our product listing data. Second, we calculate the total sales by all brands in this subsample, R^M. Third, for each brand i, we calculate the total sales by that brand in this subsample, r_i^M. Finally, the total market share of each mass-market brand s_i is given by:

$$s_i = \frac{r_i^M}{R^M} \times S^M$$

Where S^M is the total market share by mass-market brands in the color cosmetic market.

We don't have data on the market shares of premium brands. Therefore, we assume that each of the 251 premium brands that markets color cosmetic products has an equal market share of 0.2% (49.5% share of premium brands in the color cosmetic market ÷ 251 premium brands).

For private label brands, we assume that each private label brand in our sample has an equal market share of 0.1% in the color cosmetic market (0.9% market share by private-label brands ÷ 12 private-label brands selling colorless cosmetic products in the sample).

D. Sales by Product and Formulation

To estimate the sales by each sunscreen-only product, we assume that each sunscreen-only product marketed by a given brand has an equal market share in the sunscreen-only market. Then, the market share of that product is the market share of the brand divided by the number of sunscreen-only products marketed by the brand. For products with multiple formulations, we assume that each formulation of a product has an equal market share in the sunscreen only market. Then, the market share of that formulation is the market share of the product divided by the number of formulations of the product. Finally, the sales of each formulation equal the market share of the formulation times the total sales in the sunscreen-only market, given by Table 6. We perform parallel calculations to estimate the sales for each colorless cosmetic formulation and for each color cosmetic formulation.

IV. Consumption by Product

To estimate the consumption of each product, we first estimate the average price per volume of different types of products. For mass-market sunscreen-only products, we estimate the average price per ounce of brand name UPCs in the "Sun Tan" category of the IRI data. For premium sunscreen-only products, we assume that premium products are the same volume as mass-market sunscreen-only products, at double the price of mass-market products. We request comment on this assumption. For private label sunscreen-only products, we estimate the average price per ounce of private label UPCs in the "Sun Tan" category of the IRI data.

For mass-market, colorless cosmetic products, we estimate the average price per ounce of UPCs in the "Hand and Body Lotion" and "Skin Care" categories of the IRI data. For premium colorless cosmetic products, we assume that premium products are the same volume as mass-market colorless cosmetic products, at double the price of mass-market products. We request comment on this assumption. For private label colorless cosmetic products, we estimate the average price per ounce of private label UPCs in the "Hand and Body Lotion" and "Skin Care" categories of the IRI data.

For mass-market color cosmetic products, we estimate the average price per ounce of UPCs in the "Facial Cosmetics", "Eye Cosmetics", and "Lip Cosmetics" categories of the IRI data. For premium color cosmetic products, we assume that premium products are the same volume as mass-market products, at double the price of mass-market products. We request comment on this assumption as well. For private label color cosmetic products, we estimate the average price per ounce of private label UPCs in the "Facial Cosmetics", "Eye Cosmetics", and "Lip Cosmetics" categories of the IRI data.

Table 8 shows the average prices, average sizes, and average price per volume of different types of sunscreen products. We match each product in our listing data to a type, based on the brand and the product category. Then, the consumption of a product of a given type is the sales of that product divided by the average price per volume of sunscreens of that type.

Table 8. Average Price and Volume of Sunscreen Products by Type

Category	Market	Average Price ($)	Average Volume (oz)	Average Price per Volume ($/oz)
Sunscreen-Only	Mass	$9.48	5.82	$1.63
	Premium	$18.96	5.82	$3.26
	Private Label	$6.31	7.31	$0.86
Colorless Cosmetic	Mass	$12.90	6.94	$1.86
	Premium	$25.80	6.94	$3.72
	Private Label	$7.02	9.52	$0.74
Color Cosmetic	Mass	$7.45	0.33	$22.35
	Premium	$14.90	0.33	$44.71
	Private Label	$8.56	0.54	$15.76

All price estimates are in 2017 dollars.