CPSC Staff Statement on "Final Cordless Window Coverings Comprehensive Cost Analysis"[1]
December
2018

The report titled, "Final Cordless Window Coverings Comprehensive Cost Analysis," presents the findings of research conducted by Industrial Economics (IEc) under Contract CPSC-D-15-004, Task Order 4. In 2015, CPSC staff issued this task order to provide estimates of social cost of a mandatory cordless requirement for window coverings.

The attached report uses information collected by CPSC during the preparation of an advance notice of proposed rulemaking (ANPR), information from the public comments on the ANPR, a market research report[2] prepared by IEc, and a manufacturing cost analysis[3] conducted by a subcontractor, Dr. Jitesh Panchal of Purdue University, to estimate the social costs of cordless window coverings.

[1] This statement was prepared by CPSC staff, and attached report was produced by IEc for CPSC staff. The statement and report have not been reviewed or approved by, and do not necessarily represent the views of the Commission.

[2] "Window Coverings Market Research Report," Industrial Economics, Inc., Cambridge, Massachusetts, December 2015.

[3] "Manufacturing Cost Analysis: Cordless vs. Corded Products," Jitesh Panchal, Ph.D., Purdue University, February 2016.

IEc

MEMORANDUM | 8 April 2016

TO Consumer Product Safety Commission, Directorate for Economic Analysis

FROM Jennifer Baxter and Saritha Ramakrishna, Industrial Economics, Incorporated

SUBJECT Final Cordless Window Coverings Comprehensive Cost Analysis

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On May 23, 2013, Parents for Window Blind Safety, Consumer Federation of America, Consumers Union, Kids in Danger, Public Citizen, U.S. Public Interest Research Group, Independent Safety Consulting, Safety Behavior Analysis, Inc., and Onder, Shelton, O'Leary & Peterson, LLC (petitioners), petitioned CPSC to promulgate a mandatory standard to eliminate accessible cords on window covering products (78 FR 42026). The petitioners requested that CPSC address the hazard of strangulation to young children posed by window covering cords when a feasible cordless alternative exists, and require that all cords be made inaccessible through the use of passive guarding devices when a feasible cordless alternative does not exist.

CPSC published an Advanced Notice of Proposed Rulemaking (ANPR) on January 16, 2015 (80 FR 2327), which included a characterization of the window coverings market and provided preliminary estimates of the potential costs and benefits of regulating window coverings. It also solicited additional information from the public via a set of 40 specific questions. The public comment period closed on June 1, 2015.

To enhance CPSC's understanding of the market for window coverings, IEc conducted market research relying on publically available information and limited outreach to potentially affected entities. This effort was intended to supplement information and data previously collected by CPSC and provided via public comment. The results of that effort were provided to CPSC in memorandum dated December 17, 2015 (IEc, 2015).

In a parallel effort, IEc worked with an independent engineering expert, Dr. Jitesh Panchal of Purdue University, to develop estimates of the incremental cost of manufacturing cordless products. The results of Dr. Panchal's engineering cost analysis were provided to CPSC on February 9, 2016 (Panchal, 2016).

In this memorandum, we use the information collected by CPSC during the preparation of ANPR and via public comment, as well as the results of our market research effort and engineering cost analysis, to estimate the social cost of a mandatory cordless requirement for window coverings. This information can be compared to monetary estimates of the likely benefits of such a requirement to determine whether monetized net benefits are likely to be positive. CPSC is preparing estimates of the likely benefits under a separate, parallel effort.

In the remainder of this memorandum, we begin by providing background information describing window covering products and the possible requirement. Next, we discuss the conceptual framework for our analysis, followed by an overview of key data sources. A detailed discussion of our analytic steps and presentation of the results follows. We conclude with a discussion of the limitations and key sources of uncertainty in our analysis and recommended next steps.

1.0 BACKGROUND

This section provides context for the cost analysis. First we describe the types of window covering products potentially affected. Then, we discuss the potential mandatory cordless requirement and the current frequency at which consumers select cordless technology absent a regulation.

1.1 MARKET OVERVIEW

Window coverings serve multiple purposes, including providing privacy and light control, improving the energy efficiency of a home, and providing aesthetic benefits. They can be classified into the following product categories:

- Blinds (including horizontal and vertical blinds);
- Shades (including cellular, pleated, roller, and Roman); and
- Curtains and draperies.[1]

Blinds are the most common type of covering currently in use in homes in the United States, accounting for 62 percent of all residential window coverings (D&R, 2013). Curtains and shades represent 19 and 17 percent of residential coverings, respectively (D&R, 2013).

According to the Window Covering Manufacturers Association (WCMA), window covering products can be further segregated into two distinct categories: stock and custom products (WCMA, 2015b). Stock products are generally available pre-made in standard sizes, packaged, and ready to install. Stock products tend to have lower price points and account for a greater share of the installed base of window coverings (D&R, 2013). For example, vinyl and metal blinds, which have the lowest prices across all products, represent 26 percent of the installed base (D&R, 2013). According to the WCMA, stock products are designed for a shorter product life and tend to be replaced more frequently than custom products.[2]

Custom products, in contrast, are made to order for a specific customer. They tend to have higher price points and are subject to far greater variation in terms of size, materials, and features. Given the cost of custom products, homeowners often work with interior designers to order and/or install these products (WCMA, 2015a).

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[1] Approximately two percent of residential window coverings are shutters. Because this type of covering does not rely on cords, and thus is not subject to potential regulation, we do not include it in further discussion in this memorandum.

[2] In its 2015 presentation to CPSC, the members of the WCMA stated that the target product life for custom products is 10 years, though many of these products remain in homes for 15 to 20 or more years. By comparison, the target product life for stock products is three to five years; many of these products remain in homes for ten or more years (WCMA, 2015a).

In terms of annual shipments by window coverings manufacturers to the U.S. residential market, evidence suggests metal or vinyl horizontal blinds (largely stock products) dominate. In a study prepared for the U.S. Department of Energy (DOE), analysts estimate 86 million metal or vinyl horizontal blinds are shipped annually. The WCMA estimates that 100 million window coverings of all types are produced per year (WCMA, 2015b).[3] Combining the two figures suggests metal or horizontal blinds account for more than 80 percent of shipments. A public comment submitted by Safety Behavior Analysts, Inc. supports this conclusion, stating that 80 percent of all window coverings sold are off-the-shelf stock window coverings (Safety Behavior Analysis, Inc., 2015).

Importantly, vinyl and metal blinds are primarily manufactured outside the United States. For example, WCMA members provided data suggesting more than 95 percent of vinyl blinds and more than 75 percent of metal blinds, are produced overseas (D&R, 2015). It appears that generally, higher priced products, such as cellular, roller, and Roman shades, are more likely to be produced domestically (D&R, 2015).

1.2 POSSIBLE CORDLESS REQUIREMENT AND BASELINE ADOPTION RATE[4]

The petitioners requested that CPSC address the hazard of strangulation to young children posed by window covering cords when a feasible cordless alternative exists, and require that all cords be made inaccessible through the use of passive guarding devices when a feasible cordless alternative does not exist. CPSC has not yet defined a proposed rule to reduce the risk of strangulation to young children as a result of window covering cords. For the purpose of this analysis, we assume that in the future, all window coverings would be required to adopt cordless technology.

Traditionally, shades and blinds generally have cords located inside the product (inner cord), to the side of the product (operating cord or outer cord), or both. The inner cords may be exposed from the front, rear, or bottom of the window covering or can be rendered inaccessible, depending upon how the product is constructed. The outer cord or operating cord allows the user to raise, lower, open and close, rotate, or tilt the window covering. Operating cord systems generally fall into one of three categories; (1) standard; (2) single cord; and (3) continuous loop.

Virtually every window covering type is available with a "cordless" operating system, which means it has been designed to function without an operating cord.[5] In lieu of an operating cord, cordless operating systems can be manual or motorized. A manual operating system allows users to lift or lower the window covering with a plastic handle

[3] WCMA's public comment letter does not specify whether its estimate of 100 million window coverings produced annually applies to both residential and commercial applications, or just residential applications. The majority of its comment focuses on residential applications; therefore, we assume this estimate is similarly applicable to that portion of the market. In addition, the figure is less than the lowest estimate of the residential market provided by D&R (2013).

[4] The discussion in this section of current corded and cordless technology and the potential requirement is taken nearly verbatim from CPSC (2014).

[5] The availability of alternatives to corded operating systems may be constrained at times due to the size and weight of the window covering (WCMA, 2015a).

or directly by hand. A motorized operating system uses a motor and control system to manipulate the window covering function, such as a remote control or wall switch.

Window coverings with cordless operating systems are generally more expensive than comparable corded systems (IEc, 2015). According to the WCMA, absent a regulation, consumers are more likely to select a cordless option with higher-priced, custom products than with stock products (WCMA, 2015a). For example, it estimates consumers almost never (approximately one percent of units) select the cordless option for stock horizontal blinds (WCMA, 2015a). These users tend not to raise and lower the blinds; rather, they simply rotate the louvers to let in light (WCMA, 2015a). In contrast, consumers select cordless options more than 50 percent of the time for cellular and roller shades (WCMA, 2015a).

2.0 CONCEPTUAL FRAMEWORK

To quantify the costs of a regulation, economists evaluate its impacts on economic welfare, as measured by changes in producer and consumer surplus. In the context of the market for window coverings, producer surplus is the difference between the total amount that manufacturers and retailers receive for supplying the market and the economic costs incurred in this process. Similarly, consumer surplus is the difference between the maximum amount that consumers would be willing to pay for window coverings and the price they actually pay. Any reduction in consumer or producer surplus represents a loss of economic welfare, and thus a cost to society.

If there are no market distortions, consumer surplus and producer surplus can be measured or approximated by analyzing market demand and supply curves. The information currently available, however, is insufficient to estimate well-specified demand and supply curves for each major segment of the window coverings market. In the face of these limitations, we employ two alternative approaches for estimating costs.

- **Approach 1: Direct Compliance Costs.** Under this approach, we estimate the direct compliance costs of the regulations. Specifically, we multiply estimates of the percent increase in retail price likely to result from implementing manual cordless technology by baseline prices and the number of units sold annually. This approach is more likely to overstate than understate the likely change in economic welfare because it assumes the quantity of units sold remains unchanged after the regulation takes effect. Furthermore, the approach does not specify who will bear the costs. Manufacturers or retailers could incur costs in the form of reduced profits, or consumers could bear the costs in the form of increased prices.
- **Approach 2: Consumer Surplus Loss.** As an alternative, we assume that the total cost of the regulation is borne by consumers in the form of higher prices.[6] Thus, we estimate the change in consumer surplus resulting from increased prices.

[6] Effectively, under this assumption, we assume that supply curve is flat. As a result, no producer surplus exists. This approach represents an upper bound on the potential effect on consumers.

As previously noted, the information required to derive a well-specified demand curve for the various stock and custom markets is not currently available. In the absence of such information, we employ an assumption about the slope of the demand curve reflecting the price elasticity of demand for window coverings. The price elasticity of demand characterizes the extent to which demand for a particular good is likely to change for a given change in price. In combination with information about current market conditions (prices and quantity sold), an estimate of the price elasticity of demand for window coverings can be used to characterize the loss in consumer surplus associated with the regulation. The more inelastic the demand for the product (i.e., the closer the own-price elasticity of demand is to zero), the greater the consumer surplus loss will be.

We apply the direct compliance cost approach to all window covering product types except roller shades, vertical blinds, and curtains and drapery.[7] The consumer surplus approach is only applied in the context of stock horizontal and vinyl blinds. This market is more homogenous, and the range in product prices is relatively small compared to the custom market (D&R, 2013; IEc, 2015). Thus, we have greater confidence about the equilibrium price of this product in the baseline (i.e., absent the requirement).

The results of these two approaches are not additive. The direct compliance cost approach provides an approximation of surplus loss assuming no change in the quantity of units sold. The consumer surplus approach is a partial equilibrium approach that takes into account the potential change in the quantity of blinds sold. Comparing the results of the two approaches for horizontal vinyl and metal blinds provides some insight into the degree to which the direct compliance approach may overstate the actual impact on economic welfare.

As discussed in the following sections, we rely on estimates of the likely cost increase prepared for CPSC by an academic expert (Panchal, 2016). Dr. Panchal uses a product archeology approach, supplemented by standard models for calculating manufacturing and assembly costs, to estimate the incremental cost of implementing standard manual cordless technology. He notes that his approach does not account for costs associated with product development, testing, licensing of technology, and training of personnel (Panchal, 2016). In addition, higher incremental costs could result from the use of higher-quality cordless systems than those analyzed in his report, the need to create customized solutions for window coverings of greater size and weight, and costs associated with coverings manufactured at lower volumes (Panchal, 2016). Thus, we assume that the incremental cost increases estimated in Panchal (2016) represent a low-end estimate (referred to in this memorandum as the "low-end scenario") of the impact of a cordless requirement.

[7] Dr. Panchal found that current manual cordless options for vertical blinds and curtains and drapery are generally no more expensive than the corded versions. Thus, we exclude these product types from our analysis. Our market research (IEc 2015) suggests the same may be true for many types of roller shades, thus we also exclude this product type.

For each cost approach (direct compliance costs and consumer surplus) we also calculate an alternative, high-end estimate (the "high-end scenario") of the impact using an alternative estimate provided by the WCMA (2015a). During its 2015 presentation, WCMA representatives commented on the share of cost of a given stock or custom unit that derives from the cordless technology. Because the estimate references the cost of the product, rather than its retail price, we adjust the estimate using information from Supplier Relations US, LLC (2010) describing the typical retail margin, over and above manufacturing, freight, and distribution costs, for window coverings.[8]

Exhibit 1 summarizes each approach and cost scenario. The direct compliance cost approach is applied to stock and custom products including: horizontal blinds; cellular shades; pleated shades; and Roman shades. As discussed earlier, the consumer surplus approach is only applied to horizontal metal and vinyl blinds. Because current manual cordless options are generally no more expensive than corded options for vertical blinds and curtains and drapery products, we assume the incremental effect of a cordless requirement for these products is zero. Finally, our analysis focuses solely on residential users because we lack information describing the type and quantity of window coverings sold for use at commercial properties.

EXHIBIT 1. SUMMARY OF PRODUCTS COVERED UNDER EACH APPROACH[a]

APPROACH	LOW-END SCENARIO Panchal (2016) data on incremental unit costs	HIGH-END SCENARIO WCMA (2015a) information on incremental unit costs
Direct compliance costs: - Costs may be borne by producers, retailers, or consumers - Quantity demanded does not change based on consumer preferences	Stock and Custom: • Horizontal blinds • Cellular shades • Pleated shades • Roman shades	Stock and Custom: • Horizontal blinds • Cellular shades • Pleated shades • Roman shades
Consumer surplus loss: - Assumes costs are borne entirely by consumers - Quantity demanded changes based on consumer preferences	Stock: • Horizontal metal • Vinyl blinds	Stock: • Horizontal metal • Vinyl blinds
Notes: a.) The analysis focuses on residential markets; window coverings sold for use at commercial properties are not included.		

[8] Supplier Relations US, LLC (2010) provides data and information related to the "Blind and Shade Manufacturing Industry", which it defines as "establishments primarily engaged in manufacturing one or more of the following: venetian blinds, other window blinds, shades; curtain and drapery rods, poles; and/or curtain and drapery fixtures." Thus, we assume the reported margins apply to all of the product categories analyzed in this memorandum.

3.0 KEY SOURCES OF DATA

This section provides an overview of the key data sources we rely upon in our analysis. Additional details about specific model variables are provided in the following section, where we describe each step of our analysis.

- **D&R, International Ltd, *Residential Windows and Window Coverings: A Detailed View of the Installed Base and User Behavior* (D&R, 2013).** In 2013, D&R prepared a report as part of an effort to expand the ENERGY STAR program to include window coverings. The report was funded (or received financial support) from the WCMA, DOE, and the Lawrence Berkeley National Laboratory (LBNL). D&R designed and implemented a household survey that yielded approximately 2,100 responses as part of an effort to characterize the installed base of residential windows and window coverings in the United States. The report summarizes the results of this survey and includes a methodology to estimate the share of each type of window covering, which we adopt in our analysis. The report also provides information about the range, median, and mean price points for different categories of coverings based in information the authors obtained from WCMA and major retailers.[9] We generally find the study to be a comprehensive and thorough effort in characterizing the market for window coverings.[10]
- **WCMA Technical Presentation to CPSC, May, 27 2015 (WCMA, 2015a).** On May 27, 2015, members of the WCMA participated in a meeting with CPSC staff to discuss currently available cordless and cord inaccessible technologies, achievable alternatives, and the impacts of these alternatives on end-users. During its presentation, WCMA provided information on the baseline rate of adoption of cordless models, which we incorporate in our analysis. WCMA also provided information on the differences between the stock and custom markets that inform our analysis. Finally, WCMA provided separate estimates for the stock and custom markets of the proportion of the total cost of producing a blind that is attributable to the cordless component. This information informs our analysis of the high-end economic cost of a cordless requirement.
- **WCMA public comment response to the Advanced Notice of Proposed Rulemaking (ANPR), June 1, 2015 (WCMA, 2015b).** On June 1, 2015, WCMA provided a response to CPSC's ANPR noting that approximately 100 million window coverings of all types are produced annually. We use this aggregate figure as the starting point for our segmentation of the market by product category.

[9] Because WCMA members have a comprehensive understanding of the window coverings market, we assume the price information reported by D&R is more comprehensive than the sample of market prices reported in IEc (2015). The information collected for IEc (2015) generally supports the information provided in D&R (2013).

[10] Note that we did not review the survey instrument, sampling plan, and statistical analysis of the data in detail; rather we rely on D&R's description of its methodology and results.

- **Panchal, J. H.,** ***Manufacturing Cost Analysis: Cordless Versus Corded Window Covering Products*** **(Panchal, 2016).** Dr. Panchal, an Associate Professor at Purdue University's School of Mechanical Engineering and leader of Purdue's Design Engineering Lab, conducted an analysis of the incremental cost of implementing cordless technology for a variety of window covering products. The work was conducted under subcontract to IEc and was funded by CPSC. Dr. Panchal's report provides the cost of cordless technology as a percentage of retail price for several categories of stock products. This incremental cost encompasses manufacturing costs only (labor and materials) and informs our low-end cost scenario.

4.0 ANALYTIC STEPS

In this section, we describe each step of our analysis in detail. Our approach generally proceeds as follows:

- **Step 1: Estimate the total number of window coverings sold in the U.S. annually.** We use WCMA's (2015b) aggregate estimate of the total number of coverings sold and segment this total by window covering type using information provided in D&R (2013).We also test the sensitivity of our results to this assumption using an alternative, higher estimate of total coverings.
- **Step 2: Estimate the share of cordless products sold in the baseline, absent a regulation.** The next step is to estimate the total number of cordless products, by category, currently purchased by consumers. These products are unaffected by the rule, and therefore are not included in our analysis. We use data from WCMA (2015a) to estimate and subtract the share of cordless products included in Step 1.
- **Step 3: Apply per-unit incremental cost estimates by product category to estimate total direct compliance costs.** Using a range of per-unit incremental cost estimates obtained from Panchal (2016) and WCMA (2015a), we calculate the incremental increase in retail price associated with implementing cordless technology for each type of window covering. The result is a range of incremental costs that would be required to implement cordless technology on a per-unit basis. Incremental costs are then multiplied by the total number of corded units sold annually in each product category in order to estimate the total direct compliance costs.
- **Step 4: Use an estimate of the elasticity of demand for window coverings to model the change in the quantity of products sold, based on the change in price (metal and vinyl blinds only).** We calculate the change in the quantity of metal and vinyl blinds purchased by residential consumers based on the incremental values from Step 3 and the application of an estimate of the elasticity of demand for these products. We limit this calculation to metal and vinyl blinds because the available unit retail price estimates for these stock

products are more certain (i.e., the range in possible prices provided in D&R (2013) is relatively narrow).

- **Step 5: Calculate the loss in consumer surplus (metal and vinyl blinds only)**. This result represents the welfare loss of the rule for metal and vinyl blinds, assuming costs are passed on entirely to consumers. Comparing this result to the direct compliance costs for metal and vinyl blinds estimated in Step 3 provides a sense of the degree to which our estimates of direct compliance costs may overstate the likely loss in economic welfare resulting from compliance with a cordless requirement.

Each step is described in greater detail below.

4.1 STEP 1: NUMBER OF WINDOW COVERINGS AFFECTED

In the first step of our analysis, we estimate the total number of window coverings sold in the United States by product type. WCMA (2015b) reports that 100 million window covering units are sold in the United States annually.[11] To segment this figure into the different types of coverings, we use data reported by D&R (2013) describing the relative number of units sold in each category to residential customers.

D&R (2013) states, "[s]hipment estimates are based on three datasets: U.S. Census Bureau reports of vinyl blind imports, shipment data supplied by WCMA members, and the installed base of coverings from the survey. These data are sufficient to enable reasonably precise estimates of shipments for blinds and WCMA member shipments, but not of the total number of window covering shipments in the United States or for other product categories, because data on imports of other product types and shipments of non-WCMA members are not available." Given this statement, we rely on D&R's (2013) estimate of 86 million total units of metal and vinyl blinds sold annually to residential customers. [12]

If 86 million units of metal and vinyl blinds are shipped annually, then the remaining product categories must total 14 million shipments (100 million units – 86 million units of metal and vinyl blinds = 14 million units of all other types of window coverings). To segregate these 14 million units into product types (e.g., cellular shades, Roman shades, etc.), we rely on the relative proportion of product types reported in D&R's estimate of total shipments. Specifically, to estimate shipments for remaining product categories,

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[11] WCMA does not specify whether this figure refers to window coverings sold to all customers, or only residential customers. However, in its public comment, it provides commentary suggesting the D&R (2013) estimate of 154 million to 235 million annual shipments for residential use is overstated, possibly due to assumptions about shorter product lifetimes than observed in practice (WCMA, 2015b). Thus, we assume the estimate of 100 million units refers to residential products.

[12] D&R (2013) relies import data for 2011 obtained at: United States Census, "USA Trade Online." https://usatrade.census.gov/. D&R confirmed via email that it relies on the commodity category "3925301000 Blinds (including Venetian Blinds) of Plastic" as the base figure for all metal and vinyl blinds shipped in the United States in a given year (Email communication with a representative of D&R International dated February 1, 2016). It multiplies the import figure by 65 percent to estimate the portion of these imports destined for residential customers (D&R, 2013). Importantly, because this figure is derived from Census data, it is not subject to the concerns about D&R's product lifetime assumptions.

D&R (2013) relies on survey data and assumptions about product lifetimes to estimate a range (low, medium, and high) of annual shipments. We estimate the relative proportions of shipments in the remaining categories under the "medium" scenario and apply that distribution to the remaining 14 million units sold annually.[13]

Considering that the aggregate figure provided by WCMA (2015a) is likely to be a rounded estimate, and because the estimated proportions of window covering categories that are not vinyl or metal horizontal blinds are relatively small when applying this methodology, we test the sensitivity of our results to our assumption regarding the aggregate number of coverings sold annually. We increase the estimate of aggregate units shipped annually by 20 percent, for a total of 120 million units.[14] Thus, assuming 86 million units are metal and vinyl blinds, the remaining 34 million units are distributed across the other product types using the approach described above. The results are presented below in Exhibit 2.

[13] To the extent that D&R underestimates product lifetimes, we assume the magnitude and direction of bias is similar across all product types. Thus, the relative proportion of products in each category can be applied to our estimate of the total units shipped.

[14] We note that D&R (2013) estimates 154 to 221 million (corrected) annual shipments of residential window coverings. WCMA's (2015b) estimate of 100 million is lower, and it does not directly comment on the reason for this difference. However, when comparing a separate WCMA estimate of current window coverings in use to an estimate presented in D&R (2013), WCMA (2015b) states it assumes fewer shipments and a longer product service life. Thus, assuming the industry association has better information regarding shipment number and typical product service life, our sensitivity analysis applies an annual shipment estimate that is larger than WCMA's estimate, but smaller than D&R's low-end scenario.

EXHIBIT 2. ESTIMATED NUMBER OF TOTAL UNITS SHIPPED IN THE U.S. ANNUALLY, BY WINDOW COVERING TYPE

WINDOW COVERING TYPE	DISTRIBUTION OF OTHER PRODUCT TYPES[a]	ESTIMATED ANNUALLY SHIPPED UNITS[a]	
		Primary Estimate	Estimate for Sensitivity Analysis
Assumed Total		**100,000,000**	**120,000,000**
Vinyl or metal horizontal blinds		**86,000,000**	**86,000,000**
Subtotal for all other product types	**100%**	**14,000,000**	**34,000,000**
Wood or faux wood horizontal blinds	16%	2,304,397	5,596,392
Vertical blinds [b]	25%	3,488,162	8,471,251
Cellular shades	10%	1,452,086	3,526,494
Pleated shades	11%	1,531,003	3,718,151
Roller shades [b]	8%	1,152,198	2,798,196
Roman shades	2%	252,537	613,303
Curtains/drapery [b]	13%	1,878,241	4,561,443
Sheer drapery [b]	3%	457,723	1,111,612
Soft sheer blinds [c]	7%	947,012	2,299,887
Soft sheer blinds (transparent)[c]	2%	315,671	766,629
Interior shutters [d]	2%	220,970	536,640

Sources: WCMA (2015b), D&R (2013), and IEc calculations.
Notes:
a.) Totals may not calculate due to rounding.
b.) We do not consider vertical blinds, roller shades or curtains/drapery in our analysis, as current cordless versions of these products are generally no more expensive than corded technology.
c.) We do not consider these products in our analysis, as these are mostly high-end, custom products, as noted in D&R (2013), and therefore likely to be cordless.
d.) Interior shutters do not use cords, and thus are not included in our analysis.

4.2 STEP 2: ESTIMATE BASELINE NUMBER OF CORDLESS UNITS

WCMA (2015a) provides information about the frequency at which customers purchasing horizontal blinds, cellular shades, and roller shades choose cordless technology. Lacking similar information for Roman shades and pleated shades, we assume customers choose cordless technology for these products at cellular shades rate. We subtract the share of cordless units typically purchased for each product category in order to calculate the baseline number of corded units affected by the potential requirement. Exhibit 3 shows

the proportions we apply in our analysis and the resulting number of affected corded products.

EXHIBIT 3. BASELINE NUMBER OF CORDED PRODUCTS

WINDOW COVERING TYPE	PERCENT OF UNITS SOLD THAT USE CORDED TECHNOLOGY	TOTAL CORDED UNITS SOLD ANNUALLY	
		Primary Estimate	Estimate for Sensitivity Analysis
Vinyl or metal horizontal blinds	99%	85,140,000	85,140,000
Wood or faux wood horizontal blinds	99%	2,281,353	5,540,428
Cellular shades	50%	726,043	1,763,247
Pleated shades [a]	50%	765,502	1,859,076
Roman shades [a]	50%	126,268	306,652

Source: WCMA (2015a) and IEc calculations.

Note:

a.) WCMA does not provide cordless take rates for these categories. We assume the cordless take rate is similar to other categories of shades.

4.3 STEP 3: ESTIMATE DIRECT COMPLIANCE COSTS

To estimate the incremental, per unit cost of implementing cordless technology, we apply estimates from two separate sources. As described in section 2.0, the low-end scenario relies on Panchal (2016), and the high-end scenario relies on WCMA (2015a). These two estimates are intended to serve as bounds on the likely impact of the requirement on economic welfare.

4.3.1 Low-end Scenario

Panchal (2016) uses a product archeology approach, supplemented by standard models for calculating manufacturing and assembly costs, to estimate the incremental cost of implementing standard manual cordless technology. He analyzes three low-price stock products: horizontal blinds, cellular shades, and Roman shades.[15] For each product, he provides incremental costs for two sizes. Additionally, he provides the increased manufacturing cost as a percent of retail price for each product (see Exhibit 4).

[15] Panchal (2016) does not analyze pleated shades, therefore, we apply the estimate for the incremental increase in price for cellular shades to this product category.

EXHIBIT 4. LOW-END SCENARIO UNIT COST OF CORDLESS TECHNOLOGY (STOCK PRODUCTS)

WINDOW COVERING TYPE	INCREASED MANUFACTURING COST AS A PERCENT OF RETAIL PRICE	
	Low Cost Environment[a]	High Cost Environment[b]
Horizontal Blinds		
27" x 64"	6 – 11%	11 – 20%
72" x 64"	5 – 9%	9 – 16%
Cellular Shades		
23" x 72"	3 – 5%	5 – 9%
72" x 72"	2 – 4%	4 – 7%
Roman Shades		
27" x 64"	4 – 8%	8 – 15%
72" x 64"	3 – 6%	7 – 13%

Source: Panchal (2016).
Notes:
a.) The low cost environment assumes manufacturing occurs overseas.
b.) The high cost environment assumes manufacturing occurs in the United States.

Panchal (2013) notes, "[t]he analysis includes only the costs associated with manufacturing content and the assembly of the product, and focuses on smaller products available in the marketplace. It does not account for any costs associated with product development, testing, licensing of technology, and training of personnel, which would further increase the overall cost of implementing cordless technologies." Furthermore, his estimates are most applicable to the more basic and inexpensive cordless products (i.e., stock products).[16] He identifies a number of factors that would result in higher incremental costs for other types of products, including the factors listed above, as well as the costs of customizing solutions for window coverings of greater size and weight; and costs associated with lower volume customized window coverings.[17]

D&R (2013) provides information on the degree to which different products are manufactured domestically. Based on this information, for each product category, we make the following assumptions, as shown in Exhibit 5, about where the units are manufactured.

[16] Panchal (2016) also analyzes two higher-end, custom products (a cellular shade and wood blinds) provided to him by Hunter Douglas. The unit costs of the cordless technology are higher in these products than for similarly sized stock products. However, because the retail price of these products is not readily-available, Dr. Panchal is unable to report costs as a percent of retail price.

[17] Panchal (2016) assumes a production rate between 100,000 and 1,000,000 units per year for the products analyzed.

EXHIBIT 5. MANUFACTURING LOCATION[a]

WINDOW COVERING TYPE	PERCENT PRODUCED IN THE OVERSEAS (Low Cost Environment)	PERCENT PRODUCED IN THE DOMESTICALLY (High Cost Environment)
Vinyl blinds	97%	3%
Metal blinds	79%	21%
Faux wood blinds	85%	15%
Wood blinds	75%	25%
Pleated shades[b]	75%	25%
Cellular shades	18%	82%
Roman shades	48%	52%

Source: D&R (2013).
Note:
a.) D&R presents its estimates in the form of a bar chart marked in deciles. We estimate the exact percentage.
b.) Though Panchal (2016) does not analyze pleated shades, we apply the incremental cost estimate for cellular shades to this product.

D&R (2013) also provides information describing the mean, median, and range of prices for each window covering type collected from WCMA members and major retailers. We assume the mean (average) price is representative of the potentially affected corded products.[18] The prices used in our analysis are presented below in Exhibit 6.

[18] The price information presented in D&R (2013) likely includes both corded and cordless products. Thus, because cordless products are more expensive, applying these prices in our analysis may overstate the economic impact of the potential requirement.

EXHIBIT 6. RETAIL PRICES OF CORDED PRODUCTS INCLUDED IN ANALYSIS (2012 DOLLARS)

WINDOW COVERING TYPE	AVERAGE PRICE[a]
Vinyl Blinds	$27.00
Metal Blinds	$65.00
Faux Wood Blinds	$112.00
Wood Blinds	$123.00
Pleated Shades	$84.00
Roller Shades	$96.00
Cellular Shades	$104.00
Roman Shades	$284.00

Source: D&R (2013).
Note:
a.) Price data were collected in 2012 (WCMA, 2013). Price data do not distinguish between stock, cut-to-fit or custom products, and are an aggregation of market research and data received from some, but not all WCMA members.

To estimate total direct compliance costs, we estimate the average price increase for each product, weighted by manufacturing location. The average price increase is based on the lowest and highest percent of retail price reported for each window covering type, within a given cost environment, regardless of product size. We multiply the average cost increase for each window covering type by the quantity of corded units sold annually in the same category.[19] The results are presented later, in Exhibit 10.

4.3.2 High-end Scenario

In an attempt to capture costs potentially omitted from the estimates presented in Panchal (2016), we also present an alternative, high-end scenario. In its May 2015 presentation to CPSC, representatives of the WCMA noted that the cost of implementing cordless technology is within the range of 20 to 40 percent of the overall product cost for custom products and 40 to 60 percent of the overall product cost for stock products. We assume that these estimates include costs associated with product development, testing, licensing of technology, training of personnel, customized solutions for larger or heavier products, and smaller production volumes for custom products.

To determine the per product incremental cost of cordless technology as a proportion of retail price, we require information describing the typical mark-up applied by retailers.

[19] D&R (2013) aggregates faux wood and wood horizontal blinds, as well as metal and vinyl blinds into two categories in determining the quantity of annually shipped units. However, the reported mean price points for each of these four product categories vary considerably. We assume that each category is divided equally between the two relevant types of blinds. For example, we assume that an estimate of 86 million units of metal and vinyl blinds would amount to 43 million units of metal blinds and 43 million units of vinyl blinds.

Supplier Relations US, LLC (2010) reports that producer price represents 46.4 percent of the total retail price for window coverings.[20] Thus, the impact of implementing cordless technology on retail price is equal to the percent increase noted by WCMA, multiplied by the proportion of the retail price attributable to the cost of producing the product (46.4 percent). For example, for custom products, we assume cordless technology will increase prices by nine percent (0.464 * 0.2 = 0.09) to 20 percent (0.464 * 0.4 = 0.20).

We assume that all vinyl and metal blinds are stock products. We lack data regarding the share of stock versus custom production for all other product categories. Exhibit 7 below shows the WCMA estimates, as applied in the analysis. We multiply the quantity of units sold for each window covering type by the estimated manufacturing costs and the relevant percent increase in cost for the high-end products. The results are presented later, in Exhibit 10.

EXHIBIT 7. HIGH-END SCENARIO UNIT COST OF CORDLESS TECHNOLOGY (ALL PRODUCTS)

WINDOW COVERING TYPE	PORTION OF THE TOTAL COST OF A WINDOW COVERING ATTRIBUTABLE TO THE CORDLESS COMPONENTS	COST OF THE CORDLESS COMPONENT RELATIVE TO THE RETAIL PRICE OF THE WINDOW COVERING[a,b]
Vinyl blinds	40-60%	20-30%
Metal blinds	40-60%	20-30%
Faux wood blinds	20-40%	9-20%
Wood blinds	20-40%	9-20%
Pleated shades	20-40%	9-20%
Cellular shades	20-40%	9-20%
Roman shades	20-40%	9-20%

Note:

a.) For example, if 40 percent of the total cost of a window covering is attributable to cordless technology, and the cost of producing a window covering is 46.4 percent of the retail price, then 0.4 x 0.464=0.20, or the percent increase in retail price.

b.) Results are rounded to one significant digit.

[20] The remainder of the retail price is comprised of margins for wholesalers (9.6 percent), retailers (36.9 percent) and freight (7.1 percent).

4.4 CHANGE IN THE QUANTITY OF WINDOW COVERINGS PURCHASED

As an alternative to the direct compliance cost estimates estimated in Step 3, we use an estimate of the price elasticity of demand for window coverings to calculate the resulting decrease in quantity of metal and vinyl blinds purchased by residential consumers. The price elasticity of demand characterizes the extent to which demand for a particular good is likely to change for a given change in price. The more inelastic the demand for the product (i.e., the closer the own-price elasticity of demand is to zero), the greater the consumer surplus loss will be.

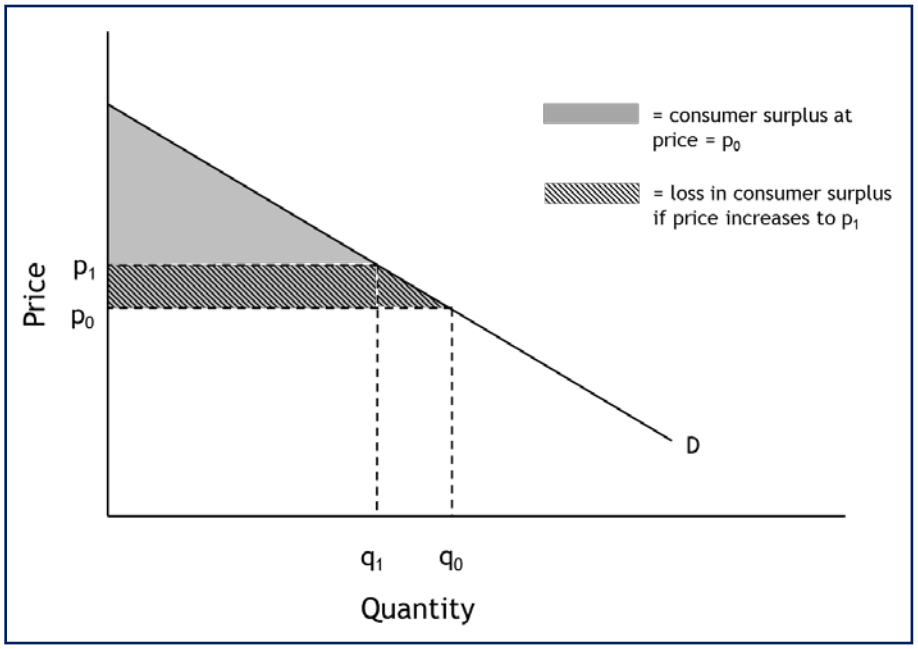
Taylor and Houthakker (2010) estimate an elasticity of demand for home goods, which they define as including: "floor coverings; picture frames; mirrors; art products; portable lamps; window coverings and hardware; telephone equipment; writing equipment; and hand, power, and garden tools." They estimate a long run elasticity of - 0.3367. In other words, for every one percent increase in the price of these goods, the quantity demanded decreases by approximately one-third of a percent. To estimate the change in the number of units purchased, we multiply the percent change in unit price by the elasticity estimate and the baseline quantity shipped.

4.5 CONSUMER SURPLUS LOSSS

Consumer surplus is the difference between the maximum amount that consumers would be willing to pay for window coverings and the price they actually pay. Any reduction in consumer surplus represents a loss of economic welfare, and thus a cost to society. To estimate the potential consumer surplus loss associated with a cordless requirement for metal and vinyl blinds, we estimate the change in the area under the demand curve for these products. Exhibit 8 illustrates the area of interest.

The horizontal axis represents the quantity of blinds (q) demanded and the vertical axis represents the price of blinds (p). The market demand curve (D) indicates both consumers' willingness to pay at each quantity and the quantity that would be purchased at each price. A rise in price ($p_0 – p_1$) affects consumers in two ways. First, they will buy fewer units ($q_0 - q_1$) where the price of those units exceeds their willingness to pay. Second, they will pay more for the remaining q_1 units then they would have in the absence of the requirement. The area marked with diagonal lines indicates the loss in consumer surplus that results from the price increase from p_0 to p_1.

EXHIBIT 8. CONSUMER SURPLUS



We estimate the change in consumer surplus separately for vinyl and metal blinds, using the change in price estimated in Step 3 and the change in quantity demanded in Step 4. The results are presented later, in Exhibit 11. The surplus loss represents an alternative estimate of the economic impact of a cordless requirement, assuming consumers bear all of the costs. It can be compared with, but not added to, the estimates of direct compliance costs produced in Step 3.

5.0 PRESENTATION OF RESULTS

We present the results of our analysis below. First, Exhibit 9 presents the low-end and high-end scenario estimates of the per unit compliance costs. For example, the average price of a vinyl blind is $27. In the low-end scenario, this price will increase, on average, by $2.21 per blind, representing an eight percent increase in price. In the high-end scenario, this price will increase, on average, by $6.26, representing a 23 percent increase in price.

EXHIBIT 9. AVERAGE INCREMENTAL INCREASES IN PRICE (2012 DOLLARS)

WINDOW COVERING TYPE	MEAN UNIT PRICE	LOW-END ESTIMATES (PANCHAL, 2016)		HIGH-END ESTIMATES (WCMA, 2015A)	
		Average Unit Cost Increase[a]	Average Cost Increase as a Percent of Retail Price[a]	Average Unit Cost Increase[b]	Average Cost Increase as a Percent of Retail Price[b]
Vinyl Blinds	$27.00	$2.21	8%	$6.26	23%
Metal Blinds	$65.00	$6.09	9%	$15.08	23%
Faux Wood Blinds	$112.00	$10.05	9%	$15.59	14%
Wood Blinds	$123.00	$11.84	10%	$17.12	14%
Pleated Shades	$84.00	$3.57	4%	$11.69	14%
Cellular Shades	$104.00	$6.20	6%	$14.48	14%
Roman Shades	$284.00	$23.74	8%	$39.53	14%

Notes:

a) The cost increases presented in this column represent a weighted average of the range of increases estimated in Panchal (2016), depending on the relative proportion of each product type produced domestically and overseas.

b) The cost increases presented in this column represent the average of the range of cost increases estimated by WCMA (2015a), adjusted to account for the contribution of retailer, wholesaler, and freight margins to retail prices.

Exhibit 10 presents the direct compliance costs of implementing a cordless requirement. In the low-end scenario, total costs are $390 million annually. At the high-end scenario, costs are $970 million annually.

We also test the sensitivity of these results to an alternative estimate of the total number of window coverings sold annually, increasing that number by 20 percent (up from 100 million to 120 million). The results suggest annual costs would increase, ranging from $440 million to $1.1 billion. Total costs increase by less than 20 percent because the number of metal and vinyl blinds sold, which makes up the largest share of window coverings, is unchanged.

EXHIBIT 10. TOTAL COMPLIANCE COSTS (2012 DOLLARS)

WINDOW COVERING TYPES	PRIMARY ESTIMATE (100 million residential coverings sold annually)			SENSITIVITY ANALYSIS (120 million coverings sold annually)		
	Total Number of Corded Units	Low-end Estimates (Panchal, 2016)	High-end Estimates (WCMA, 2015a)	Total Number of Corded Units	Low-end Estimates (Panchal, 2016)	High-end Estimates (WCMA, 2015a)
Vinyl Blinds	42,570,000	$94 million	$270 million	42,570,000	$94 million	$270 million
Metal Blinds	42,570,000	$260 million	$640 million	42,570,000	$260 million	$640 million
Faux Wood Blinds	1,140,676	$11 million	$18 million	2,770,214	$28 million	$43 million
Wood Blinds	1,140,676	$14 million	$20 million	2,770,214	$33 million	$47 million
Pleated Shades	765,502	$2.7 million	$9.0 million	1,859,076	$6.6 million	$22 million
Cellular Shades	726,043	$4.5 million	$11 million	1,763,247	$11 million	$26 million
Roman Shades	126,268	$3.0 million	$5.0 million	306,652	$7.3 million	$12 million
Total	**89,039,166**	**$390 million**	**$970 million**	**94,609,402**	**$440 million**	**$1,100 million**
Note: Totals may not sum due to rounding.						

If, instead, for comparison purposes we estimate the change in consumer surplus resulting from a cordless requirement, we find the economic impact is likely to be modestly smaller under both scenarios. For vinyl blinds, the low-end economic impact is $93 million (Exhibit 11), compared with $94 million in direct compliance costs (Exhibit 10). Under the high-end scenario, the impact associated with vinyl blinds is $260 million, compared to $270 million in direct compliance costs.[21]

EXHIBIT 11. TOTAL LOSS IN CONSUMER SURPLUS, METAL AND VINYL BLINDS (2012 DOLLARS)

PRODUCT CATEGORY	SURPLUS LOSS, LOWER-BOUND (PANCHAL, 2016)	SURPLUS LOSS, UPPER-BOUND (WCMA, 2015a)
Vinyl Blinds	$93 million	$260 million
Metal Blinds	$250 million	$620 million

6.0 LIMITATIONS AND KEY SOURCES OF UNCERTAINTY

The analysis presented in this memorandum relies on a number of assumptions and thus is subject to uncertainty. In Exhibit 12, we list each assumption and describe how it affects our estimates of the total cost of the cordless requirement. Possible next steps for refining this analysis might include the following:

- Research or collect additional data describing the quantity, price, and type of window coverings purchased by commercial entities so that costs associated with potentially affected commercial products can be added to the analysis;
- Test the sensitivity of our results to each of the remaining assumptions so that we can identify other key areas of additional research; and
- Best practices suggest that for regulations with impacts potentially exceeding $1 billion annually, probabilistic uncertainty analysis is appropriate.

[21] The results are unchanged if we increase total residential coverings sold annually by 20 percent because the number of vinyl and metal blinds sold is fixed at 86 million.

EXHIBIT 12. ASSUMPTIONS AND SOURCES OF UNCERTAINTY

ASSUMPTION	SOURCE	POSSIBLE INFLUENCE ON THE RESULTS OF THE ANALYSIS
Exclusion of commercial window coverings from the analysis.	Excluded due to a lack of readily available data describing quantity and product types purchased by commercial entities.	**Understates** the total costs of a cordless requirement, assuming the requirement applies to all window coverings.
100-120 million residential window coverings sold annually.	WCMA (2015b)	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the actual number of annual coverings.
86 million units are metal or vinyl blinds.	D&R (2013)	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the actual number of metal or vinyl blinds.
The distribution of window covering type for products other than metal or vinyl blinds mimics the D&R medium scenario distribution.	D&R (2013)	**Uncertain.** Total costs could be higher or lower depending on the actual mix of other products sold annually.
Exclude vertical blinds, curtains/draperies and roller shades.	IEc assumption.	May **understate** costs if current users of corded coverings switch to motorized, rather than manual technology.
Exclude soft sheer blinds.	IEc assumption.	May **understate** total costs if current users do not purchase cordless units in the baseline scenario.
Baseline cordless take rate for all types of blinds (metal, vinyl, wood, and faux wood) is 1%.	WCMA (2015a).	May **overstate** total cost estimates if the baseline take rate of cordless technology is higher for some types of blinds.
Baseline cordless take rate for cellular shades is 50%.	WCMA (2015a).	**Uncertain.** Total costs could be higher or lower depending on whether this assumption overstates or understates baseline take rates for cordless technology.
Baseline cordless take rate for Roman and pleated shades is identical (50%) to cellular shades.	IEc assumption.	**Uncertain.** Total costs could be higher or lower depending on whether this assumption overstates or understates baseline take rates for cordless technology.

ASSUMPTION	SOURCE	POSSIBLE INFLUENCE ON THE RESULTS OF THE ANALYSIS
Weighted average unit cost increases in the low-end scenario are: • Vinyl blinds: 8.2% • Metal blinds: 9.4% • Faux wood blinds: 9.0% • Wood blinds: 9.6% • Pleated shades: 4.3% • Cellular shades: 6.0% • Roman shades: 8.4%	Average of the lowest and highest unit cost increases across all product sizes within a product category (Panchal 2016), weighted by manufacturing location (D&R, 2013).	May **understate** total costs if manufacturers incur additional costs associated with product development, testing, licensing of technology, training of personnel, customizing solutions for larger or heavier window coverings, and producing lower volumes of customized products.
Manufacturing location (% produced overseas): • Vinyl blinds: 97% • Metal blinds: 79% • Faux wood blinds: 85% • Pleated shades: 75% • Wood blinds: 75% • Cellular shades: 18% • Roman shades: 48%	Estimated from bar chart in D&R (2013).	**Uncertain.** Costs may be higher or lower depending on whether these assumptions overstate or understate the percent of products produced overseas.
Average retail price per unit: • Vinyl blinds: $27 • Metal blinds: $65 • Faux wood blinds: $112 • Wood blinds: $123 • Pleated shades: $84 • Cellular shades: $104 • Roman shades: $284	D&R (2013).	**Uncertain.** May be more likely to overstate than understate retail prices of corded products if the average prices include some more expensive cordless products.
Unit costs presented in 2012 dollars.	IEc decision not to adjust for inflation.	**Uncertain.** Given the other sources of uncertainty associated with these price estimates, adjusting for inflation is unlikely to materially affect the final cost estimates.
Assume the total quantity of metal and vinyl blinds reported by D&R is divided evenly between the two types.	IEc assumption.	**Uncertain.** Costs may be higher or lower depending on whether the relative proportions of the two types of blinds are understated or overstated.
Assume the total quantity of faux wood and wood blinds reported by D&R is divided equally between the two types.	IEc assumption.	**Uncertain.** Costs may be higher or lower depending on whether the relative proportions of the two types of blinds are understated or overstated.

ASSUMPTION	SOURCE	POSSIBLE INFLUENCE ON THE RESULTS OF THE ANALYSIS
Producer costs are 46.4 percent of retail price.	Supplier Relations US, LLC (2010)	**Uncertain.** May overstate or understate total costs depending on whether or not the wholesaler, retailer, and freight margins are under- or overstated for a particular product type.
Average unit cost increases in the high-end scenario are: • Vinyl blinds: 23% • Metal blinds: 23% • Faux wood blinds: 14% • Wood blinds: 14% • Pleated shades: 14% • Cellular shades: 14% • Roman shades: 14%	WCMA (2015a).	**Uncertain** May overstate or understate total costs depending on whether or not the unit cost increases provided by WCMA are over- or understated for a particular product type.
The price elasticity of demand for window coverings is -0.3367.	Taylor and Houthakker (2010).	**Uncertain.** Costs may be higher or lower depending on whether the elasticity estimate is understated or overstated.

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