IEc

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TO Consumer Product Safety Commission, Directorate for Economic Analysis

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SUBJECT Final Table Saws Cost Impact Analysis

On April 15, 2003, Stephen Gass, David Fanning, and James Fulmer, representing SawStop, petitioned the Consumer Protection Safety Commission (CPSC) to promulgate a mandatory standard to reduce or prevent injuries from contact with the blade of a table saw. The petitioners alleged that table saws pose an unacceptable risk of severe injury because they lack an adequate safety system to protect the user from accidental contact with the spinning blade during operation. To mitigate this risk, the petitioners requested that CPSC require that table saws include active injury mitigation (AIM) systems that stops or retracts the table saw blade instantly upon contact with human flesh. The request was docketed as CP03-2 and published for comment.[1]

On July 11, 2006, CPSC voted to grant Petition CP03-2 and directed staff to draft an advance notice of proposed rulemaking (ANPR). The CPSC lost its quorum on July 15, 2006 and was unable the move forward the publication of the ANPR at that time. The ANPR was ultimately published in 2011.[2] The goal of the ANPR is to reduce blade contact injuries from table saws.

To enhance CPSC's understanding of the market for table saws, IEc conducted market research relying on publicly available information and limited outreach to potentially affected entities.[3] This effort was intended to supplement information and data previously collected by CPSC and provided via public comment.

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, to estimate the social cost of a mandatory requirement that table saws include an AIM system. 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.

[1] 68 FR 40912.

[2] 76 FR 62678.

[3] Industrial Economics, Incorporated. 2015. "Revised Table Saws Market Research Report." Memorandum to Willian Zamula and Robert Franklin, Consumer Product Safety Commission, Directorate for Economic Analysis from Jane Israel, Matthew Baumann, and Jennifer Baxter. March 28.

This memorandum is organized as follows:

- **Section 1: Background**. This section provides context for the cost analysis, including a discussion of the U.S. table saws market and the potential requirement.
- **Section 2: Conceptual Framework**. We describe the two alternative approaches used to estimate the costs of the potential requirement.
- **Section 3: Key Sources of Data**. This section summarizes the data sources underlying the cost analysis.
- **Section 4: Analytic Steps**. This section presents the calculations undertaken to quantify the costs of requiring AIM technology for table saws.
- **Section 5: Presentation of Results**. The results of the analysis are presented here.
- **Section 6: Limitations and Key Sources of Uncertainty.** This section summarizes assumptions underlying the analysis and the key limitations and sources of uncertainty.
- **Appendix A: Sensitivity Results.** Finally, in an appendix, we test the sensitivity of our results to key assumptions.

1.0 BACKGROUND

This section provides context for the cost analysis. First we describe the types of table saw products potentially affected. Next, we discuss the potential mandatory AIM requirement.

1.1 TABLE SAW MARKET OVERVIEW

A table saw is a stationary power tool consisting of a circular saw blade, mounted on an arbor, which is driven by an electric motor (either belt driven or gear driven). The blade protrudes through the surface of a table, which provides support for the material, usually wood, being cut. Table saws generally fall into three product types:

- **Bench saws** (e.g., benchtop and portable saws) are the least expensive, tend to be lightweight and portable, and are popular with professional carpenters due to the ease of transporting them to job sites. Most of the bench saw models come with some form of stand, either a rolling, folding, or fixed stand. Bench saws generally require only 110-120 volts to run. Most bench saws are gear driven; that is, no belts are used to transmit power from the electric motor to the blade.
- **Contractor saws** are typically larger and more powerful than bench saws. Most contractor saws come with a fixed or rolling stand. Contractor saws typically run on 120 or 240 volts; many models offer both configuration options. The blade is usually driven with a single belt.
- **Cabinet saws** (e.g., stationary saws) are larger, heavier, and more powerful than contractor saws, and their blades are enclosed in a cabinet. Cabinet saws generally require 230- to 240-volt power, and some require three-phase wiring. The blade is driven with one or more belts.

While there is no exact dividing line, the distinction between these types of saws is generally based on size, weight, portability, power transmission and price. In addition to these three primary product types, two additional types of table saws are available in the U.S. market, including hybrid and sliding table saws. For purposes of this cost analysis, hybrid table saws have been combined with the contractor saw category. We exclude sliding saws from the analysis because they are unlikely to be purchased for consumer use due to the electrical requirements for operating this type of saw. Specifically, sliding saws generally require 220 to 240 volts and generate a minimum of three horsepower.

According to the information provided by the Power Tool Institute (PTI), shipments of all table saws to the U.S. market averaged approximately 675,000 table saws annually over the past 15 years. Based on available information, bench saws account for approximately 75 percent of the table saw market by unit volume.[4]

1.2 POSSIBLE ACTIVE INJURY MITIGATION REQUIREMENT

The petitioners requested that CPSC address the hazard injuries from contact with the blade of a table saw by requiring that table saws include an AIM system that retracts the table saw blade instantly upon contact with human flesh. CPSC has not yet defined a proposed rule to reduce the risk of injury from accidental contact with the blade during table saw operation. For the purpose of this analysis, we assume that in the future, all table saws would be required to include AIM technology. We assume this would be a performance-based standard, which could involve implementing a previously developed technology or some yet undeveloped technology.

1.2.1 Current Status of AIM Technology Development

Currently, we are aware of three manufacturers who have developed AIM technology, although only one is currently available to consumers.[5] These include:

- **SawStop's AIM technology**, which induces a small electrical signal onto the saw blade that is partially absorbed by the human body if contact is made. When this reduction in signal is detected, the system applies a brake to the blade that stops and retracts the blade below the table surface in less than five milliseconds. SawStop cabinet saws have been available to consumers since 2004, contractor saws were introduced in 2008, and a new bench saw was introduced in March 2015.[6]
- **Bosch's Active Response Technology™**, which rapidly detects human flesh that comes in contact with the blade (through electronic sensors) and initiates a explosive activation cartridge which drives the saw blade below the tabletop.

[4] Estimates of bench saws as a segment of the table saw market range from 70 percent to 85 percent. (Power Tool Institute, Inc. 2015. Facts at a Glance. January; and, interview with table saw manufacturer on November 24, 2015; Grizzly Industrial Inc. 2012. Letter to CPSC. Formal Response to Docket No. CPSC-2011-0074 Table Saw Blade Contact Injuries; ANPR. February 10; and Email communication from CPSC on February 24, 2016.)

[5] In addition to these three AIM technologies, we are also aware that various safety devices that could reduce blade saw injuries are being sold by Save'em System; these devices range in price from $129 to $239. Save'em System website, accessed on April 21, 2016. at: www.savemsystem.com.

[6] SawStop website. Accessed on January 23, 2016 at: http://www.sawstop.com/.

Bosch announced this technology in a March 2015 press release, but it is not yet available on the market due to ongoing litigation.[7] The Bosch saw is now scheduled to be introduced to the public June 1, 2016.[8]

- **Whirlwind's Black Box flesh-sensing prototype**, which does not involve a blade retraction system, but rather uses a fixed protective guard and a very rapid, non-destructive motor-braking to stop the saw blade when the operator's hand is too close to the spinning blade. Whirlwind's website indicates that it is currently looking for funding to develop its technology and that Whirlwind is the plaintiff in ongoing litigation that has hampered its efforts to bring the technology to the market. Details of the pending litigation are not provided.[9]

1.2.2 Patent/Licensing Issues

Ongoing litigation involving the patents for SawStop's AIM technology represents an important source of uncertainty in the cost analysis presented in this report. If the outcome of current litigation permits companies to develop and implement alternative AIM technologies, then manufacturers may choose this approach, rather than licensing current SawStop technology. We assume manufacturers would pursue their own technology if the upfront development costs are expected to be lower in present value terms, or more certain, than long-term royalty payments. If, however, courts decide that table saws with alternative AIM technologies infringe on SawStop patents, then SawStop may effectively have a monopoly on the technology needed to comply with a mandatory rule. Other manufacturers would likely be required to work with SawStop to license the SawStop technology for use in their saws, or leave the table saw market.

Stakeholders have expressed concern that a mandatory rule could impose a monopoly for SawStop technology given the numerous patents that have been filed by Stephen Gass. PTI notes that Stephen Gass has filed more than 140 patent applications, and has over 100 issued patents which pertain to SawStop technology.[10] Grizzly has stated that mandating AIM technology during the life of the SawStop patents will cause numerous businesses to be unable to stay in the table saw business.[11] PTI has also expressed concerns that "there can be no assurance that Petitioners and SawStop would be willing to license their patent

[7] Bosch. 2015. Press Release titled: Bosch GTS1041A REAXX™ Portable Jobsite Table Saw Takes User Safety to the Next Level, and Saves the Blade Too. Accessed on January 20, 2016 at: http://www.boschtools.com/AboutBoschTools/PressRoom/Pages/031815_reaxxsaw.aspx.

[8] Bosch. 2016. Press release dated April 6, 2016, titled Bosch GTS1041A REAXX™ Jobsite Table Saw Takes User Safety to the Next Level and also Saves the Blade, Bosch Active Response Technology™ delivers flesh-detecting technology to help reduce potential serious user injury. Accessed on May 12, 2016 at: http://pressroom.boschtools.com/news-releases?item=122521.

[9] Whirlwind Tools website. Whirlwind Tool Patented Safety Technology for Sale or License. Accessed on November 17, 2015 at: http://www.whirlwindtool.com/.

[10] PTI. 2015. Facts at a Glance. January.

[11] Grizzly Industrial Inc. 2012. Letter to CPSC. Formal Response to Docket No. CPSC-2011-0074 Table Saw Blade Contact Injuries; ANPR. February 10.

technology at *any* price, notwithstanding any of their assertions to the Commission to the contrary."[12]

To date, several companies have attempted to license the SawStop technology without success.[13] To our knowledge, the only company to partner with SawStop to date has been Griggio, SA, an Italian manufacturer that collaborated with SawStop to develop a sliding table saw. The saw was demonstrated in May 2015 at a trade show in Germany.[14]

Currently, two pending lawsuits may have bearing on SawStop or other companies' willingness to license their AIM technologies. One involves Whirlwind Tools, which indicates that they are the plaintiff in litigation ongoing since 2012.[15] Another is the suit by SawStop against Bosch. SawStop has filed complaints at the U.S. International Trade Commission and the U.S. District Court in Oregon to stop alleged infringement of SawStop's patents.[16] The outcome of these ongoing lawsuits will determine the ultimate impacts that may result from a mandatory rule requiring AIM technology in table saws.

In fact, even if courts determine that manufacture of saws with alternative AIM systems would not infringe on SawStop's patents, some companies may choose to license SawStop (or other) AIM technology rather than to develop their own. The size of the royalty payments will play a significant role in determining the impacts on table saw manufacturers or consumers. Dr. Gass states that SawStop would accept royalty payments of eight percent of a saw's wholesale price, but only if a rule requiring AIM technology is passed.[17] It is unclear when SawStop's patents expire, which could also significantly affect the impact of the rule. Finally, even if the original patents expire during the ten-year time frame of this analysis, additional patents may be issued to SawStop or its competitors during that period. These additional patents could serve as a deterrent to other firms considering whether to develop their own technology.

2.0 CONCEPTUAL FRAMEWORK

This section lays out the conceptual framework of our cost analysis. 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 table saws, 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.

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[12] PTI. 2012. U.S. Consumer Product Safety Commission [Docket No. CPSC-2011-0074] Table Saw Blade Injuries; Advance Notice of Proposed Rulemaking. Comment of Power Tool Institute. March 16. Page 4.

[13] Grizzly Industrial Inc. 2012. Letter to CPSC. Formal Response to Docket No. CPSC-2011-0074 Table Saw Blade Contact Injuries; ANPR. February 10. Also, interviews with table saw manufacturers, November 24, 2015

[14] FDMC. 2015. SawStop and Griggio to develop safer panel saw. May. Accessed December 8, 2015 at: http://www.fdmcdigital.com/ArticleDetails/tabid/162/ArticleID/95172/Default.aspx.

[15] Whirlwind Tools website. Whirlwind Tool Patented Safety Technology for Sale or License. Accessed on November 17, 2015 at: http://www.whirlwindtool.com/.

[16] SawStop website. Accessed on January 23, 2016 at: http://www.sawstop.com/company/news/press-releases/sawstop-sues-bosch-to-protect-inventions.

[17] Dr. Gass states typical industry mark-ups from wholesale to retail price are 10 to 20 percent; therefore, profits would be reduced to roughly 2.7 to 12.7 percent, assuming the licensing cost is borne entirely by the U.S. manufacturer/supplier.

Similarly, consumer surplus is the difference between the maximum amount that consumers would be willing to pay for table saws 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 segment of the table saws 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 increase in costs likely to result from implementing AIM technology by 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.[18] Thus, we estimate the change in consumer surplus resulting from increased prices. As previously noted, the information required to derive a well-specified demand curve for the various types of table saws 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 table saws. 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 table saws 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.

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 saws sold. Comparing the results of the two approaches provides some insight into the degree to which the direct compliance approach may overstate the actual impact on economic welfare.

[18] 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.

The following sections discuss other important considerations in framing the analysis, including the timeframe, factors affecting the retail price impacts, and the presentation of the result.

2.1 TIMEFRAME

The effective date of a mandatory requirement for table saws to include AIM systems is not known. As such, the analysis estimates impacts of the rule over an unspecified 10-year period, not tied to a specific implementation date. We estimate impacts over a 10-year period because retail price impacts are expected to decline over this period once the upfront costs of redesign and retooling are recovered and market equilibrium is attained.

2.2 ESTIMATED PER UNIT IMPACTS

To quantify the impacts of the rule, we rely on estimates of the likely impact on retail price provided by table saw manufacturers.[19] This information was obtained from interviews with manufacturers and public comments. To capture the range in possible price effects, we analyze a low- and high-end scenario. In general, for purposes of this analysis, we assume that the projected retail price impacts of the proposed rule provided by manufacturers also represent the manufacturing cost impacts. In other words, the manufacturing cost increases associated with the rule are pushed forward to consumers on a dollar for dollar basis, and the expected price increases (with the exception of royalty payments) are reflective of the underlying increase in costs of production.[20]

In addition to the retail price impact, which incorporates costs associated with redesigning saws to incorporate SawStop's AIM technology and retooling requirement to implement the redesign, we include the costs of purchasing replacement brake cartridges and blades that are required when the technology is activated. In the direct compliance cost calculations, we exclude the royalties paid by manufacturers to SawStop for the use of its technology. From a societal perspective, these royalties represent a transfer payment from one sector to another. These resources (i.e., money) remain available for productive uses, and thus do not represent a cost of the requirement from a societal perspective. We recognize, however, that the royalties will have distributional effects on manufacturers and consumers.[21]

Similarly, we do not count these transfer payments in our estimate of consumer surplus losses. We do, however, incorporate the impact of the royalty payments in the final retail

[19] Table saw manufacturers also provided information describing potential increases in manufacturing costs that would result from a rule mandating a new performance standard for AIM. Manufacturers may incur redesign and retooling costs to incorporate AIM technology. However, we lack the detailed information necessary to translate these manufacturing costs to a per unit price impact. Specifically, we lack information on: (1) how engineering and design and tooling costs would be spread across various models and potentially shared with overseas contract manufacturers; (2) how many units of each model are produced; and (3) and the timing for amortizing or recovering these costs. As such, for purposes of our analysis, we effectively assume that the costs are fully passed on to consumers and the estimates of retail price increases do not include additional markups or royalties except where explicitly stated.

[20] As noted in the next paragraph, while royalty payments are included as a retail price impact, they are excluded from compliance cost calculations because they would represent a transfer to from the manufacturer to SawStop.

[21] Distributional effects refers to the concept that, although the net resources available to society have not changed, some entities will benefit, while others experience costs.

price of saws in order to estimate reductions in the quantity of units sold. Doing so allows us to estimate the deadweight loss (a surplus loss) associated with such monopolistic conditions.

Finally, the manufacturers note that the retail price impact will likely decline over time as the upfront costs of the redesign and retooling are recovered and manufacturers have gained more experience and optimized their designs and production. Thus, we assume a short-term price impact, which occurs over the first five years, and a long-term price impact, which occurs over the last five years of the analysis.

2.3 PRESENTATION OF RESULTS

In order to capture the impacts over a 10-year period, impacts are described in present value and annualized terms. The U.S. Office of Management and Budget (OMB) specifies the use of two discount rates, three and seven percent, intended to test the sensitivity of the analysis to the discount rate assumption.[22] Throughout the main body of this report, we present the results of our analysis applying a three percent discount rate. The results assuming a seven percent rate are presented in the Appendix. Finally, because retail price data were collected in 2015, we present the results of the analysis in 2015 dollars.

3.0 KEY SOURCES OF DATA

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

- **Market research conducted in 2015**. Information on the current retail prices for the specific categories of table saws was collected through online research. An Excel file, along with a memo describing the data fields, was provided to CPSC on March 29, 2016. Our data collection effort identified a total of 25 table saw firms and their major brands, including 157 table saw models. The primary sources for our research included company websites, annual reports for public companies, and retailer websites providing product specifications and prices.
- **Interviews with table saw manufacturers.** As part of our market research effort, we spoke with representatives of four firms supplying table saws. Across the four firms, they produce all of the relevant types of saws, span small and large firms, and include private labelers and manufacturers.
- **Public comments submitted in response to ANPR and other information submitted by interested parties.** Examples of these data sources include the ANPR briefing package prepared by CPSC, comment letters submitted in response to the ANPR, PTI "Facts at a Glance," and other publicly available information.

[22] U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, February 3, 2003.

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 number of affected table saws sold annually in the United States, by product category.** We calculate average annual sales for the period spanning 2001 through 2016 based on information and projections provided by CPSC. We subtract the number of saws that are already compliant (i.e., SawStop saws) because we assume these saws will not be affected by the potential requirement. We allocate the remaining units across the three product types based on information from PTI and other manufacturers about the relative proportion of units sold annually in each category. The default assumption of the analysis is zero growth in future sales over the 10-year timeframe of the analysis.
- **Step 2: Apply estimates of the per-unit incremental cost increase and annual brake cartridge replacement costs to estimate total direct compliance costs.** As a proxy for compliance costs, we calculate the per-unit incremental increase in retail price, before royalty payments, resulting from the rule, accounting for changes in price increases over the long-term. We also make an assumption about the annual number of replacement brake cartridges and blades required per saw and their cost. The sum of the incremental retail price increases and replacement costs is then multiplied by the number of affected units sold per year to calculate the annual direct compliance costs of the rule. We then estimate both the annualized and present value compliance costs over the 10-year period of the analysis.
- **Step 3: Calculate the change in the quantity of products sold for purposes of estimating consumer surplus loss.** To estimate the change in demand, we include royalties in our estimate of the retail prices consumers will pay as a result of the potential rule. Using an estimate of the elasticity of demand for table saws, we calculate the likely decrease in the quantity of table saws demanded by consumers as a result of the price increase.
- **Step 4: Calculate the loss in consumer surplus.** Based on the new quantity of saws demanded, we estimate consumer surplus losses associated with the rule. Comparing this result to the direct compliance costs estimated in Step 2 provides a sense of the degree to which our estimates of direct compliance costs may overstate the potential loss in economic welfare resulting from an AIM requirement.

Each step is described in greater detail below.

4.1 STEP 1: NUMBER OF TABLE SAWS AFFECTED

In the first step of our analysis, we estimate the total number of table saws sold in the United States by product type. CPSC provided information on annual table saw

shipments from 2001through 2016.[23] Based on these data, 675,000 units, on average, are sold annually. Of these, 10,000 units are SawStop saws, which may already be compliant with a potential AIM requirement.[24] Thus, we assume 665,000 saws will be affected annually by a new requirement.

We estimate that bench saws make up approximately 75 percent, contractor/hybrid saws make up 20 percent, and cabinet saws make up five percent of the units sold.[25] We multiply these shares by the average annual number of potentially affected units in each category. The results are presented below in Exhibit 1.

EXHIBIT 1. ESTIMATED NUMBER OF POTENTIALLY AFFECTED TABLE SAW SHIPMENTS

TABLE SAW TYPE	SHARE OF TOTAL[a]	ESTIMATED UNITS SHIPPED ANNUALLY[b]
TOTAL AFFECTED UNITS	**100%**	**665,000**
Bench Saws	75%	498,000
Contractor/Hybrid Saws	20%	133,000
Cabinet Saws	5%	33,000

Notes: The estimates may not sum to the total reported due to rounding.
Sources:

a. Power Tool Institute, Inc., 2015. Facts at a Glance. January; and, interview with table saw manufacturer on November 24, 2015; Grizzly Industrial Inc. 2012. Letter to CPSC. Formal Response to Docket No. CPSC-2011-0074 Table Saw Blade Contact Injuries; ANPR. February 10; and Email communication from CPSC on February 24, 2016. Note, information is not available regarding the market share of contractor versus cabinet saws; we estimate cabinet saws account for approximately five percent of the market based on the sales of SawStop saws (10,000 per year). SawStop primarily makes cabinet saws and claims to account for a large portion of U.S. sales in this category (Interview with Dr. Stephen Gass, SawStop, November 6, 2015).
b. Estimates of total annual shipments of table saws for the entire table saw market provided to IEc by CPSC on April 6, 2016.

4.2 STEP 2: APPLY PER-UNIT INCREMENTAL COST INCREASE ESTIMATES BY PRODUCT CATEGORY AND REPLACEMENT COSTS TO ESTIMATE TOTAL DIRECT COMPLIANCE COSTS

As part of our market research effort, we collected retail price information for all table saw models in the U.S. market. Data describing the unit sales of each individual model are not available; therefore, we are unable to calculate a weighted average retail price for

[23] Estimates of total annual shipments of table saws for the entire table saw market, as summarized in a spreadsheet provided to IEc by CPSC on April 6, 2016. Note, data for 2001, 2015 and 2016 are estimates.

[24] Personal communication with Dr. Stephen Gass, SawStop, November 6, 2015.

[25] Power Tool Institute, Inc., 2015. Facts at a Glance. January; and, interview with table saw manufacturer on November 24, 2015; Grizzly Industrial Inc. 2012. Letter to CPSC. Formal Response to Docket No. CPSC-2011-0074 Table Saw Blade Contact Injuries; ANPR. February 10; and Email communication from CPSC on February 24, 2016. Note, information is not available regarding the market share of contractor versus cabinet saws; we estimate cabinet saws account for approximately five percent of the market based on the sales of SawStop saws (10,000 per year). SawStop primarily makes cabinet saws and claims to account for a large portion of U.S. sales in this category (Interview with Dr. Stephen Gass, SawStop, November 6, 2015.

each category of saws. Instead, we apply the median retail price advertised for each category. We do not include SawStop products in our median estimates, as these products may already be compliant with the rule. Exhibit 2 summarizes the median baseline retail prices in each product category and the number of models in our dataset.

EXHIBIT 2. BASELINE RETAIL PRICES BY PRODUCT CATEGORY

TABLE SAW TYPE	MEDIAN RETAIL PRICE	NUMBER OF MODELS
Bench Saws	$400	29
Contractor/Hybrid Saws	$1,224	27
Cabinet Saws	$2,549	62
Source: Market research conducted by IEc in 2015.		

We then estimate the incremental increase in retail prices for each product category for two scenarios. The scenarios provide low- and high-end estimates of direct compliance costs based on the range of estimates of projected price increases provided by table saw manufacturers. The analysis also assumes that these price changes will diminish over time, as described below.

4.2.1 Low-end Scenario

SawStop suggests in both a presentation to CPSC and court testimony that retail prices for bench saws would increase by no more than $150 per unit a result of the rule. [26] We use this figure as the basis for the low-end estimate of retail price increases for bench saws.

Dr. Gass notes that in the short-term (i.e., within the first five years following the promulgation of the rule), the cheapest saws available will have a price of approximately $299. We assume that this statement refers specifically to bench saws. Eventually, in the long term, after the first five years, Dr. Gass estimates the price of the same saw will decrease to approximately $199. [27] From this information, we calculate the difference between the short-term increase in price and long-term increase in price as $100, a decrease of 67 percent from $150, the incremental increase for bench saws.

For contractor/hybrid and cabinet saws, we use the low-end of the estimates of expected retail price impacts provided by other industry members. One manufacturer estimates that the retail price of saws would increase 30 percent as a result of the rule, including the cost of royalties.[28] We assume that SawStop will charge a royalty for its AIM technology equal to eight percent of the wholesale price of the saw. We further assume that the typical retail markup relative to wholesale prices is 20 percent.[29] Given this, the cost

[26] SawStop, LLC. 2009. Presentation to CPS. December 8 & 9. Also, Osorio v. One World Technologies, Inc., 659 F3d 81, 83 (1st Cir 2011).

[27] Interview with Dr. Stephen Gass, SawStop, November 6, 2015.

[28] Interview with table saw manufacturer, November 24, 2015.

[29] SawStop, LLC. 2012. Comments and Information Responsive to ANPR for Table Saw Blade Contact Injuries By SawStop, LLC. U.S. Consumer Product Safety Commission Docket No. CPSC-2011-0074. March 16.

increase associated with redesign, retooling, and materials is roughly equivalent to 23 percent of the retail price. We applied this estimate to the current retail price of this manufacturer's only saw, a contractor saw priced at $1,099. Thus, the incremental increase in price excluding royalties is approximately $260. We apply the unit cost increase to all contractor/hybrid saws and cabinet saws. In the long term, we assume the incremental cost of the AIM technology decreases by approximately 67 percent. Exhibit 3 summarizes the incremental increases in unit costs, by product type, applied in the analysis of direct compliance costs.

4.2.2 High-end Scenario

For the high-end scenario, we base the incremental increase in the price of bench saws on information provided by PTI. It estimates that the increase would be $100 to $800 per saw, excluding royalties. [30] We take the midpoint of this range, and assume an increase of $450.

For contractor and cabinet saw models, we apply the high-end of the range estimated by PTI and other manufacturers. One table saw manufacturer provided an estimate ranging from $500 to $800 for "larger saws," excluding royalties. [31] Another manufacturer estimates that the retail price of saws would increase 20 percent, excluding the cost of royalties.[32] Applying this percentage to the company's cabinet saw models results in a range of $260 to $800.We assume the incremental price increase is $800, the upper bound of each of these ranges. In years six through 10, we assume that the incremental price change will decrease by approximately two-thirds (67 percent). High-end retail price increases are summarized in Exhibit 3.

EXHIBIT 3. PER UNIT INCREASE IN RETAIL PRICE (WITHOUT ROYALTIES)

TABLE SAW TYPE	LOW-END INCREASE IN RETAIL PRICE		HIGH-END INCREASE IN RETAIL PRICE	
	SHORT-TERM (YEARS 1-5)	LONG -TERM (YEARS 6-10)	SHORT-TERM (YEARS 1-5)	LONG -TERM (YEARS 6-10)
Bench Saws	$150[a]	$50[a]	$450[c]	$150[a,c]
Contractor/Hybrid Saws	$256[b]	$86[a,b]	$800[d]	$267[a,d]
Cabinet Saws	$256[b]	$86[a,b]	$800[d]	$267[a,d]

Sources:
a. Interview with Dr. Stephen Gass, SawStop, November 6, 2015.
b. Interview with table saw manufacturer, November 24, 2015.
c. PTI. 2012. U.S. Consumer Product Safety Commission [Docket No. CPSC-2011-0074] Table Saw Blade Injuries; Advance Notice of Proposed Rulemaking. Comment of Power Tool Institute. March 16, 2012.
d. Interviews with table saw manufacturers, November 30, 2015 and November 24, 2015.

[30] PTI. 2012. U.S. Consumer Product Safety Commission [Docket No. CPSC-2011-0074] Table Saw Blade Injuries; Advance Notice of Proposed Rulemaking. Comment of Power Tool Institute. March 16, 2012.

[31] Interview with table saw manufacturer, November 30, 2015.

[32] Interview with table saw manufacturer, November 24, 2015.

4.2.3 Replacement Part Costs

The direct costs of compliance include not only the incremental retail price increase, but also the added costs of replacement parts related to the AIM system. For purposes of our analysis, we base the cost of replacement parts on the SawStop system, which requires replacement of the brake cartridge and blade after every activation of the system. Replacement part prices are estimated to include $69 for a replacement brake cartridge (based on current online prices), and $60 for a replacement blade.[33, 34] Based on sales of replacement brake cartridges, SawStop estimates that the AIM system may activate about once every nine years of use.[35] At a replacement rate of once every nine years, this results in an annual per-unit replacement part price of approximately $14.[36] These prices are the same under both the low-end and high-end scenarios.

Note that we assume the replacement of the blade after activation of the system is in addition to routine blade replacements occurring as a result of standard operating procedures (e.g., when the blade is worn out). To the extent that AIM activation coincides with the timing for normal replacement of the blade, incremental compliance costs may be overstated.

4.2.4 Total Direct Compliance Costs

Per-unit compliance costs are calculated by summing the per-unit incremental retail price increases with the annual per unit price of replacement parts, as shown below in Exhibit 4. In order to calculate the aggregate cost of compliance for each saw type, we multiply the low-end and high-end per unit compliance costs by annual unit sales for each category. These results are presented later in Exhibit 9.

EXHIBIT 4. ANNUAL PER-UNIT COMPLIANCE COSTS (2015 DOLLARS)

TABLE SAW CATEGORIES	BASELINE RETAIL PRICE	LOW-END ESTIMATES (PERCENT OF MEDIAN BASELINE PRICE)		HIGH-END ESTIMATES (PERCENT OF MEDIAN BASELINE PRICE)	
		SHORT TERM (YEARS 1-5)	LONG TERM (YEARS 6-10)	SHORT TERM (YEARS 1-5)	LONG TERM (YEARS 6-10)
Bench Saws	$400	$164 (41%)	$64 (16%)	$464 (116%)	$164 (41%)
Contractor and Hybrid Saws	$1,224	$271 (22%)	$100 (5%)	$814 (67%)	$281 (13%)
Cabinet Saws	$2,549	$271 (11%)	$100 (3%)	$814 (32%)	$281 (6%)

[33] As with the costs of the AIM technology estimated earlier in this memorandum, we use retail prices as a proxy for compliance costs.

[34] PTI. 2015. Facts at a Glance. January.

[35] SawStop, March, 2011, Information Package for Petition CP-03-02. As cited in: CPSC. 2011. Table Saws Blade Contact Injuries; Advance Notice of Proposed Rulemaking. September 14.

[36] The Bosch Active Response Technology™ may have a lower replacement cost of firing because it does not damage the blade; thus, replacement saw blades are not required. In addition, the Bosch system includes a two-shot cartridge which would only need to be replaced after two activations.

4.3 STEP 3: CHANGE IN THE QUANTITY OF TABLE SAWS PURCHASED

As an alternative to the direct compliance cost estimates estimated in Step 2, we estimate consumer surplus losses. To calculate consumer surplus losses, we first use an estimate of the price elasticity of demand for table saws to calculate the resulting decrease in the quantity of table saws purchased by 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. [37]

The incremental increases in retail price we present in Step 2 of our analysis do not include royalty payments. However, for purposes of calculating consumer surplus losses, we assume that firms will pass on all incremental costs to consumers. Thus we include royalty payments in calculating the percentage increase in price experienced by consumers.

Based on our interview with Dr. Gass, we apply a royalty payment of eight percent of the wholesale unit price.[38] We further assume that the typical retail markup is 20 percent relative to wholesale prices, based on information from SawStop.[39] We use this estimate to calculate wholesale prices relative to our new retail prices. We then calculate royalty payments based on these wholesale prices. Exhibit 5 provides an illustration of this calculation, using the short-term prices (i.e., prices applied in years 1 – 5 in the analysis). Note, royalties fees per unit will decrease in later years as retail prices decline.

EXHIBIT 5. ILLUSTRATION OF ROYALTY FEE CALCULATION (BASED ON SHORT-TERM PRICES)

TABLE SAW TYPE	LOW-END ESTIMATES			HIGH-END ESTIMATES		
	PRICE WITH AIM TECHNOLOGY (a)	WHOLESALE PRICE (b=a/1.2)	ROYALTY FEE (c=b*0.08)	PRICE WITH AIM TECHNOLOGY (a)	WHOLESALE PRICE (b=a/1.2)	ROYALTY FEE (c=b*0.08)
Bench Saws	$550	$458	$37	$850	$708	$57
Contractor and Hybrid Saws	$1,480	$1,233	$99	$2,024	$1,686	$135
Cabinet Saws	$2,806	$2,338	$187	$3,349	$2,791	$223

[37] The elasticity of demand value from Taylor and Houthakker (2010) applies to the purchases of residential consumers. Estimates for the elasticity of demand for commercial users are not available. It is likely that the demand of commercial purchasers is less elastic, resulting in a smaller decrease in overall quantity demanded, as commercial entities may have less flexibility to modify purchasing patterns.

[38] Interview with Dr. Stephen Gass, SawStop, November 6, 2015.

[39] SawStop, LLC. 2012. Comments and Information Responsive to ANPR for Table Saw Blade Contact Injuries By SawStop, LLC. U.S. Consumer Product Safety Commission Docket No. CPSC-2011-0074. March 16.

The total present value of royalties that would be paid over a 10-year period is shown in Exhibit 6, for both the low-end and high-end scenarios. Total costs range from $300 million to $390 million, or $35 million to $46 million on an annualized basis.

EXHIBIT 6. TOTAL ROYALTY FEES OVER 10-YEAR PERIOD (2015 DOLLARS, THREE PERCENT DISCOUNT RATE)

TABLE SAW TYPE	TOTAL ROYALTY FEES	
	LOW-END	HIGH-END
Bench Saws	$140,000,000	$200,000,000
Contractor/Hybrid Saws	$110,000,000	$130,000,000
Cabinet Saws	$52,000,000	$58,600,000
Total Present Value over 10 years	**$300,000,000**	**$390,000,000**
Annualized Value	**$35,000,000**	**$46,000,000**

To estimate the change in the number of units purchased, we first determine the percentage increase in retail price observed by the consumers, including both the incremental increase in retail price calculated in Step 2 and the royalty payments. We then multiply this percentage increase in price by the elasticity estimate and the baseline quantity shipped. Exhibit 7 presents the quantity of table saws demanded as a result of the expected retail price increases.[40]

EXHIBIT 7. QUANTITY OF TABLE SAWS DEMANDED ASSUMING CONSUMERS RESPOND TO PRICE INCREASES

TABLE SAW CATEGORIES	BASELINE QUANTITY DEMANDED	LOW-END ESTIMATES NEW QUANTITY DEMANDED (PERCENT OF BASELINE QUANTITY)		HIGH-END ESTIMATES NEW QUANTITY DEMANDED (PERCENT OF BASELINE QUANTITY)	
		SHORT TERM (YEARS 1-5)	LONG TERM (YEARS 6-10)	SHORT TERM (YEARS 1-5)	LONG TERM (YEARS 6-10)
Bench Saws	498,000	420,000 (-16%)	465,000 (-7%)	286,000 (-43%)	420,000 (-16%)
Contractor and Hybrid Saws	133,000	120,000 (-10%)	127,000 (-5%)	99,000 (-26%)	120,000 (-10%)
Cabinet Saws	33,000	31,000 (-6%)	32,000 (-3%)	29,000 (-14%)	31,000 (-6%)

4.4 STEP 4: CALCULATE CONSUMER SURPLUS LOSS

Consumer surplus is the difference between the maximum amount that consumers would be willing to pay for table saws and the price they actually pay. Any reduction in

[40] In this simplified analysis, we assume the demand curve does not shift in response to the addition of AIM technology. Any increase in consumer surplus associated with the risk reduction provided by this technology is captured in a separate analysis of the potential benefits of the proposed regulation.

consumer surplus represents a loss of economic welfare, and thus a cost to society. To estimate the potential consumer surplus loss associated with compliance, 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 table saws (q) demanded and the vertical axis represents the price of table saws (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. P_0 represents the current, baseline price of saws in a given category. Q_0 represents the quantity of saws demanded at that the current price.

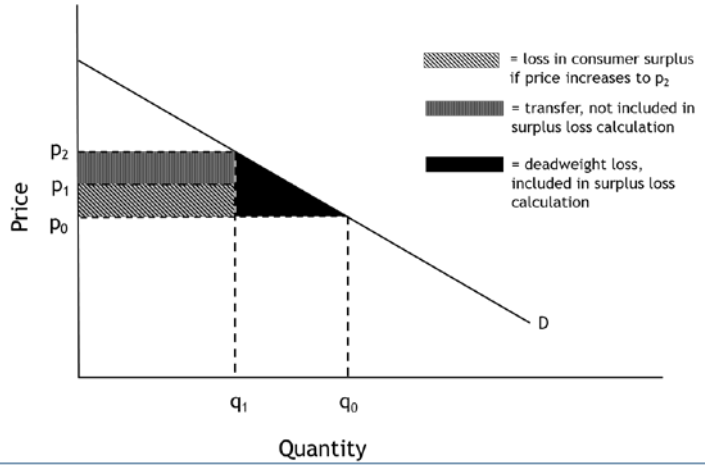
Implementing the AIM technology will increase price in two ways. First, the costs of redesign, retooling, and replacement parts will increase the retail price of saws to p_1. Second, the royalty payments for the AIM technology will further increase the retail price to p_2.

A rise in price ($p_2 - p_0$) will affect 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 than they would have in the absence of the requirements.

The rectangle marked with diagonal lines represents the manufacturing cost associated with implementing the AIM technology. This area is counted in our estimate of the welfare loss because these resources are no longer available for other purposes. The rectangle marked with light gray shading represents the royalty payment associated with licensing the AIM technology. These funds are transferred from the consumers (who pay higher prices) to SawStop (which receives the royalty payment). Even though these resources have changed hands, they are still available for productive uses and do not constitute a welfare loss. Thus, they are not counted in our estimate.

Finally, although the transfer payment does not represent a loss to society, it creates a market inefficiency that results in a deadweight loss, marked in black. The deadweight loss occurs due to the distortion of economic behavior away from a competitive equilibrium. We calculate the area of this triangle and include the associated cost in our estimate of the total welfare loss.

EXHIBIT 8. ILLUSTRATION OF CONSUMER SURPLUS LOSS



We estimate the change in consumer surplus for table saws using the change in price estimated in Steps 2 and 3 and the change in quantity demanded in Step 3. The results are presented later, in Exhibit 9. The welfare loss represents an alternative estimate of the economic impact of a mandatory AIM technology 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 2.

5.0 PRESENTATION OF RESULTS

This section presents the results of our analysis. We first discuss direct compliance costs. Then, we present the consumer surplus loss estimates. The results of both methods are summarized in Exhibit 9.

5.1 DIRECT COMPLIANCE COSTS

Per-unit direct compliance costs are summarized above, in Exhibit 4. Exhibit 9 presents the total direct compliance costs in present value and annualized terms, assuming a three percent discount rate.[41] Total present value incremental compliance costs are estimated to range from $770 million to $2.2 billion over ten years. On an annualized basis, direct compliance costs range from $91 million to $260 million. Compliance costs for bench saws make up the bulk (just over 60 percent) of these impacts, while contractor/hybrid saws account for approximately 30 percent, and cabinet saws account for less than 10 percent, regardless of the scenario.

EXHIBIT 9. TOTAL 10-YEAR COST OF IMPLEMENTING AN AIM REQUIREMENT (2015 DOLLARS, THREE PERCENT DISCOUNT RATE)

TABLE SAW TYPE	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
Bench Saws	$500,000,000	$1,400,000,000	$480,000,000	$1,200,000,000
Contractor/Hybrid Saws	$220,000,000	$640,000,000	$210,000,000	$590,000,000
Cabinet Saws	$54,000,000	$160,000,000	$54,000,000	$150,000,000
Total Present Value over 10 years	**$770,000,000**	**$2,200,000,000**	**$740,000,000**	**$1,900,000,000**
Annualized Cost[1]	**$91,000,000**	**$260,000,000**	**$87,000,000**	**$220,000,000**

Notes: The estimates may not sum to the totals reported due to rounding.
1. The annualized value of a stream of costs is the constant amount that, if maintained for the same number of years as the initial stream (in this case 10 years), has the same present value. In other words, annualization spreads the costs evenly over the time period assessed, taking the discount rate into account.

5.2 CONSUMER SURPLUS LOSS

If, instead, for comparison purposes we estimate the change in consumer surplus resulting from an AIM system requirement, we find the economic impact is likely to be slightly

[41] Results estimated by applying a seven percent discount rate are presented in the Appendix.

less under both scenarios, as shown in Exhibit 9. Assuming a three percent discount rate, the low-end present value economic impact is $740 million over 10 years, compared to $770 million in direct compliance costs. Under the high-end scenario, the present value impact associated with bench saws is $1.9 billion over 10 years, compared to $2.2 billion in direct compliance costs.

5.3 SENSITIVITY RESULTS

We also test the sensitivity of these results to alternative assumptions. A detailed discussion of our sensitivity analysis is presented in Appendix A. The results are summarized in Exhibit 10.

EXHIBIT 10. RESULTS OF THE SENSITIVITY ANALYSIS (PRESENT VALUE OVER A 10-YEAR PERIOD, 2015 DOLLARS)

SCENARIO	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
PRIMARY ESTIMATE (3% discount rate, no growth in baseline units sold absent the requirement, 9-year replacement rate, 67% lower retail price increase in years 6-10)	**$770,000,000**	**$2,200,000,000**	**$740,000,000**	**$1,900,000,000**
7% Discount Rate	$660,000,000	$1,900,000,000	$640,000,000	$1,600,000,000
3% Annual growth in baseline units sold	$850,000,000	$2,400,000,000	$820,000,000	$2,100,000,000
AIM technology triggered once every 4 years	$870,000,000	$2,300,000,000	$840,000,000	$2,000,000,000
AIM technology triggered once every 14 years	$740,000,000	$2,200,000,000	$720,000,000	$1,900,000,000
33% lower retail price increase in years 6-10[1]	$930,000,000	$2,700,000,000	$890,000,000	$2,300,000,000

Notes:

1. To test the sensitivity of the results to the rate at which retail price increases decline over time we apply a reduction (33%) that is approximately half of the 67% reduction in retail price increase over the long term that was applied in our primary estimate.

Overall, our sensitivity analysis suggests modest sensitivity to changes in the discount rate, sales growth rate, part replacement rate, or rate at which retail prices decline over

time. As illustrated in Exhibit 11, results increase by no more than 14 to 22 percent under any given scenario.

Increasing the discount rate from three percent to seven percent results in a reduction in present value direct compliance costs over ten years of $110 million under the low-end scenario and (e.g, from $770 million to $660 million) and $310 million under the high-end scenario (e.g., from $2.2 billion to $1.9 billion). Under the consumer surplus approach, increasing the discount rate to seven percent will decrease impacts by $110 million at the low-end and $270 million at the high-end.

We also considered the sensitivity of our results to assumptions about future growth in baseline saw sales and the frequency that the AIM technology will be triggered, requiring replacement brake cartridges and blades. Assuming a three percent discount rate:

- If we increase the growth rate in baseline table saw unit sales from zero to three percent, the present value direct compliance costs over ten years increase by $79 million at the low-end (e.g., from $770 million to $850 million after rounding), and $220 million at the high-end (e.g., from $2.2 billion to $2.4 billion after rounding). Under the consumer surplus model, this difference falls to $77 million at the low-end, and $196 million at the high-end.
- If we increase the rate at which we expect the AIM system to be triggered, requiring part replacement, to every four years instead of nine years, this results in an increase in present value direct compliance costs over ten years of $100 million, under both the low-end and high-end scenarios (e.g., from $770 million to $870 million for the low-end and from $2.2 billion to $2.3 billion for the high-end). Under the consumer surplus approach, increasing the replacement rate to four years will increase impacts by $96 million at the low-end, and $88 million at the high-end.
- If we decrease the frequency of replacing parts from once every nine years to 14 years, this results in an reduction in present value direct compliance costs over ten years of $29 million under both the low-end and high-end scenarios (e.g., from $770 million to $740 million for the low-end, and nearly constant at $2.2 billion for the high-end). Under the consumer surplus approach, decreasing the replacement rate to 14 years will decrease impacts by $28 million at the low-end and $25 million at the high-end.

Changing the rate at which retail prices decline over time has the largest effect on the results. In the sensitivity analysis, we assume the retail price increase is one-third (33 percent) lower in years 6 through 10 than in years 1 through 5. By comparison, in our default analysis, we assume the price increase is two-thirds (67 percent) lower in years 6 through 10. Direct compliance costs increase by $150 million to $470 million as a result of assuming less of a change in retail prices in the latter half of the analysis period. Similarly, consumer surplus losses increase by $150 to $400 million.

EXHIBIT 11. COMPARISON OF SENSITIVITY RESULTS TO PRIMARY ESTIMATES, PERCENT CHANGE IN PRESENT VALUE AS COMPARED TO PRIMARY ESTIMATE

SCENARIO	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
7% Discount Rate	-14%	-14%	-14%	-14%
3% Growth Rate	10%	10%	10%	10%
4-Year Replacement Rate	13%	5%	13%	5%
14-Year Replacement Rate	-4%	-1%	-4%	-1%
33% Lower Retail Price Increases in Years 6 - 10	20%	22%	20%	21%

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 a mandatory AIM requirement. Possible next steps for refining this analysis might include the following:

- Research or collect additional data describing the quantity and type of table saws purchased so that we can confirm the baseline retail costs of potentially affected products; and
- Test the sensitivity of our results to each of the remaining assumptions so that we can identify other key areas of additional research.

EXHIBIT 12. ASSUMPTIONS AND SOURCES OF UNCERTAINTY

ASSUMPTION	SOURCE	POSSIBLE INFLUENCE ON THE RESULTS OF THE ANALYSIS
Exclusion of sliding table saws from the analysis.	Excluded because these saws tend to be used by professionals in commercial settings.	**Understates** the total costs of a mandatory AIM requirement if the requirement applies to all table saws.
675,000 table saws sold annually.	CPSC (2016)	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the actual number of annual table saw sales.
Baseline table saw sales remain static over the next ten years.	IEc assumption.	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the actual number of annual table saw sales in the future. We account for this uncertainty in our sensitivity analysis, by applying an alternative growth rate of three percent.

ASSUMPTION	SOURCE	POSSIBLE INFLUENCE ON THE RESULTS OF THE ANALYSIS
Baseline number of compliant table saws is 10,000 based on the number of SawStop saws sold annually.	SawStop (2015)	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the actual sales of SawStop table saws.
75 percent of units are bench saws, 20 percent are contractor/hybrid saws, and five percent are cabinet saws.	PTI (2015); Grizzly (2015); and, Interviews with table saw manufacturers, November 2015.	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the actual share of bench saws versus other table saw types.
Baseline retail prices are based on the median price for all models in the table saw category: Bench saws: $400 Contractor/Hybrid saws: $1,224 Cabinet saws: $2,549	IEc (2015)	**Uncertain.** Total costs could be higher or lower depending on whether this assumption understates or overstates the average retail price.
Per-unit retail price increases in the low-end scenario (without royalties) are: Bench saws: $150 Contractor/Hybrid saws: $256 Cabinet saws: $256 Per-unit retail price increases in the high-end scenario are: Bench saws: $450 Contractor/Hybrid saws: $800 Cabinet saws: $800	Interviews with table saw manufacturers, November 2015.	**Uncertain.** Total costs at the low or high-end could be higher or lower depending on whether these per unit price impacts are understated or overstated. However, in specifying the low- and high-end scenarios, we attempt to capture this uncertainty.
Prices increases decline 67 percent in the long term (years six through 10).	Calculated based on the indicated decline in price increase from short term to long term as discussed by Dr. Gass, SawStop (2015).	**Uncertain.** May overstate or understate total costs depending on whether or not this percentage is under- or overstated. We account for this uncertainty in our sensitivity analysis, by applying an alternative assumption of a 33 percent lower price increase in the long term.
Wholesale prices are 20 percent of lower than retail prices for table saws.	SawStop (2012)	**Uncertain.** May overstate or understate total costs depending on whether or not this percentage is under- or overstated.

ASSUMPTION	SOURCE	POSSIBLE INFLUENCE ON THE RESULTS OF THE ANALYSIS
Increase in retail prices (without royalties) represents the cost of compliance.	IEc assumption.	**Uncertain.** May overstate or understate compliance costs depending on whether entire cost is passed on to consumers. Information is not available to apply estimates of the increase in manufacturing and production costs that would be incurred as a result of the rule. For example, while estimates of tooling and redesign costs for a particular model are available, information on the number of units produced per model, and whether costs would be shared across models or with overseas manufacturing contractors are unavailable.
Royalty payments of eight percent of wholesale price of table saws will be paid to SawStop.	SawStop (2015)	**Uncertain.** May overstate or understate total costs depending on whether this percentage is under- or overstated.
The AIM technology is triggered on average once every nine years.	SawStop (2011), as cited in ANPR	**Uncertain.** May overstate or understate total costs depending on whether this frequency is under- or overstated. We account for this uncertainty in our sensitivity analysis, by applying alternative replacement rates of four and 14 years.
Saw blades would not be replaced but for the AIM technology being triggered and rendering the blade unusable.	IEc assumption.	May **overstate** total compliance cost estimates if users would replace saw blades more frequently in the absence of the AIM technology.
Replacement part prices include: $69 for brake cartridge, and $60 for replacement blade	IEc (2015)	May **overstate** total compliance cost estimates if a technology other than SawStop's AIM system is implemented.
The price elasticity of demand for table saws is -0.3367.	Taylor and Houthakker (2010)	May **overstate** consumer surplus loss estimates. This estimate of elasticity of demand applies to the purchases of residential consumers. It is likely that the demand of commercial purchasers is less elastic, resulting in a smaller decrease in overall quantity demanded, as commercial entities may have less flexibility to modify purchasing patterns.

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APPENDIX A: SENSITIVITY ANALYSIS

In this appendix, we test the sensitivity of our results to four key assumptions, including:

- Discount rate;
- Growth in baseline sales of saws;
- The frequency with which the AIM technology is triggered by users, resulting in the need to purchase replacement parts; and,
- The rate at which retail prices decline over time as the upfront costs of the redesign and retooling are recovered and manufacturers gain more experience and optimize their designs and production.

A.1 ALTERNATIVE DISCOUNT RATE

In the cost impact analysis, we calculate present value and annualized values over the 10-year period of the analysis using a three percent discount rate. As prescribed by OMB in Circular A-4, we test the sensitivity of our results to the discount rate assumption by applying a seven percent discount rate. The results are presented in Exhibit A-1. Regardless of the cost estimation approach or the impact scenario considered, the present value impacts are 14 percent less when applying a seven percent discount rate as compared to a three percent discount rate.

EXHIBIT A-1. SENSITIVITY ANALYSIS RESULTS: SEVEN PERCENT DISCOUNT RATE (2015 DOLLARS)

TABLE SAW TYPE	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
Bench Saws	$430,000,000	$1,200,000,000	$410,000,000	$1,000,000,000
Contractor/Hybrid Saws	$190,000,000	$550,000,000	$180,000,000	$500,000,000
Cabinet Saws	$47,000,000	$140,000,000	$46,000,000	$130,000,000
Total Present Value over 10 Years	$660,000,000	$1,900,000,000	$640,000,000	$1,600,000,000
Total Annualized	$94,000,000	$270,000,000	$90,000,000	$230,000,000
Note: The estimates may not sum to the totals reported due to rounding.				

A.2 ALTERNATIVE GROWTH RATE

In the cost impact analysis, we assume that annual, baseline sales of table saws will be constant over the 10-year period of the analysis absent an AIM requirement. Based on available information regarding the trends in the market, this assumption appears appropriate. However, to test the sensitivity of our results to the no-growth assumption, we apply a three percent annual growth rate to baseline sales of table saws. The results of this sensitivity analysis are presented in Exhibit A-2. Regardless of the cost estimation approach or the impact scenario considered, applying a three percent growth rate results

in a 10 percent increase in the present value over 10 years as compared to the no-growth scenario.

EXHIBIT A-2. SENSITIVITY ANALYSIS RESULTS: THREE PERCENT ANNUAL GROWTH IN BASELINE SAW SALES (2015 DOLLARS, THREE PERCENT DISCOUNT RATE)

TABLE SAW TYPE	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
Bench Saws	$550,000,000	$1,500,000,000	$530,000,000	$1,300,000,000
Contractor/Hybrid Saws	$240,000,000	$710,000,000	$230,000,000	$640,000,000
Cabinet Saws	$60,000,000	$180,000,000	$60,000,000	$170,000,000
Total Present Value over 10 years	$850,000,000	$2,400,000,000	$820,000,000	$2,100,000,000
Annualized Value	$100,000,000	$280,000,000	$96,000,000	$250,000,000
Note: The estimates may not sum to the totals reported due to rounding.				

A.3 ALTERNATIVE PART REPLACEMENT RATE

In the cost impact analysis, we assume that on average, the AIM system will be triggered and parts will need to be replaced once every nine years. This assumption is based on information provided to CPSC by SawStop, as cited in the ANPR. In actuality, the AIM system may be triggered more or less frequently. As such, we test the sensitivity of our cost estimates to this assumption by applying two alternatives: assuming parts are replaced on average every four and 14 years. Changing the replacement rate assumption affects the low-end results more significantly than the high-end, because the magnitude of the replacement parts costs accounts for a greater portion of the impacts. The results of these sensitivity analyses are presented below.

Exhibit A-3 presents the results assuming the brake cartridge and blade are replaced once every four years. Regardless of the approach (e.g., direct compliance costs or consumer surplus loss), this assumption results in a 13 percent increase in impacts at the low-end, and a five percent increase in impacts at the high-end.

EXHIBIT A-3. SENSITIVITY RESULTS: AIM TECHNOLOGY TRIGGERED ONCE EVERY FOUR YEARS (2015 DOLLARS, THREE PERCENT DISCOUNT RATE)

TABLE SAW TYPE	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
Bench Saws	$580,000,000	$1,500,000,000	$550,000,000	$1,200,000,000
Contractor/Hybrid Saws	$240,000,000	$660,000,000	$230,000,000	$600,000,000
Cabinet Saws	$59,000,000	$170,000,000	$59,000,000	$160,000,000
Total Present Value over 10 years	$870,000,000	$2,300,000,000	$840,000,000	$2,000,000,000
Annualized Value	$100,000,000	$270,000,000	$98,000,000	$230,000,000
Note: The estimates may not sum to the totals reported due to rounding.				

Alternatively, the AIM system may be triggered less frequently. To test the sensitivity of the results to expanding this timeframe, we assume the brake cartridge and blade must be replaced once every 14 years. Exhibit A-4 presents the results of the compliance costs and consumer surplus loss results under this new assumption. Regardless of the approach (e.g., direct compliance costs or consumer surplus loss), applying this assumption results in a four percent decrease in impacts at the low-end, and a one percent decrease in impacts at the high-end.

EXHIBIT A-4. SENSITIVITY RESULTS: 14-YEAR REPLACEMENT RATE (2015 DOLLARS, THREE PERCENT DISCOUNT RATE)

TABLE SAW TYPE	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
Bench Saws	$480,000,000	$1,400,000,000	$460,000,000	$1,100,000,000
Contractor/Hybrid Saws	$210,000,000	$640,000,000	$210,000,000	$580,000,000
Cabinet Saws	$53,000,000	$160,000,000	$53,000,000	$150,000,000
Total Present Value over 10 years	$740,000,000	$2,200,000,000	$720,000,000	$1,900,000,000
Annualized Value	$87,000,000	$250,000,000	$84,000,000	$220,000,000
Note: The estimates may not sum to the totals reported due to rounding.				

A.4 ALTERNATIVE PERCENT REDUCTION IN THE PRICE INCREASE OVER TIME

In the cost impact analysis, we assume that retail prices will decline over time as the upfront costs of the redesign and retooling are recovered and manufacturers gain more experience and optimize their designs and production processes. We assume the incremental retail price increase attributed to the new technology will be two-thirds (67 percent) lower in years 6 through 10 of the analysis. In our sensitivity analysis, we assume the decline is half that of the base case, or approximately 33 percent. The results are presented below. This change results in an increase in cost of between 20 and 22 percent.

EXHIBIT A-5. SENSITIVITY RESULTS: 33 PERCENT LOWER PRICE INCREASE OVER TIME (2015 DOLLARS, THREE PERCENT DISCOUNT RATE)

TABLE SAW TYPE	DIRECT COMPLIANCE COSTS		CONSUMER SURPLUS LOSS	
	LOW-END	HIGH-END	LOW-END	HIGH-END
Bench Saws	$600,000,000	$1,700,000,000	$570,000,000	$1,400,000,000
Contractor/Hybrid Saws	$260,000,000	$780,000,000	$260,000,000	$710,000,000
Cabinet Saws	$66,000,000	$200,000,000	$65,000,000	$190,000,000
Total Present Value over 10 years	$930,000,000	$2,700,000,000	$890,000,000	$2,300,000,000
Annualized Value	$110,000,000	$310,000,000	$100,000,000	$270,000,000
Note: The estimates may not sum to the totals reported due to rounding.				