

## CHAPTER 6. MARKUPS FOR PRODUCT PRICE DETERMINATION

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## CHAPTER 6. MARKUPS FOR PRODUCT PRICE DETERMINATION

### 6.1 INTRODUCTION

To carry out its analyses, DOE needed to determine the cost to the consumer of baseline products and the cost of more-efficient units. For products with higher-than-baseline efficiency, DOE estimated the consumer prices by applying appropriate markups to the incremental manufacturing costs estimated in the engineering analysis.

#### 6.1.1 Distribution Channels

The appropriate markups for determining consumer equipment prices depend on the type of distribution channels through which products move from manufacturers to purchasers. At each point in the distribution channel, companies mark up the price of the equipment to cover their business costs and profit margin.

Data from the Association of Home Appliance Manufacturers (AHAM)<sup>1</sup> indicate that an overwhelming majority of residential appliances are sold through retail outlets. Because DOE is not aware of any other distribution channel that plays a significant role for residential microwave ovens, DOE assumed that all of the microwaves are purchased by consumers from retail outlets.

#### 6.1.2 Markup Calculation Procedure

At each point in the distribution channel, companies mark up the price of the equipment to cover their business costs and profit margin. In company income statements, gross margin is the difference between the company revenue and the company cost of goods sold (*CGS*). The gross margin includes the expenses of companies in the distribution channel—including overhead costs (sales, general, and administration); research and development (R&D) and interest expenses; depreciation, and taxes—and company profits. To cover costs and to contribute positively to company cash flow, the price of products must include a markup. Products command lower or higher markups, depending on company expenses associated with the product and the degree of market competition. In developing markups for manufacturers and retailers, DOE obtained data about the revenue, *CGS*, and expenses of firms that sell residential microwave ovens.

### 6.2 MANUFACTURER MARKUPS

DOE uses manufacturer markups to transform a manufacturer's production costs into a manufacturer sales price. Using the *CGS* and gross margin, DOE calculated the manufacturer markup ( $MU_{MFG}$ ) with the following equation:

$$MU_{MFG} = \frac{CGS_{MFG} + GM_{MFG}}{CGS_{MFG}}$$

Where:

- $MU_{MFG}$  = Manufacturer markup,
- $CGS_{MFG}$  = Manufacturer's cost of goods sold or Manufacturer Production Cost (MPC), and
- $GM_{MFG}$  = Manufacturer's gross margin.

The manufacturer's *CGS* (or *MPC*) plus its *GM* equals the manufacturer selling price (*MSP*).

DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission (SEC) 10-K reports filed by four publicly-traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes residential refrigeration products.<sup>2</sup> The four manufacturers represent a nearly 50 percent market share for major appliances. Because these companies are typically diversified, producing a range of different appliances, an industry average markup was assumed by DOE to be representative for the manufacture of refrigeration products. DOE evaluated markups for the years 2002–2005.

Table 6.2.1 lists the average corporate gross margin during the years 2002–2005, and corresponding markups, for each of the four manufacturers. The average markup value based on these four companies is 1.26, which is the value that DOE used.

**Table 6.2.1 Major Appliance Manufacturer Gross Margins and Markups**

	<b>Mfr A</b>	<b>Mfr B</b>	<b>Mfr C</b>	<b>Mfr D</b>
Average Net Revenues (Million)	\$372	\$280	\$4770	\$12,682
Corporate Gross Margin	15%	28%	16%	22%
Markup	1.18	1.39	1.19	1.28

Source: SEC 10-K reports (2002-2005)

## 6.3 RETAILER MARKUP

### 6.3.1 Approach for Retailer Markups

DOE based the retailer markups for residential microwave ovens on financial data for Electronics and Appliance Stores from the 2002 U.S. Census Business Expenditure Survey (BES), which is the most recent available survey.<sup>3</sup> DOE organized the financial data into statements that break down cost components incurred by firms in this category. DOE assumes that the income statements faithfully represent the various average costs incurred by firms selling home appliances. Although Electronics and Appliance Stores handle multiple commodity lines,

the data for this sector provide the most accurate available indication of expenses for selling home appliances.

The BES data provided for Electronics and Appliance Stores only contain total sales and detailed operating expenses. In order to construct a complete data set to estimate markups, DOE needed to estimate CGS and gross margin. The 1997 Business Expenses Survey provides total sales, gross margin and detailed operating expenses of Household Appliance Stores. The CGS and gross margin account for approximately 70% and 30% of the total sales, respectively. DOE found that gross margin as percent of sales has been roughly constant in this sector from 1993 to 2007.<sup>a</sup> Therefore, DOE assumed that the fractions of CGS and gross margin as percent of sales in 2002 are the same as in 1997. Following this assumption, DOE calculated the CGS, gross margin and net profit for Electronics and Appliance Stores in the 2002 BES.

### 6.3.1.1 Baseline Retailer Markup

The baseline markup relates the manufacturer sales price of baseline products to the retailer sales price. DOE considers baseline models to be equipment sold under existing market conditions (i.e., without new energy efficiency standards). DOE calculated the baseline markup ( $MU_{BASE}$ ) for retailers as an average markup using the following equation:

$$MU_{BASE} = \frac{CGS_{RTL} + GM_{RTL}}{CGS_{RTL}}$$

Where:

$MU_{BASE}$  = Baseline retailer markup,  
 $CGS_{RTL}$  = Retailer's cost of goods sold,  
 $GM_{RTL}$  = Retailer's gross margin,

Table 6.3.1 shows the calculation of the baseline retailer markup.

**Table 6.3.1 Data for Baseline Markup Calculation: Electronics and Appliance Stores (2002)**

Kind of business item	Amount (\$1,000)
Sales	\$83,896,811
Cost of Goods Sold (CGS)	\$57,888,800
Gross Margin (GM)	\$26,008,011
<b>Baseline Markup = (CGS+GM)/CGS</b>	<b>1.45</b>

<sup>a</sup> U.S. Census, 2007 Annual Retail Trade Report: Electronics and Appliance Stores Sales and Gross Margin. Gross margin as a percent of sales ranges between 25% and 33% over this time period, with an average of 30% and no discernible upward or downward trend.

### 6.3.1.2 Incremental Retailer Markup

Incremental markups are coefficients that relate the change in the manufacturer sales price of higher-efficiency models to the change in the retailer sales price. DOE considers higher-efficiency models to be equipment sold under market conditions with new efficiency standards. The incremental markup reflects a situation in which the retailer faces an increase in CGS for a particular product due to new or amended standards.

Unfortunately, empirical evidence regarding appliance retailer markup practices when a product increases in cost (due to increased efficiency or other factors) is deficient. DOE understands that real-world markup practices will vary depending on the market conditions faced by retailers, on the magnitude of the change in CGS associated with an efficiency increase and on any associated changes in retail costs. Pricing in retail stores may also involve rules of thumb that are difficult to identify and to incorporate into DOE's analysis.

Given the uncertainty about actual markup practices in appliance retailing, DOE uses an approach that reflects the following key concepts:

1. Changes in the efficiency of the goods sold are not expected to increase economic profits. Thus, DOE calculates markups/gross margins to allow cost recovery for retail companies in the distribution chain (including changes in the cost of capital) without changes in company profit margins.
2. Efficiency improvements impact some distribution costs but not others. DOE sets markups and retail prices to cover the distribution costs expected to change with efficiency but not the distribution costs that are not expected to change with efficiency.

The incremental markup approach is described in more detail in Dale et al (2004).<sup>4</sup>

To estimate incremental retailer markups, DOE divides retailers' operating expenses into two categories: (1) Those that do not change when CGS increases due to amended efficiency standards ("fixed"), and (2) Those that increase proportionately with CGS ("variable"). DOE defines fixed costs to include labor and occupancy expenses because these costs are not likely to increase as a result of a rise in CGS due to amended efficiency standards. All other expenses, as well as the net profit, are assumed to vary in proportion to CGS. Although it is possible that some of the other expenses may not scale with CGS, DOE is inclined to take a more conservative position and include these as variable costs.<sup>b</sup>

DOE calculated the incremental markup ( $MU_{INCR}$ ) for retailers using the following equation:

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<sup>b</sup> Note that under DOE's approach, a high fixed cost component yields a low incremental markup.

$$MU_{INCR} = \frac{CGS_{RTL} + VC_{RTL}}{CGS_{RTL}}$$

Where:

$MU_{INCR}$  = Incremental retailer markup,  
 $CGS_{RTL}$  = Retailer's cost of goods sold, and  
 $VC_{RTL}$  = Retailer's variable costs.

Table 6.3.2 shows the breakdown of operating expenses using the 2002 BES data. DOE estimates that the incremental markup is 1.17 for retailers of microwave ovens.

**Table 6.3.2 Data for Incremental Markup Calculation: Electronics and Appliance Stores (2002)**

	Amount (\$1,000)
Sales	\$83,896,811
<i>Cost of Goods Sold (CGS)</i>	<i>\$57,888,800</i>
<i>Gross Margin (GM)</i>	<i>\$26,008,011</i>
<b>Labor &amp; Occupancy Expenses (“Fixed”)</b>	
Annual payroll	\$10,267,605
Employer costs for fringe benefit	\$1,407,970
Contract labor costs including temporary help	\$160,094
Purchased utilities, total	\$427,809
Cost of purchased repair and maintenance services	\$308,789
Cost of purchased management consulting administrative services and other professional services	\$300,548
Purchased communication services	\$400,598
Lease and rental payments	\$2,655,286
Taxes and license fees (mostly income taxes)	\$385,538
Subtotal:	\$16,314,237
<b>Other Operating Expenses &amp; Profit (“Variable”)</b>	
Expensed computer related supplies	\$86,751
Cost of purchased packaging and containers	\$41,866
Other materials and supplies not for resale	\$611,361
Cost of purchased transportation, shipping and warehousing services	\$500,233
Cost of purchased printing services	\$285,012
Cost of purchased advertising and promotional services	\$1,840,898
Cost of purchased legal services	\$90,020
Cost of purchased accounting, auditing, and bookkeeping services	\$86,292
Cost of purchased custom coded original software (expensed) including adaption of off-the-shelf software	\$18,944
Cost of system support design and services including web design	\$35,748
Cost of insurance	\$393,201
Cost of data processing and other purchased computer services, except communications	\$41,056
Depreciation and amortization charges	\$1,229,110
Commissions paid	\$106,061
Other operating expenses	\$2,929,906
Cost of contract work	\$21,955
<i>Net profit before taxes</i>	<i>\$1,375,360</i>
Subtotal:	\$9,693,774
<b>Incremental Markup = (CGS+Total Other Operating Expenses and Profit)/CGS</b>	<b>1.17</b>

Source: U.S. Census, 2002 Business Expenses Survey

By dividing expenses into fixed and variable components, the incremental markup approach assumes that retailers cover costs changes without changing profit margins. Although retailers may be able to obtain higher profits for a time, DOE’s approach assumes that

competition in the appliance retail market, combined with relatively inelastic demand (*i.e.*, the demand is not expected to decrease significantly with a relatively small increase in price), will exert a counterbalancing downward pressure on retailer profit margins.

To measure the degree of competition in appliance retailing, DOE estimated the four firm concentration ratio (FFCR) of major appliance sales in three retail channels: Electronics and Appliance Stores, Building and Material and Supplies Dealers, and General Merchandise Stores. The FFCR represents the market share of the four largest firms in the relevant sector. Generally, an FFCR of less than 40% indicates that the sector is not concentrated and an FFCR of more than 70% indicates that a sector is highly concentrated.<sup>c d</sup>

The FFCR of sub-sector appliance sales within each channel is equal to the sector FFCR times the percent of total sales within each channel accounted for by major appliances. As shown in Table 6.3.3, the results indicate that appliance sales in Electronics and Appliance Stores, Household Appliance Stores, Building Material Supplies Dealers and General Merchandise Stores have a FFCR well under the 40% threshold. Moreover, the Electronics and Appliance Stores sector includes “Household Appliance Stores” as a subsector. Because there are many stores in this subsector, it has a FFCR of only 16.8%.

**Table 6.3.3 Electronics and Appliance Stores, Concentration by Four Large Firms**

<b>Sector</b>	<b>Four Firm Concentration Ratio</b> (Percent of Sector Sales)	<b>Percent of Sales Accounted for by Major Appliances</b>	<b>Four Firm Concentration Ratio</b> (Percent of Major Appliance Sales)
Electronics and Appliance Stores	44.3	39.4	17.5
Household Appliance Stores subsector	16.8	-	-
Building Material and Supplies Dealers	36.7	15.8	5.8
General Merchandise Stores	65.6	35.4	23.2

Sources: U.S. Economic Census, Establishment and Firm Size: Concentration by Largest Firms for the United States 2002; U.S. Economic Census, Product Lines: Kings of Business by Broad Product Line, 2002.

\*Note: The assumption used here is that major appliance sales are uniformly distributed within all firms in each sector.

<sup>c</sup> University of Maryland University College  
<http://info.umuc.edu/mba/public/AMBA607/IndustryStructure.html>

<sup>d</sup> Quick MBA  
<http://www.quickmba.com/econ/micro/indcon.shtml>



## 6.4 SALES TAXES

The sales tax represents state and local sales taxes that are applied to the consumer equipment price. The sales tax is a multiplicative factor that increases the consumer equipment price.

DOE derived state and local taxes from data provided by the Sales Tax Clearinghouse.<sup>5</sup> DOE derived population-weighted average tax values for each Census division and large state, as well as the U.S. population-weighted average tax of 7.2% (Table 6.4.1).

**Table 6.4.1 Average Sales Tax Rates by Census Division and Large State**

Census Division/State	Tax Rate
New England	5.5%
Mid Atlantic	6.6%
East North Central	6.9%
West North Central	6.9%
South Atlantic	6.4%
East South Central	7.9%
West South Central	8.4%
Mountain	6.5%
Pacific	5.2%
New York State	8.5%
California	9.2%
Texas	8.1%
Florida	6.7%
<b>U.S. Average</b>	<b>7.2%</b>

## 6.5 SUMMARY OF MARKUPS

Table 6.5.1 summarizes the markups at each stage in the distribution channel and the average sales tax.

**Table 6.5.1 Summary of Markups**

Markup	Baseline	Incremental
Manufacturer	1.26	
Retailer	1.45	1.17
Sales Tax	1.072	
Total	1.96	1.58

## REFERENCES

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- <sup>1</sup> Association of Home Appliance Manufacturers. *AHAM 2003 Fact Book*, 2003. Washington, DC. p. 25.
- <sup>2</sup> Security Exchange Commission, *SEC 10-K Reports*, Various dates, 2002-2005, Security Exchange Commission. <<http://www.sec.gov/>>
- <sup>3</sup> U.S. Census Bureau. *2002 Economic Census, Business Expenses Survey, Retail Trade, Household Appliance Stores*, 2002. Washington, DC. <<http://www.census.gov/csd/bes/bes97.htm>>
- <sup>4</sup> Dale, Larry et al., “An Analysis of Price Determination and Markups in the Air-Conditioning and Heating Equipment Industry”, LBNL-52791, January 2004.
- <sup>5</sup> Sales Tax Clearinghouse, Inc. *State sales tax rates along with combined average city and county rates*. <<http://thestic.com/STrates.stm>>