CHAPTER 6. MARKUPS FOR EQUIPMENT PRICE DETERMINATION

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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. As discussed in chapter 8, DOE developed retail prices for baseline products using proprietary retail price data collected by The NPD Group. 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 product 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 product to cover their business costs and profit margin.

Data from the Association of Home Appliance Manufacturers (AHAM) [(1)] 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 clothes washers, DOE assumed that all of the clothes washers are purchased by consumers from retail outlets. DOE did not include a separate distribution channel for clothes washers products included as part of a new home, as it did not have information on the extent to which these products are "pre-installed" by builders in new homes.

6.1.2 Markup Calculation Procedure

As just discussed, at each point in the distribution channel, companies mark up the price of the product to cover their business costs and profit margin. In financial statements, gross margin is the difference between the company revenue and the company cost of sales or 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 produce and sell the products of interest.

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 publicly available financial information including Securities and Exchange Commission (SEC) 10-K reports for manufacturers of major household appliances whose product offerings include residential dishwashers. These four manufacturers hold a combined 99 percent of the market for residential dishwashers in the United States. 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 dishwashers. DOE evaluated markups for 2003–2010. Table 6.2.1 lists the average corporate gross margin during the years 2003–2010, and corresponding markups, for each of the four manufacturers.

Table 6.2.1 Major Appliance Manufacturers: Gross Margins and Markups

	Mfr A	Mfr B	Mfr C	Mfr D
Average Net Revenues **million $**	12,178	16,447	15,379	11,278
Average Cost of Goods Sold **$**	7,975	13,914	12,023	6,624
Markup	1.53	1.18	1.28	1.70

Source: SEC 10-K reports (2010-2003)

The weighted average markup values based on these four companies is 1.24; therefore DOE used the 1.24 markup for both standard and compact dishwashers.

6.3 RETAILER MARKUP

6.3.1 Approach for Retailer Markups

DOE based the retailer markups for residential clothes washers 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. [3] 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 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 around 70 percent and 30 percent of the total sales, respectively. DOE found that gross margin as percent of sales has been roughly constant in this category from 1993 to 2007.[a] 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 products 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, and
GM_{RTL} = retailer's gross margin.

Table 6.3.1 shows the calculation of the baseline retailer markup.

[a] U.S. Census, 2007 Annual Retail Trade Report: Electronics and Appliance Stores Sales and Gross Margin

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
Baseline Markup = (CGS+GM)/CGS	**1.45**

Source: U.S. Census, 2002 Business Expenses Survey (for sales) and 1997 Business Expenses Survey (for CGS and GM shares)

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 products 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 lacking. 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 know 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 profits.

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). [(4)]

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. (Note: Under DOE's approach, a high fixed cost component yields a low incremental markup.)

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

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

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. The incremental markup is calculated as 1.17.

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

Input Data for Incremental Markup Calculation	Amount **$1,000**
Sales	83,896,811
Cost of Goods Sold (CGS)	*57,888,800*
Gross Margin (GM)	*26,008,011*
Labor & Occupancy Expenses ("Fixed")	
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
Other Operating Expenses & Profit ("Variable")	
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
Net profit before taxes	*1,375,360*
Subtotal:	9,693,774
Incremental Markup = (CGS+Total Other Operating Expenses and Profit)/CGS	**1.17**

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

By dividing expenses into fixed and variable components, the incremental markup approach envisions that retailers cover costs without changing profits. Although retailers may be able to reap higher profits for a time, DOE's approach assumes that competition in the appliance retail market will tend to pressure retail margins back down.

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 industry. Generally, an FFCR of less than 40 percent indicates that the industry is not concentrated and an FFCR of more than 70 percent indicates that an industry is highly concentrated.[b] [c]

The FFCR of major appliance sales is equal to the sector FFCR times the percent of total sales within each sector 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-percent 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 percent.

Table 6.3.3 Electronics and Appliance Stores: Concentration by Four Large Firms

Sector	Four-Firm Concentration Ratio % of sector sales	Percent of Sales Accounted for by Major Appliances %	Four-Firm Concentration Ratio % of major appliance sales
Electronics and Appliance Stores	43.9	39.4	17.3
Household Appliance Stores subsector	16.8	-	-
Building Material and Supplies Dealers	41.7	15.7	6.5
General Merchandise Stores	65.1	35.4	23.0

Source: U.S. Economic Census, Establishment and Firm Size: (Including Legal Form of Organization), 1997, 2002.
*Note: The assumption used here is that major appliance sales are uniformly distributed within all firms in each sector.

[b] University of Maryland University College, AMBA 607 course materials: note on industry structure: http://info.umuc.edu/mba/public/AMBA607/IndustryStructure.html . [Last accessed July 10, 2012.]

[c] Quick MBA, Economics: industry concentration: http://www.quickmba.com/econ/micro/indcon.shtml . [Last accessed July 10, 2012.]

6.4 SALES TAXES

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

DOE derived state and local taxes from data provided by the Sales Tax Clearinghouse. [5] DOE derived population-weighted average tax values for each Census division and large state, as shown in Table 6.4.1.

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

Census Division/State	Tax Rate 2009 %
New England	5.55
Mid Atlantic	6.62
East North Central	6.88
West North Central	7.06
South Atlantic	6.51
East South Central	7.93
West South Central	8.42
Mountain	6.81
Pacific	5.23
New York State	8.45
California	9.20
Texas	8.05
Florida	6.65

DOE then derived U.S. average tax values for each product (as shown in Table 6.4.2) based on the product's saturation within each Census division and large state. It determined the saturations from the DOE Energy Information Administration (EIA)'s 2005 Residential Energy Consumption Survey. [6]

Table 6.4.2 Average Sales Tax Rates

Product	Tax Rate %
Standard-Sized Dishwashers	7.17
Compact Dishwashers	7.17

6.5 SUMMARY OF MARKUPS

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

Table 6.5.1 Summary of Markups

	Standard		Compact	
Markup	**Baseline**	**Incremental**	**Baseline**	**Incremental**
Manufacturer	1.24		1.24	
Retailer	1.45	1.17	1.45	1.17
Sales Tax	1.0717		1.0717	
Overall	1.93	1.55	1.93	1.55

REFERENCES

1. Association of Home Appliance Manufacturers. *AHAM 2003 Fact Book*. 2003. Washington, DC. p. 25.

2. Securities and Exchange Commission, SEC 10-K Reports, Various dates, 2004-2009, Securities and Exchange Commission. (Last accessed July 10, 2012.) <http://www.sec.gov/edgar/searchedgar/webusers.htm>.

3. U.S. Census Bureau. 2002 Economic Census, Business Expenses Survey, Retail Trade, Household Appliance Stores, 2002. Washington, DC. [Last accessed July 10, 2012.] <http://www.census.gov/econ/bes/historic_releases.html>

4. Dale, L., D. Millstein, K. Coughlin, R. Van Buskirk, G. Rosenquist, A. Lekov, and S. Bhuyan. *An Analysis of Price Determination and Markups in the Air-Conditioning and Heating Equipment Industry*. January 2004. Lawrence Berkeley National Laboratory: Berkeley, CA. Report No. LBNL-52791.

5. Sales Tax Clearinghouse, Inc. State sales tax rates along with combined average city and county rates. (Last accessed July 10, 2012.) <http://thestc.com/STrates.stm>

6. U.S. Department of Energy–Energy Information Administration. Residential Energy Consumption Survey, 2005. Public Use Data Files. Washington, DC. (Last accessed July 10, 2012.) < http://www.eia.gov/emeu/recs/recspubuse05/pubuse05.html>