United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park, NC 27711

EPA-450/3-91-021
October 1991

Air

EPA

Economic Impact Analysis of Regulatory Controls in the Dry Cleaning Industry

Final

NESHAP

Economic Impact Analysis of Regulatory Controls in the Dry Cleaning Industry

Emission Standards Division

U.S. Environmental Protection Agency
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711
October 1991

(Disclaimer)

This report has been reviewed by the Emission Standards Division of the Office of Air Quality Planning and Standards, EPA, and approved for publication. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use. Copies of this report are available through the Library Services Office (MD-35), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, or from National Technical Information Services, 5285 Port Royal Road, Springfield, VA 22161.

This report contains portions of the economic impact analysis report that are related to the industry profile.

SECTION 2

SUPPLY OF DRY CLEANING SERVICES

The dry cleaning industry is a mature service industry involved in the cleaning, pressing, and finishing of clothing and related products. This section provides a profile of each sector of the industry, production history and trends, an overview of the production process, and the estimated costs of production.

2.1 PROFILE OF SUPPLIERS BY INDUSTRY SECTOR

The dry cleaning industry is composed of three sectors:

- commercial (SIC 7216),
- coin-operated (SIC 7215), and
- industrial (SIC 7218).

Commercial facilities are the most prevalent of the three types and are generally located in shopping centers and near densely populated areas. Coin-operated plants are typically part of a laundromat and provide dry cleaning either on a self-service basis or by accepting items over the counter--similar to commercial facilities. Industrial plants usually rent uniforms and other items to their customers and are generally larger than commercial and coin-operated facilities.

2.1.1 Commercial Sector

Commercial dry cleaning facilities, the most familiar type of establishment, provide services for households and include independently operated neighborhood shops, franchises, and specialty cleaners. Commercial dry cleaners provide full service dry cleaning, which includes spotting, pressing, finishing, and packaging. In addition, many commercial dry cleaners provide laundry services for water-washable garments, rug cleaning services, and minor alteration and repair services. On average approximately 85 percent of the receipts at a commercial dry cleaning establishment are from dry cleaning activities. The remaining 15 percent are from the auxiliary services provided by the facility (U.S. Department of Commerce, 1991).

Approximately 30,494 commercial dry cleaners operate in the U.S. Over 80 percent or about 24,947 commercial dry cleaners use perchloroethylene (PCE) in their cleaning process. Table 2-1 shows the distribution of PCE establishments, the distribution of PCE machines, and the corresponding number of machines per facility for 5 income categories (based on annual receipts per facility). This estimated total number of dry cleaning facilities and the distribution of facilities by income level is based on the number and distribution of PCE dry cleaning machines by design capacity, the average number of machines per facility in the commercial sector (approximately 1.25) (Radian 1990c), and the distribution of facilities reported in the 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990b). In addition, it is assumed that facilities below $100 thousand in annual receipts have one machine per facility.

Tables 2-2 and 2-3 show the 1991 distribution of annual receipts for all commercial establishments and for establishments that use PCE, respectively. Over three fourths of the total receipts to dry cleaning establishments were earned by facilities with $100,000 or more in annual receipts. These facilities represent only about one third of the total number of commercial dry cleaning establishments. At the other end of the spectrum, small facilities with below $25,000 in annual receipts account for more than 25 percent of the total number of facilities but only about 3 percent of total receipts to commercial dry cleaners.

Dry cleaning output for the sector totals 571,984 Mg per year with 446,492 Mg from facilities that use PCE. Total output is computed by first multiplying total annual receipts by the share of receipts from dry cleaning activities (85%) to compute the receipts directly attributable to drycleaning. This value is then divided by the estimated 1989 baseline price of $6.34 per kilogram for dry cleaning services to compute total annual output measured in kilograms of clothes cleaned. Tables 2-4 and 2-5 report 1991 estimated total output and average output per establishment by income category.

TABLE 2-1. DISTRIBUTION OF PCE DRY CLEANING MACHINES AND FACILITIES IN THE COMMERCIAL SECTOR

Annual Receipts ($000/yr)	Number of PCE Machines	PCE Machines Per Establishment	Number of PCE Establishments	Number of PCE and non-PCE Establishments[a]
0 - 25	6,822	1	6,822	8,026
25 - 50	4,270	1	4,270	5,024
50 - 75[b]	2,632	1	2,632	3,096
75 - 100[b]	2,632	1	2,632	3,096
over 100	15,076	1.75	8,591	11,251
Total	31,432	1.26	24,947	30,494

[a]The total number of dry cleaning facilities in each income category is computed based on the assumption that 85 percent of dry cleaning machines use PCE (Safety Kleen, 1986). Note that the number of machines per establishment refers to PCE machines only. It is assumed the average number machines per establishment is one for all non-PCE establishments.

[b]Census data do not subdivide facilities with annual receipts between $50 and $100 thousand. For the purposes of analysis it is assumed that one half of facilities with $50 to $100 thousand annual receipts are below $75 thousand and one half are above $75 thousand.

Source: Radian, 1990c; 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990); Safety-Kleen, 1986.

TABLE 2-2. 1991 DISTRIBUTION OF RECEIPTS FOR COMMERCIAL DRY CLEANING ESTABLISHMENTS: PCE AND NON-PCE ESTABLISHMENTS ($1989)

Annual Receipts ($000/yr)	Number of Establishments[a]	Percent	Total Annual Receipts[b] ($000/yr)	Percent	Average Annual Receipts Per Establishment[c] ($/yr)
0-25	8,026	26.32	142,350	3.34	17,736
25-50	5,024	16.47	203,679	4.77	40,545
50-75	3,096	10.15	207,528	4.86	67,021
75-100	3,096	10.15	290,539	6.81	93,829
>100	11,251	36.90	3,421,966	80.21	304,135
Total	30,494	100.00	4,266,062	100.00	-

[a]See Table 2-1.
[b]Average annual receipts multiplied by number of establishments.
[c]Based on data reported in the 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990) for commercial dry cleaning establishments with payroll converted to $1989 using the CPI for Apparel and Upkeep.

TABLE 2-3. 1991 DISTRIBUTION OF RECEIPTS FOR COMMERCIAL DRY CLEANING ESTABLISHMENTS: PCE ESTABLISHMENTS ONLY ($1989)

Annual Receipts ($000/yr)	Number of Establishments[a]	Percent	Total Annual Receipts[b] ($000/yr)	Percent	Average Annual Receipts Per Establishment[c] ($/yr)
0-25	6,822	27.35	120,998	3.63	17,736
25-50	4,270	17.12	173,127	5.20	40,545
50-75	2,632	10.55	176,399	5.30	67,021
75-100	2,632	10.55	246,958	7.42	93,829
>100	8,591	34.44	2,612,824	78.46	304,135
Total	24,947	100.00	3,330,305	100.00	-

[a]See Table 2-1.
[b]Average annual receipts multiplied by number of establishments.
[c]Based on data reported in the 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990) for commercial dry cleaning establishments with payroll converted to $1989 using the CPI for Apparel and Upkeep.

TABLE 2-4. 1991 DISTRIBUTION OF DRY CLEANING OUTPUT IN THE COMMERCIAL SECTOR: PCE AND NON-PCE ESTABLISHMENTS

Annual Receipts ($000/yr)	Number of Establishments[a]	Percent	Total Annual Output[b] (Mg/yr)	Percent	Average Annual Output Per Establishment[b] (kg/yr)
0-25	8,026	26.32	19,085	3.34	2,378
25-50	5,024	16.47	27,307	4.77	5,436
50-75	3,096	10.15	27,823	4.86	8,985
75-100	3,096	10.15	38,952	6.81	12,580
>100	11,251	36.90	458,781	80.21	40,775
Total	30,494	100.00	571,948	100.00	-

[a]See Table 2-1.
[b]Receipts from Table 2-2 multiplied by the share of receipts from dry cleaning activities (85%) divided by the 1989 base price ($6.34 per kg).

TABLE 2-5. 1991 DISTRIBUTION OF DRY CLEANING OUTPUT IN THE COMMERCIAL SECTOR: PCE ESTABLISHMENTS ONLY

Annual Receipts ($000/yr)	Number of Establishments[a]	Percent	Total Annual Output[b] (Mg/yr)	Percent	Average Annual Output Per Establishment[b] (kg/yr)
0-25	6,822	27.35	16,222	3.63	2,378
25-50	4,270	17.12	23,211	5.20	5,436
50-75	2,632	10.55	23,650	5.30	8,985
75-100	2,632	10.55	33,110	7.42	12,580
>100	8,591	34.44	350,300	78.46	40,775
Total	24,947	100.00	446,492	100.00	-

[a]See Table 2-1.
[b]Receipts from Table 2-3 multiplied by the share of receipts from dry cleaning activities (85%) divided by the 1989 base price ($6.34 per kg).

The commercial sector baseline price is derived using International Fabricare Institute (IFI) data on the average price to clean a two-piece man's suit weighing one kilogram (Faig, 1990). Control cost estimates and other financial data used in the economic impact analysis are measured in 1989

dollars. However, the most recent base price estimate available for the commercial sector is the average 1988 value ($5.92). The 1989 base price was projected by first fitting a regression line to the natural logarithm of base prices from 1973 to 1988 and a time trend. The slope of the regression line (0.0707) is an estimate of the average growth rate of base prices over that time period.

The projected 1989 base price is then calculated as the sum of the 1988 price plus the growth amount:

$$P_{1989} = P_{1988} \cdot (1 + 0.0707) \qquad (2.1)$$

$$= \$5.92 \cdot (1 + 0.0707)$$

$$= \$6.34$$

For the purposes of analysis, all facilities are assumed to charge $6.34 per kilogram of clothes cleaned in the baseline. In following sections, price changes due to the regulation are projected based on the price computed in this section.

2.1.2 Coin-operated Sector

Facilities in the coin-operated sector also supply dry cleaning services to households and are usually part of a laundromat. Water washing and drying account for the majority of sales with dry cleaning offered as an auxiliary service (Torp, 1990). Approximately 10 percent of total receipts at coin-operated laundries that offer dry cleaning services are from dry cleaning activities.

Two types of dry cleaning services are available in this sector: self-service and employee assisted dry cleaning. Self-service, coin-operated dry cleaning, as the name suggests, requires the consumer to operate the dry cleaning machine and does not include pressing, spotting, or other finishing services. Employee assisted dry cleaning (referred to as plant-operated in the balance of this report) is virtually indistinguishable from the service provided by commercial dry cleaners except that the facility also offers coin-operated laundry services. Consumers use coin-operated dry cleaners because

they desire lower priced cleaning, have large items, or do not live near commercial cleaners (ICF, 1986).

Census data indicate that 27,180 coin-operated laundries--including facilities with and without payroll--were operating in the U.S. in 1987 (U.S. Department of Commerce, 1990a). Approximately 3,044 coin-operated laundries offer dry cleaning services. About 2,831 establishments offer plant-operated dry cleaning and another 213 establishments offer self-service dry cleaning (Radian, 1991c). Virtually all coin-operated laundries that offer dry cleaning services use PCE in the cleaning process.

Table 2-6 shows the 1991 distribution of coin-operated establishments with dry cleaning operations. The income distribution is based on the income distribution of all coin-operated laundries with payroll including those without dry cleaning capacity (U.S. Department of Commerce, 1990b). Establishments with over $100,000 in annual receipts account for approximately 14 percent of the establishments and more than half of the receipts at plants with dry cleaning operations. Establishments that collect less than $25,000 in annual receipts account for about 17 percent of the plants and less than 4 percent of receipts at plants with dry cleaning operations. Nearly one half of all plants in this sector with dry cleaning operations are in the $25 to $50 thousand receipts range.

TABLE 2-6. 1991 DISTRIBUTION OF RECEIPTS FOR COIN-OPERATED ESTABLISHMENTS WITH DRY CLEANING CAPACITY ($1989)

Annual Receipts ($000/yr)	Number of Establishments[a]	Percent	Total Annual Receipts[b] ($000/yr)	Percent	Average Annual Receipts Per Establishment[c] ($/yr)
0-25	523	17.19	9,248	3.61	17,683
25-50	1,451	47.70	58,706	22.93	40,459
50-75	475	15.61	31,835	12.43	67,021
75-100	169	5.49	15,669	6.12	93,829
>100	426	14.00	140,571	54.90	329,978
Total	3,044[d]	100.00	256,029	100.00	-

[a]The distribution of establishments is based on the distribution of all coin-operated laundries with payroll (including those without dry cleaning capacity) reported in the 1987 Census of Service Industries (U.S. Department of Commerce, 1991b).
[b]Average annual receipts multiplied by the number of establishments.
[c]Based on data reported in the 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990) for coin-operated laundries with payroll converted to $1989 using the CPI for Apparel and Upkeep.
[d]Radian 1991a.

Projected 1991 annual receipts to coin-operated laundries with dry cleaning operations total $256 million. However, only about 10 percent or $25.6 million in receipts are directly from dry cleaning activities in the coin-operated sector. Dry cleaning output for this sector totals 4,298 Mg per year. Output is computed based on an average price of $6.34 per kilogram of clothes cleaned at plant-operated facilities and $1.65 per kilogram for self-service facilities. Table 2-7 shows the total dry cleaning output and the average output per establishment by income category for the coin-operated sector.

TABLE 2-7. 1991 DISTRIBUTION OF DRY CLEANING OUTPUT IN THE COIN-OPERATED SECTOR

Annual Receipts ($000/yr)	Number of Establishments[a]	Percent	Total Annual Output[b] (Mg/yr)	Percent	Average Annual Output Per Establishment[b] (kg/yr)
0-25	523	17.19	179	4.01	343
25-50	1,451	47.70	1,138	25.47	784
50-75	475	15.61	616	13.79	1,297
75-100	169	5.49	317	7.10	1,878
>100	426	14.00	2,217	49.62	5,205
Total	3,044[c]	100.00	4,468	100.00	-

[a]The distribution of establishments is based on the distribution of all coin-operated laundries with payroll (including those without dry cleaning capacity) reported in the 1987 census of service industries (U.S. Department of Commerce, 1991b).
[b]Receipts from Table 2-6 multiplied by the share of receipts from dry cleaning activities (10%) divided by the 1989 base price. Base price for coin-operated (self-service) is $1.65 per kg. Base price for coin-operated (plant-operated) is $6.34 per kg. See Table 2-13 for the share of plant-operated and self-service establishments in each receipts category.
[c]Radian 1991a.

Price information is unavailable for the coin-operated sector. Based on conversations with industry officials, plant-operated facilities probably charge the same price as commercial facilities or $6.34 per kilogram (Torp, 1990). A survey of two coin-operated facilities with self-service machines indicated that they both charge $6.00 to run one cycle in a 3.6 kilogram capacity machine. Presumably, these facilities are representative of the sector and $6.00 is the average price to use a 3.6 kilogram self-service coin-operated machine. Thus, the average price to clean one kilogram of clothing is calculated to be $1.65.

2.1.3 Industrial Sector

The industrial sector supplies items such as laundered uniforms, wiping towels, floor mats, and work gloves to industrial or commercial users. Industrial laundries provide services for a diverse group of industrial and

commercial users including auto service and repair shops, food processing plants, manufacturing concerns, construction firms, hotels, restaurants, security firms, banks, and real estate companies. The commercial or industrial user usually rents the items from the industrial launderer who provides pick-up, laundry, and delivery services for the consumer on a regular basis (Coor and Grady, 1991).

Service agreements between the industrial launderers and their customers to provide clean uniforms generally specify the number of changes per employee and a schedule for delivery of the rented items. For example, the typical agreement for uniform rental specifies that the industrial launderer provide 11 changes of clothing per employee per week including 5 clean suits left with the customer, 5 dirty suits taken back to the laundry, and 1 transition suit (the garment worn by the employee of the customer firm at the time of delivery). Items are generally delivered and collected at the same time each week (Coor and Grady, 1991).

According to Census data 1,379 industrial laundry facilities with payroll were operating in 1987. Over 90 percent of these establishments receive annual receipts over $100 thousand (U.S. Department of Commerce, 1990b). For this analysis, it is assumed that all industrial launderers with dry cleaning capacity have annual receipts of over $100 thousand. Approximately 325 industrial launderers have dry cleaning capacity. Of these about 40 percent (or 130) use PCE and 60 percent (or 195) use petroleum (Sluizer, 1990).

Annual receipts for industrial facilities with dry cleaning capacity total approximately $977 million. On average, about 35 percent of the receipts at facilities with dry cleaning capacity are from dry cleaning activities with the balance from water washing or other activities. Using an average price of $2.00 per kilogram of clothes cleaned, the estimated total dry cleaning output from commercial facilities is 170,901 Mg per year.

Price data are unavailable for the industrial sector. Therefore, a small survey was conducted to determine the average price charged to provide one clean uniform weighing approximately one kilogram. Prices ranged from $1.75 to $2.25 per change. A representative from an industry trade

association confirmed that these prices are representative of the prices charged in the industry (Sluizer, 1990). The midpoint of the range ($2.00) is assumed to be the average base price for the industry.

2.2 PRODUCTION HISTORY AND TRENDS

Although dry cleaning technology has existed for many years, the industry did not experience widespread expansion until the 1960's. A deep recession in the early 1970's eliminated part of the industry, but the late 1970's and early 1980's saw a resurgence of dry cleaners (Fischer, 1987).

During the 1950's, petroleum was the principle solvent in dry cleaning plants. The 1960's brought a shift toward chlorinated solvents (e.g., PCE, F-113) that has continued to the present. The main reason for the shift was the widespread implementation of fire codes during this period. In addition, an existing new source performance standard (NSPS) for petroleum-based dry cleaning restricts the use of this solvent in new facilities. Because none of the chlorinated solvents exhibit the flammable properties of petroleum, the large number of plants built in shopping malls and suburban areas since the 1960's has been based on chlorinated-solvent technology (ICF, 1986).

Currently, a vast majority of all dry cleaners use PCE. However, demand for PCE by the dry cleaning industry has been declining and is expected to continue to decrease slowly due to greater recycling and lower solvent emissions from equipment (Chemical Marketing Reporter, 1986). The economic incentive for self-imposed emission reductions and solvent recycling has persuaded several plants to install control devices and/or switch to more efficient machines voluntarily.

No direct measurement of the quantity of clothes dry cleaned per year is available for the dry cleaning industry. However, an estimate of aggregate output can be derived through the quotient of total receipts for dry cleaning activities and an average price per kilogram of clothes cleaned. Historical information on average base prices and total receipts is available only for the commercial sector; statistics compiled for the industrial and coin-operated sectors do not distinguish between those facilities that dry clean and those that launder with water. The base price in the commercial sector is

the price charged to clean a standard two-piece men's suit weighing one kilogram. As seen in Table 2-8, the average base price and total annual receipts measured in 1989 dollars increased by over 50 percent from 1974 to 1988. Total output for the sector measured in kilograms of dry cleaned clothing declined from the mid 1970's to the early 1980's. From 1981 to 1988, dry cleaning output increased by approximately one third.

Table 2-9 presents annual growth rates for each sector of the dry cleaning industry. These estimates are based on machinery sales and are therefore broken down by machine type as well as sector. Other factors considered include machine life, current and historical sales data, and replacement rate of the machinery. Predictions indicate that the commercial sector will be the only sector to experience positive growth, at just over 2 percent per year. Both the industrial and coin-operated sectors are estimated to show negative annual growth rates of approximately 5 percent and 7 percent, respectively. These growth rates do not predict overall growth in output for the coin-operated and industrial sectors, because dry cleaning activities account for only a small portion of total output in these sectors.

Several factors have contributed to the trend away from coin-operated dry cleaning. Because of environmental regulations, consumers are increasingly aware of the hazards of operating coin-operated machinery and handling the cleaning solvents. The decline is also due in part to more expensive dry cleaning equipment, questionable returns on dry cleaning activities in this sector, and the necessity of hiring an attendant. These factors combine to make coin-operated dry cleaning operations unprofitable (Torp, 1990).

TABLE 2-8. ANNUAL RECEIPTS, AVERAGE BASE PRICE, AND TOTAL OUTPUT FOR COMMERCIAL DRY CLEANERS ($1989)[a]

Year	Total Annual Receipts (10^6/yr)[a]	Average Base Price ($/kg)[a]	Total Dry Cleaning Output (10^6 kg/yr)[b]
1974	2,692	4.02	570
1975	2,630	4.42	506
1976	2,623	4.46	499
1977	2,675	4.36	521
1978	2,825	4.87	493
1979	2,878	4.90	499
1980	2,975	5.32	475
1981	2,941	5.63	444
1982	3,517	5.72	522
1983	3,638	5.87	527
1984	3,694	5.98	525
1985	3,764	6.13	522
1986	4,390	6.14	608
1987	4,287	6.05	603
1988	4,265	6.08	596

[a]Includes receipts for facilities with payroll only. All dollar figures converted to 1989 dollars through the Consumer Price Index for Apparel and Upkeep.

[b]Total sales multiplied by share of receipts from dry cleaning activities (85%) divided by average base price per kg.

Source: Faig, 1990.

TABLE 2-9. ANNUAL GROWTH RATES BY MACHINE TYPE AND SECTOR (1986-1989)

Sector	Machine type: Dry-to-dry	Machine type: Transfer	Total
Commercial	9%	-7%	2%
Coin-Operated	-7%	N/A	-7%
Industrial	-3%	-5%	-5%

Note: Growth rates are estimates based on Section 114 information. Considered in these estimates were machine life, current sales data, replacement rate, and 5- and 10-year sales data. Total annual growth rate is weighted according to the machine populations in each sector.

Source: Radian,1991a.

The negative growth rate in industrial dry cleaning reflects increased costs of dry cleaning due to state regulations as well as the advent of polyester/cotton and polyester/wool blends that made water washable fabrics feasible even for dress clothes. In the 1980's, industrial cleaning plants have moved away from dry cleaning their output and toward laundering with new detergent formulations. Between 1980 and 1985, the number of industrial facilities that dry cleaned clothing dropped by approximately 50 percent (ICF, 1986). Virtually all the garments currently processed by industrial launderers are water washable. However, some industrial launderers continue to dry clean at least a portion of their water washable garments because dry cleaning increases the life of the garment and enhances the garment's appearance (Coor and Grady, 1991). An estimated 92 percent of the garments cleaned by industrial facilities are laundered in water and detergent, and this percentage is expected to continue to increase (Sluizer, 1990).

2.3 PRODUCTION PROCESSES

Dry cleaning services generally include cleaning, pressing, and finishing articles of clothing and other related products. In all three sectors, the dry cleaning process is almost identical to laundering in water except that a solvent, such as PCE, is used in place of water and detergent. The coin-operated sector is the only one that does not regularly provide pressing and finishing services. The processes, machinery, and controls in each sector of the dry cleaning industry are detailed in this section.

2.3.1 Machine Types

Two types of machines are commonly used in the dry cleaning industry: dry-to-dry and transfer. Dry-to-dry machines combine washing and drying in one machine and, therefore, do not have a separate machine for drying. Transfer machines, like the traditional laundry machines for water washing, consist of separate machines for washing and drying.

Most dry cleaning plants have one or more attachments to their dry cleaning machine. These include solvent filters, distillers, and vent controls. Figure 2-1 shows the typical configuration of a dry cleaning

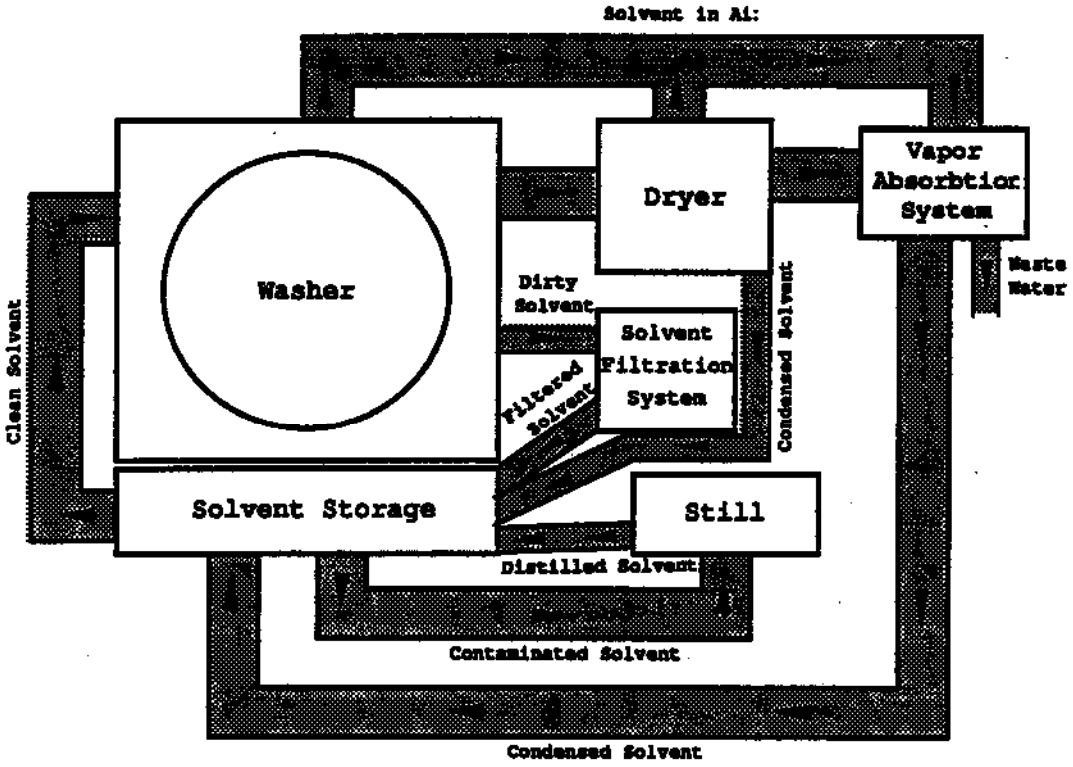

Figure 2-1. Typical Configuration of a Dry Cleaning Machine and the Various Attachments

Source: Safety-Kleen, 1986.

machine and the various attachments. Solvent filters remove impurities from the solvent and return the "clean" solvent to the solvent tank. Stills remove any impurities left in the solvent after it is filtered as well as water and detergent mixed with the solvent in the washing process through a distillation process. Virtually all dry cleaning facilities have solvent filtration systems and about 80 percent use stills. These devices extend the life of the solvent and reduce the amount of solvent that must be purchased (Safety-Kleen, 1986).

Approximately 60 percent of all PCE dry cleaning machines have vent control devices (Radian, 1991c). Vent controls are attached to the dryer and remove vaporized solvent from the dryer emissions. Vent control devices are available in two basic types: carbon adsorbers (CA's) and refrigerated condensors (RC's). With the use of a CA, PCE emissions are trapped in a carbon filter. The filter then undergoes a condensation process that

eliminates the hazardous emissions. A typical CA lasts about 15 years and reduces emissions by about 95 percent when operated properly. The second type of control device, the RC, uses a refrigerated coil to cool PCE vapors. This cooling process results in condensation of PCE emissions. The average life of a RC is about 7 years. The emission reduction achieved by RC's differs depending on the type of dry cleaning machine used. Refrigerated condensors reduce vent emissions by 85 percent on transfer machines and by about 95 percent on dry-to-dry machines.

Over 90 percent of new dry-to-dry machines built for the commercial and industrial sectors have built-in RC's (Federal Register, 1989). Add-on control devices may be purchased and attached to machines that are not equipped with vent controls from the manufacturer. A facility's selection of control devices is constrained by the capacity of its dry cleaning machine. Add-on RC's are not available for the very small machines built for the coin-operated sector or for the large machines built for the industrial sector. Both types of add-on devices are available to retrofit virtually all machines built for the commercial sector.

Owners and operators of dry cleaning facilities purchase add-on vent controls and attach them to their dryer for a variety of reasons. Some states require dry cleaners to control their emissions using a vent control device. Environmentally conscious owners may install vent controls even in the absence of state regulations. Depending on the price paid for solvent and the amount of solvent saved, some owners may realize a cost savings from reduced solvent consumption with a vent control.

2.3.2 Solvents

Four solvents are currently in use in the dry cleaning industry: PCE, fluorocarbon 113 (F-113), petroleum, and 1,1,1-trichloroethane (1,1,1-TCA). Of these four, PCE is usually considered the most efficient cleaner. Five main factors determine the suitability of a solvent for dry cleaning, each with a range of acceptable values, as opposed to an absolute standard (Busler, 1980):

- The solvent must be able to dissolve fats and oils without damaging the most common fibers and dyes.
- The solvent should not leave an unpleasant odor in garments after drying.
- Chemical stability is important to prevent damage to the metals used in dry cleaning machinery.
- A certain level of volatility is desirable to permit rapid drying and economical reclamation through distillation.
- The solvent should be compatible with common detergents used in the process.

The importance of PCE to the dry cleaning process depends on the ease with which it can be replaced by another comparable solvent. The potential for solvent substitution should be evaluated against the criteria established for the factors listed above.

F-113, petroleum, and 1,1,1-TCA can all theoretically be substituted for PCE in the dry cleaning process. However, none of these solvents will perform with the same degree of efficiency as PCE. Thus, an owner of a dry cleaning plant will need to ponder various considerations associated with solvent substitution. These factors include solvent prices, cleaning properties, capital costs, and operating costs. An additional factor in the substitution decision is the ease with which machinery designated for use with one solvent can be converted to accept other solvents.

Although all three alternative solvents are used in some dry cleaning plants, none are currently considered feasible for widespread substitution for PCE. F-113 most closely matches the cleaning abilities of PCE but is unsuitable for certain garments and stains. In addition, the possibility of regulations concerning ozone depletion may limit any immediate substitution. Finally, the unit price of F-113 is considerably higher than the unit price of PCE. Fire codes will probably prevent any substantial shift to petroleum, the second solvent. The remaining solvent, 1,1,1-TCA, has yet to attract much interest in this country. Its cleaning abilities are questionable because of high solvent aggressiveness and instability. In addition, usage costs are approximately ten times higher than for PCE (Fisher, 1990a) even though trichloroethane users can achieve energy savings of 5 to 10 percent (Fisher, 1987).

Technically, one other substitute for PCE is available. Industrial dry cleaners can switch to laundering garments with water and detergent for most items. The commercial and coin-operated sectors do not have this flexibility because the customer owns the item to be cleaned and, therefore, specifies the cleaning method.

Approximately 28,000 of the 34,000 dry cleaning plants in the United States use PCE as a cleaning solvent (see Table 2-1). Most of the remaining plants use a petroleum-based solvent, and a small percentage use either F-113 or 1,1,1-TCA. Approximately 85 percent of total dry cleaning output from commercial facilities is processed using PCE. Virtually all coin-operated facilities with dry cleaning capacity use PCE. Solvent use in the industrial sector is divided between PCE (40 percent) and petroleum (60 percent) (Sluizer, 1990).

Figure 2-2 shows the percentage of total PCE consumed by each sector. The commercial sector accounts for approximately 94.3 percent of total PCE consumption by the dry cleaning industry. The industrial sector and the coin-operated sector account for 4.6 percent and 1.1 percent of consumption, respectively.

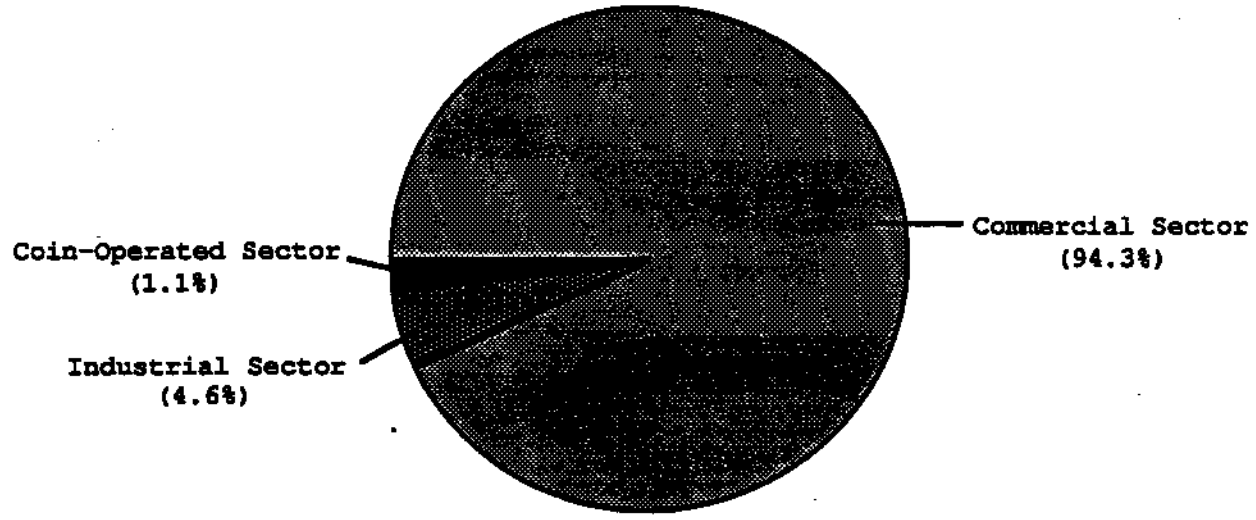

Figure 2-2. PCE Consumption by Sector for 1991
Source: Radian, 1990b.

2.3.3 Production Processes

The flow of production is basically identical in coin-operated (plant-operated) and commercial facilities. The production process begins when the dry cleaning plant receives the soiled garment from the consumer. After a garment enters the plant, a minimum of 10 steps of production are required to produce a clean garment ready for delivery. These steps of production are described below:

- Tagging--Tagging typically involves attaching a tag to the garment with a unique identification number for each customer. A record is made of the customer's name, the corresponding tag number, any special instructions, and the promised delivery date.

- Initial Classifying--Garments are separated into three basic categories at this stage of production: garments that require dry cleaning but no pre-spotting, garments that require laundering but no pre-spotting, and garments that require pre-spotting.

- Applying Spotting Chemicals--Garments stained with ink, paint, food, or other substances are treated with solvents and other compounds before they are laundered or dry cleaned.

- Further Classifying--Garments are further classified by the type of fabric and the color of fabric. This step is required because garments with different fabric types and colors require different treatment and can be damaged if they are processed with garments of dissimilar fabric type or color.

- Washing--In dry cleaning operations, garments are washed in a solvent mixture comprised of solvent, water, and detergent. The correct combination of solvent, water, and detergent and the correct washing temperature are vital to the successful removal of soil without damaging the garment. The washing step ends with extraction of the excess solvent mixture.

- Drying--After garments are washed and the excess moisture removed, they are dried using heated air. Garments may be transferred to a separate machine for drying (transfer machines) or dried in the same machine (dry-to-dry machines) used to wash the garments depending on the machine technology employed by the facility.

- Pressing and Finishing--Clean, dry garments are pressed and finished. Finishing includes replacing damaged or missing buttons, special pressing (e.g., pleated skirts), and any other special handling that may be required.

- Hanging--Garments are placed on hangers in this step of the production process.

- Assembling--After they are placed on hangers, garments are sorted and assembled by consumer identification number on the tag attached to the garment and by promised delivery date.

- Packaging--Assembled garments are packaged for delivery. Packaging typically involves placing a plastic bag over the garments.

Garments are inspected periodically throughout the process described above to determine the success in removing soil and the acceptability of the pressing and finishing steps. Additional steps may be required for heavily soiled garments, oversized items, or delicate garments that require special handling. The production process ends with delivery of the cleaned, pressed, packaged garments to the consumer.

Production of clean clothes at coin-operated (self-service) facilities involves the consumer as an active participant. The facility provides the equipment used in the washing and drying process and the individual provides the labor inputs required for the spotting, pressing, and finishing of the garment. The process of producing clean clothes is similar to that described above for commercial and coin-operated (plant-operated) facilities excluding the tagging, assembling, and packaging steps.

Unlike customers in the commercial or coin-operated sector, customers of industrial cleaners do not deliver the soiled items to the cleaning facility. Rather, the industrial cleaner collects the soiled items from the commercial or industrial user on a regular basis at no additional charge to the user.

The production process begins when the soiled garment enters the industrial plant. The steps of production are similar to those described above for commercial and coin-operated (plant-operated) facilities. A few differences do exist, however. Garments cleaned by industrial facilities generally contain a permanent identification number that identifies not only the company purchasing the dry cleaning service but also the individual that actually wears the garment, the route number, and the day of the week scheduled for delivery of the cleaned items. The process generally requires less classifying beyond the initial classifying because garments are more homogeneous with regard to fabric type and color. In addition, the process is generally more mechanized and larger in scope than the process at a typical commercial or coin-operated (plant-operated) facility. The production process

ends with the delivery of the cleaned item to the customer on the promised delivery date.

2.4 COSTS OF PRODUCTION

Costs of production in the dry cleaning industry can be classified as either fixed or variable costs. Fixed costs are incurred regardless of the level of production. Two types of fixed costs exist: those that occur only once at the start-up of a business and those that regularly recur. Variable costs depend on the level of production at a plant and fall to zero if the plant ceases operations entirely. These three categories of costs are described below:

(1) Fixed start-up costs: the costs associated with the decision to open a dry cleaning plant;

(2) Fixed recurring costs: the costs associated with the decision to operate the dry cleaning plant, and

(3) Variable costs: the costs associated with the decision to operate the dry cleaning plant at a given level of output.

The first category of costs includes most, if not all, capital costs as well as long-term materials contracts and capacity investments. Table 2-10 shows the capital costs of new dry-to-dry machines. In addition, some administrative fees and initial building overhead costs, such as remodeling or down payment, are included in this category of costs. These expenses are the fixed costs that are incurred regardless of the level of production or whether the firm operates at all. Total estimated start-up costs typically range from $95 to $120 thousand (Faig, 1991).

Table 2-11 displays information on the second and third categories of costs for commercial dry cleaning facilities by output level. On average, total wages and salaries account for the largest portion of dry cleaning costs followed by rent/building overhead expenses or total supply cost. The majority of costs incurred by a dry cleaning plant are variable such as solvent, labor, and energy costs. Table 2-12 provides unit price information for the major inputs that contribute to the variable costs of operating a dry cleaning facility.

TABLE 2-10. CAPITAL COSTS OF NEW DRY-TO-DRY MACHINES ($1989)

Machine Capacity (kg/load)	Capital Cost ($)
11.3	26,046
13.6	27,820
15.9	29,594
20.4	42,171
22.7	44,040
27.2	47,040
45.4	65,255
63.5	104,000
113.4	157,000

Source: Radian, 1990a.

Dry cleaning plants have relatively small capital equipment costs, although these vary between the sectors. In addition, the buildings used by many plants are rented or easily transferable to other uses. As a result, the relatively high variable cost to fixed cost ratio at most dry cleaning facilities promotes a dynamic industry structure in which the less efficient plants quickly terminate operations if losses become excessive.

The decision to open a new plant must be evaluated based on the costs included in all three categories above. However, for existing facilities, costs in category 1 are sunk and do not affect the owner's decision to continue operating. Production cost for existing and new facilities are discussed below.

TABLE 2-11. AVERAGE ANNUAL OPERATING COSTS FOR COMMERCIAL DRY CLEANING PLANTS

Cost Category	Annual Output (kg/yr)[a]				
	2,378	5,436	8,985	12,580	40,775
Fixed Recurring Costs					
Wages and Salaries[b]	3,542	8,078	13,383	18,736	81,727
Rent or Building Overhead	1,316	3,002	4,973	6,962	20,955
Depreciation	1,272	2,901	4,805	6,728	11,922
Interest and Bank Charges	779	1,776	2,942	4,119	3,163
Insurance	576	1,315	2,178	3,049	7,786
Variable Costs					
Wages and Salaries	3,024	6,898	11,428	16,000	58,722
Total Supply Cost	1,541	3,515	5,824	8,154	23,175
Outside Work	1,437	3,277	5,429	7,600	15,876
Payroll taxes	541	1,234	2,044	2,862	12,470
Advertising	435	991	1,642	2,299	10,949
Utility-Fuel	360	821	1,361	1,905	6,661
Repairs and Maintenance	312	712	1,180	1,651	6,813
Utility-Electricity	268	611	1,012	1,417	8,394
Office Expense	259	591	979	1,370	3,498
Administrative Expense	241	550	911	1,276	4,015
Utility-Water and Sewage	117	267	442	619	3,224
Claims	92	210	340	488	1,247
Miscellaneous	908	2,071	3,431	4,804	10,707
Total Costs	17,019	38,820	64,313	90,038	291,392

[a]Based on the average annual receipts for five income categories reported in Table 2-2.
[b]Includes owner's wages.

Source: International Fabricare Institute, 1989; Fisher, 1990b.

TABLE 2-12. AVERAGE INPUT PRICES FOR PCE DRY CLEANING FACILITIES ($1989)

Input	Price
Material	
Perchloroethylene	$0.683/kg
Energy	
Electricity	$0.0710/kWh
Steam	$6.13/1000 lb
Labor	
Operating labor	$5.94/hr
Maintenance labor	$6.53/hr

Source: Radian,1990d.

2.4.1 Costs of Production for Existing Facilities

The short-run supply curve of an existing dry cleaning facility is the portion of its marginal cost curve that lies above the minimum point of its average variable cost curve. In other words, facilities will continue to supply dry cleaning services in the short run as long as they can cover their variable costs of production. The market supply curve is the horizontal aggregation of the supply curves for all facilities in the market. This aggregation is characterized in the step supply function (see Figure 2-3) where the producer with the highest marginal cost in the market sets the market price of dry cleaning services.

Lower cost producers are able to cover some or all of their fixed costs because the market price is above their average variable cost. Differences in the production costs across producers are attributed to differences in management practices as well as differences in the productivity of capital equipment. Assuming that the productivity of dry cleaning equipment has been increasing over time, owners of new equipment would tend to have lower marginal costs than owners of older equipment, ceterus paribus.

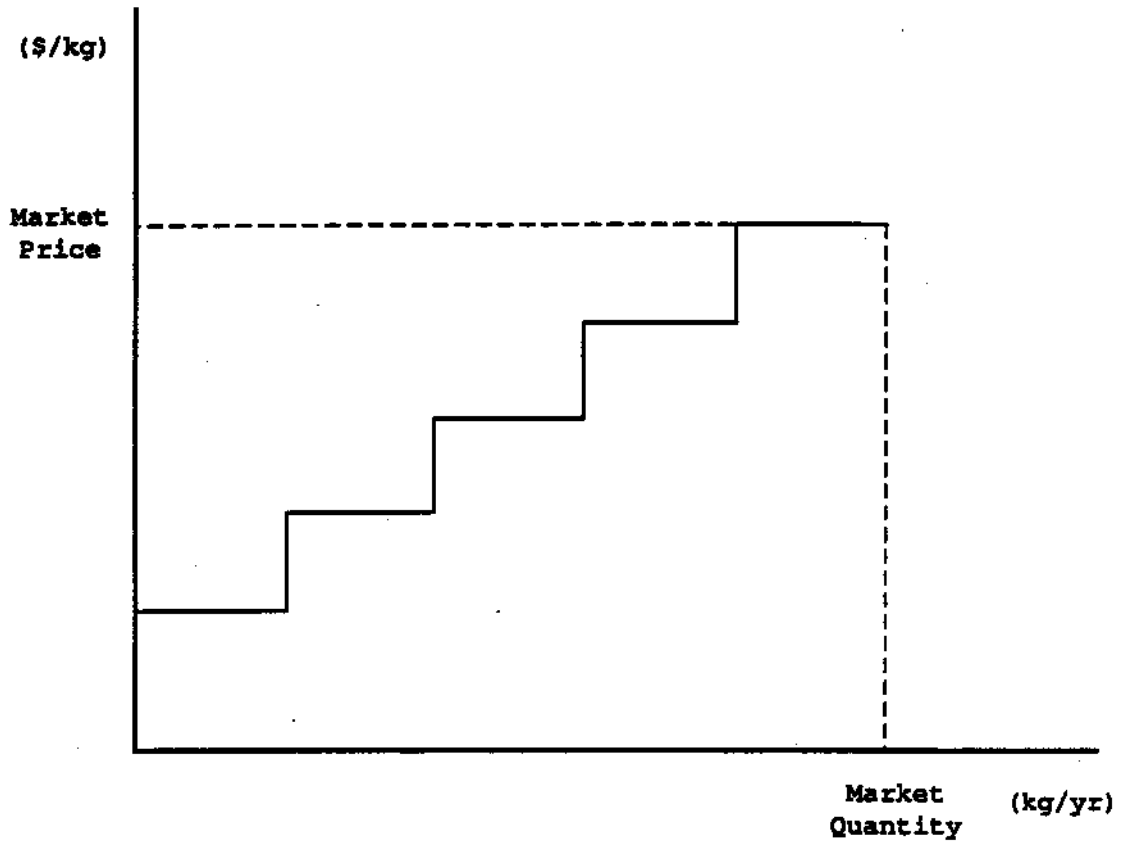

Figure 2-3. Market Supply Curve for Existing Facilities

An increase in the price of a variable input changes the facility's average variable cost and its marginal cost. Changes in the marginal cost of producing dry cleaning services would cause a shift in the supply of dry cleaning services resulting in price and output adjustments at least in the short run.

2.4.2 Costs of Production for New Facilities

An entrepreneur contemplating construction of a new dry cleaning facility won't invest unless he/she anticipates covering total costs. By definition, total cost for a new facility includes fixed start-up costs including a normal return, fixed recurring costs, and variable costs. If the average total cost of opening a new dry cleaning plant is above the market price, no new entry will occur. Conversely, if the average total cost is below the market price, new entry will occur (see Figure 2-4). Therefore, any

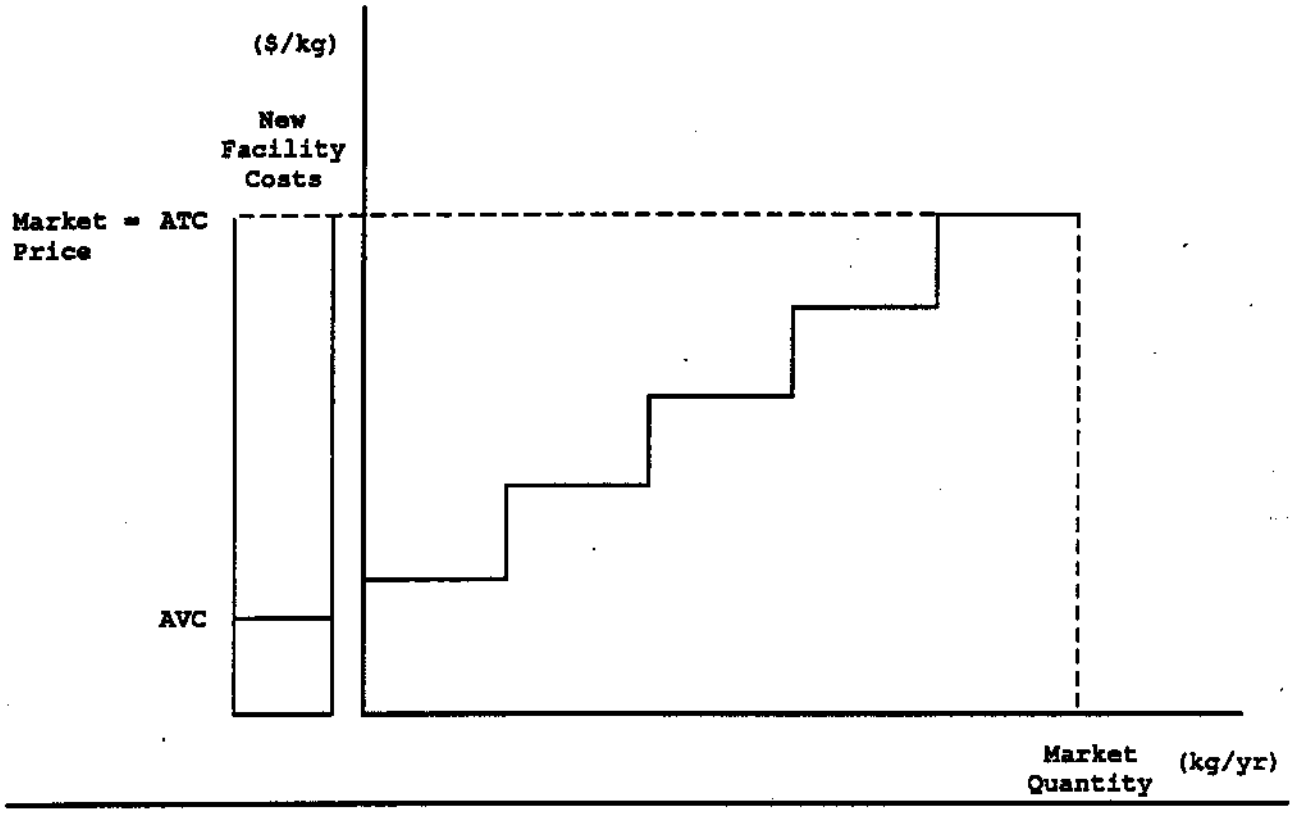

Figure 2-4. New Facility Costs Compared to Market Supply Curve for Existing Facilities

increase in the marginal costs of existing producers not affecting new suppliers would have the effect of encouraging new entry into the market. The entry of a new facility into the market displaces the marginal existing supplier. As the marginal suppliers are displaced in the market, price falls. This process continues until price equals the average total cost of building a new facility. Long-run price and output equilibrium, therefore, depends on the average total cost of building a new facility. Once a new facility is constructed, the fixed costs become sunk costs and only the variable costs are relevant to the decision to continue operating the facility. The facility continues to supply dry cleaning services as long as price exceeds average variable cost.

2.5 MODEL FACILITY PROFILE

The abundance of dry cleaning establishments precludes an approach that investigates the impacts of candidate regulatory alternatives on a facility-specific level. Ignoring the resource costs of collecting data for such a large sample, computational time alone diminishes the feasibility of a facility-specific approach. Consequently, a model plant approach is used in which fifteen model plants represent the characteristics of average PCE facilities in each sector. Table 2-13 presents operating parameters of the model plants by industry sector, machine size, and process. In addition, the distribution of PCE facilities represented by each model plant is reported for five output levels. These output levels correspond to ranges of annual receipts shown in Table 2-13.

The model plants were chosen to represent the variability in machine size and technology that is present among existing facilities in the industry. The coin-operated sector has basically only one machine size and design. However, two model facilities in this sector are differentiated by the base price charged for dry cleaning services and the type of service supplied (self-service or coin-operated). Ten model plants for the commercial sector and three model plants were selected for the industrial sector. Most of the contemporary dry cleaning facilities are purchasing dry-to-dry machines to save on solvent costs, to comply with a recently promulgated worker exposure regulation, and to reduce the environmental impact of PCE emissions. Nevertheless, some facilities continue to operate with transfer machines, and that portion of the industry is represented through appropriate model plants.

TABLE 2-13. MODEL PLANT DESCRIPTION AND THE DISTRIBUTION OF PCE FACILITIES BY INDUSTRY SECTOR AND INCOME LEVEL

Industry Sector and Model Plant Number	Machine Type	Machine Capacity (kg/load)	Operating Days Per Year	Total Number Facilities Per Model Plant Category	Number Facilities in Each Model Plant Category by Income Level ($000/yr)				
					0-25	25-50	50-75	75-100	>100[a]
Coin-Operated									
1 (self-service)	dry-to-dry	3.6	312	213	42	117	38	16	0
2 (plant-operated)	dry-to-dry	3.6	250	2,831	481	1,334	437	153	426
Total				3,044	523	1,451	475	169	426
Commercial									
3	dry-to-dry	11.3	250	2,639	1,355	527	430	155	128
4	dry-to-dry	13.6	250	1,766	901	440	274	0	76
5	dry-to-dry	15.9	250	9,761	1,838	1,336	888	532	2,584
6	transfer	15.9	250	7,665	2,748	1,403	628	603	1,142
7	dry-to-dry	20.4	250	2,753	0	353	296	645	730
8	dry-to-dry	22.7	250	2,317	0	183	91	284	880
9	transfer	22.7	250	1,918	0	28	25	219	823
10	dry-to-dry	27.2	250	91	0	0	0	57	34
11	dry-to-dry	45.4	250	1,605	0	0	0	137	1,468
12	transfer	45.4	250	726	0	0	0	0	726
Total				24,947	6,822	4,270	2,632	2,632	8,591

CONTINUED

TABLE 2-13. MODEL PLANT DESCRIPTION AND THE DISTRIBUTION OF PCE FACILITIES BY INDUSTRY SECTOR AND INCOME LEVEL (CONTINUED)

Industry Sector and Model Plant Number	Machine Type	Machine Capacity (kg/load)	Operating Days Per Year	Total Number Facilities Per Model Plant Category	Number Facilities in Each Model Plant Category by Income Level ($000/yr)				
					0-25	25-50	50-75	75-100	>100[a]
Industrial									
13	dry-to-dry	63.5	250	18	0	0	0	0	18
14	dry-to-dry	113.4	250	28	0	0	0	0	28
15	transfer	113.4	250	84	0	0	0	0	84
Total				130	0	0	0	0	130

[a]Facilities in the commercial sector with over $100 thousand in annual income may represent more than one machine. On average, there are 1.75 machines per facility in this category in the commercial sector.

Source: Radian 1991c; Radian 1990c.

SECTION 3
DEMAND FOR DRY CLEANING SERVICES

Two types of demand exist for dry cleaning services: household demand and industrial demand. Household demand is characterized by individual consumers purchasing dry cleaning services provided by commercial and coin-operated facilities. Industrial demand is characterized by firms purchasing dry cleaning services to clean employee uniforms in production and service establishments. Typically, employers rent these uniforms from an industrial cleaner who provides regular cleaning and delivery services. The subsequent sections discuss household demand and industrial demand in detail.

3.1 HOUSEHOLD DEMAND

As consuming units, households demand clean, pressed clothes. Because some garments require dry cleaning for proper care, households rely on dry cleaning services provided by others to procure clean, pressed clothes. Two types of dry cleaning services--commercial and coin-operated--are available to households. Commercial facilities and coin-operated (plant-operated) provide a complete service: garments are cleaned, pressed, and packaged for the consumer. At self-service coin-operated facilities, consumers pay for using dry cleaning machines, but they must clean and press their own clothes. Despite some similarities in the influences of demand for these services, these two sectors have experienced different growth patterns.

The subsections below discuss different facets of household demand. The first two subsections explore consumption patterns and characteristics of the consumers of dry cleaning services. The next subsection discusses the theory of household production in the context of dry cleaned clothing. How consumers value their time and their choice between coin-operated and commercial facilities is presented in the fourth subsection. The final subsection briefly examines consumer sensitivity to changes in the price of dry cleaning services.

3.1.1 Consumption and Trends

Household consumption of commercial dry cleaning services can be measured in terms of the total weight of clothes dry cleaned or in terms of

total expenditures on dry cleaning services. Figure 3-1 shows that overall consumption, measured by the total weight of clothing cleaned, increased by more than 25 percent from 1980 to 1988. However, on a per-household basis, demand for dry cleaning services increased only 11 percent during this period. Consumption per household reached its peak in 1986, when the average household consumed almost 7 kilograms per year. This pattern is depicted in Figure 3-2.

Table 3-1 shows household consumption in terms of expenditures. These data are calculated from the Consumer Expenditure Surveys (U.S. Department of Labor, 1991a). The survey compiles average annual household expenditures for a broad category called "Other Apparel Products and Services."[1] This category encompasses a wide range of goods and services, including material for making clothes, shoe repair, clothing alterations and repairs, sewing supplies, clothing rental, clothing storage, coin-operated laundry and dry cleaning, commercial laundry and dry cleaning, watches and jewelry, and watch and jewelry repair.

Expenditures on commercial laundry and dry cleaning services were estimated in the following manner. Detailed information on the relative weight of each category item (listed above) used to compile the Consumer Price Index was available for the period 1982-1984 (Manson and Butler, 1987). Based on those relative weights, expenditures on laundry and dry cleaning services (excluding coin-operated) made up about 25 percent of the category for those years. The expenditures for each category item listed above were available for 1989. Approximately 24 percent of the category expenditures were spent on laundry and dry cleaning (excluding coin-operated). The expenditures reported in Table 3-1 represent 25 percent of the "Other Apparel Products and Services" category.[2] Because the portion of the category attributed to laundry and dry

---

[1]The expenditures on apparel items come from the interview portion of the Survey. Because the reported expenditures are based on the consumer's memory, these data may not accurately reflect receipts at commercial dry cleaning establishments.

[2]For the years 1980-1983, only data on urban consumers were available. The expenditures estimated in Table 9-15 were adjusted to reflect all consumers in the following manner. In 1989, urban consumers spent three times what rural consumers did on commercial dry cleaning services; that relationship was assumed to hold for the years 1980-1983. In addition, rural households were assumed to comprise 16 percent of all households, which is approximately the portion that they comprised for the years 1984-1986. The reported estimates are a weighted average of urban consumer spending and rural consumer spending.

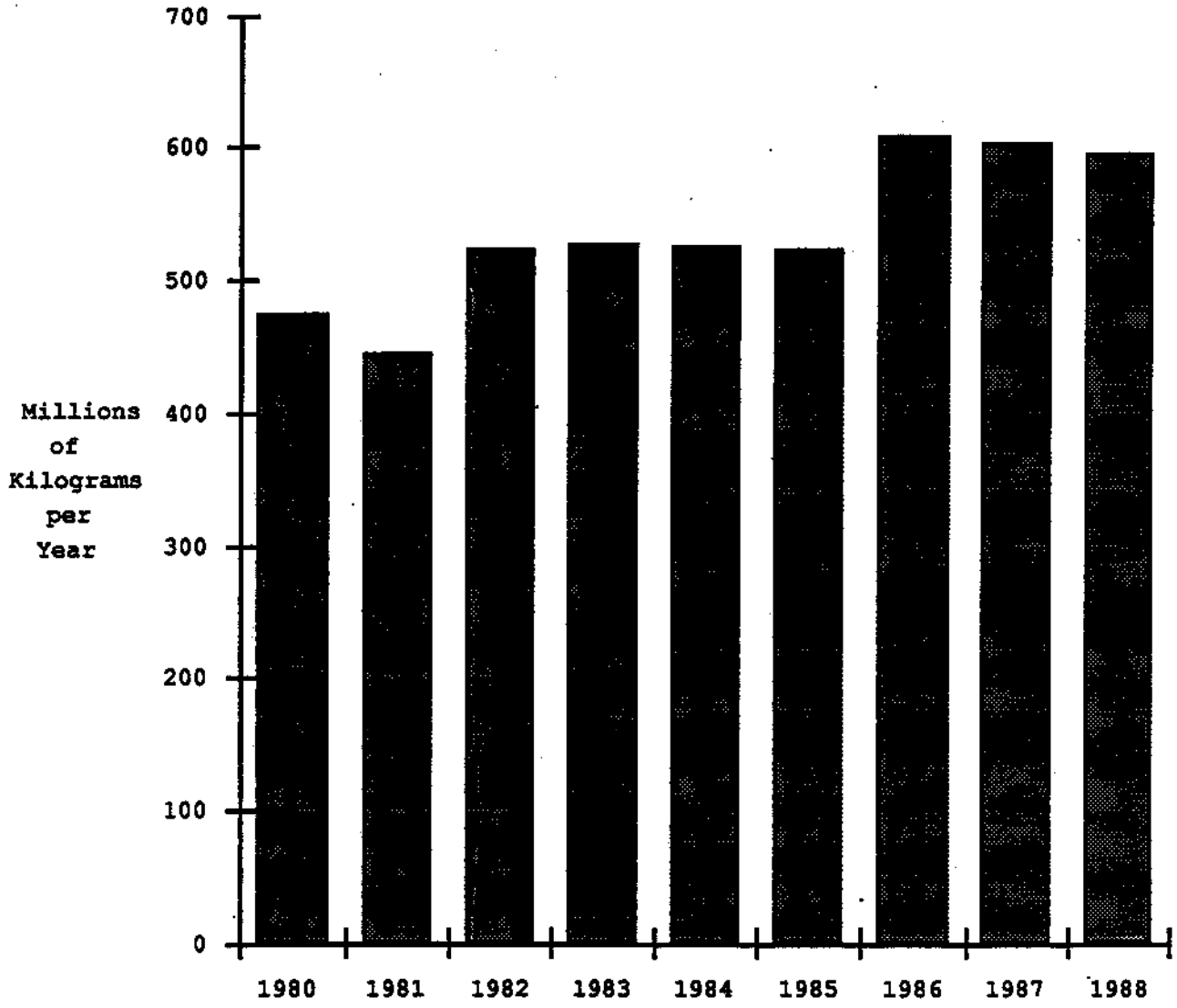

Figure 3-1. Total Annual Household Consumption of Commercial Dry Cleaning Services (1980-1988)

Source: Table 2-8

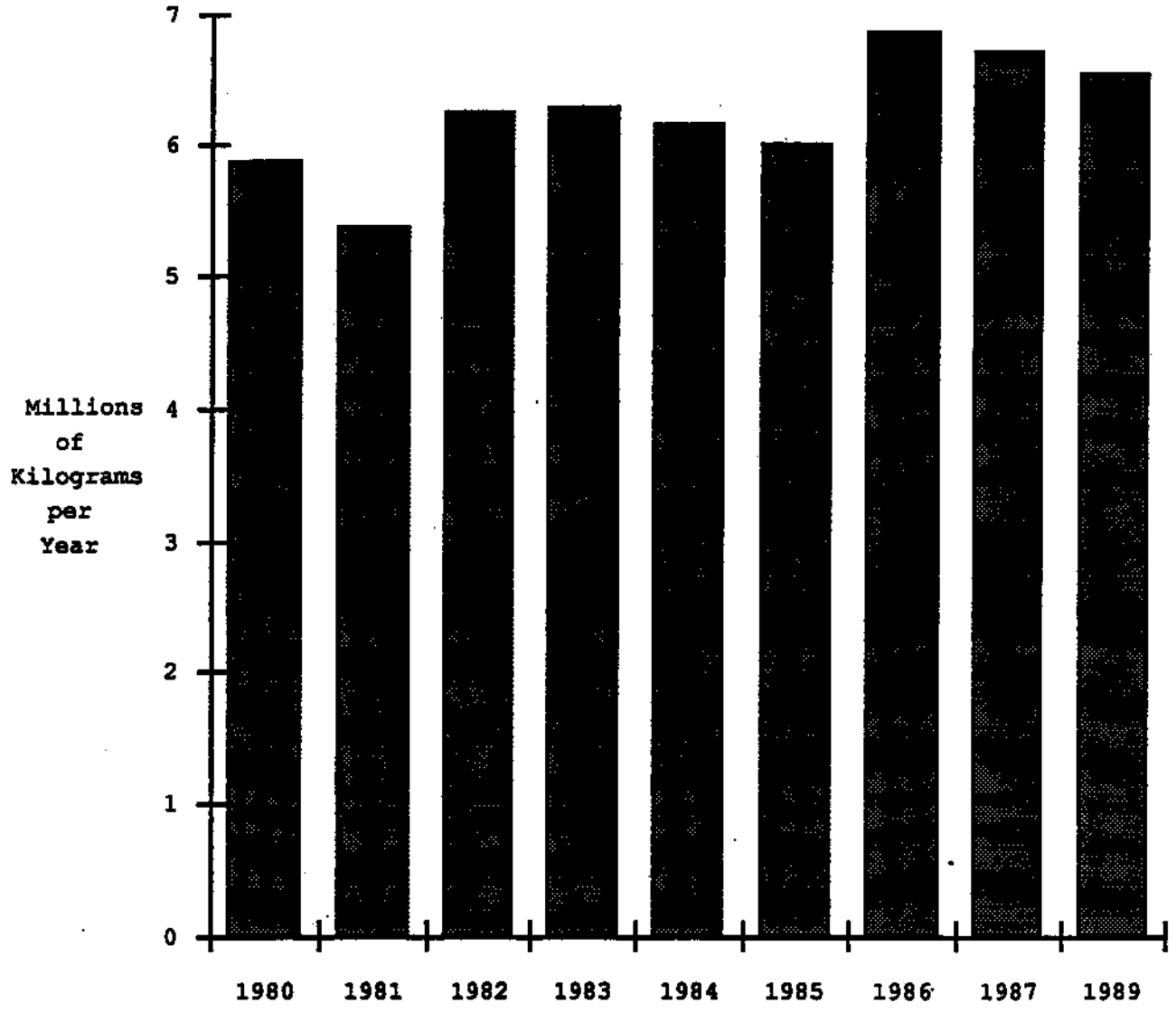

Figure 3-2 Annual Consumption of Commercial Dry Cleaning Services per Household (1980-1988)

[a]Computed by dividing total dry cleaning output (Table 2-8) by the total number of households in the U.S. reported in Statistical Abstract of the United States (U.S. Department of Commerce, 1991d); U.S. Department of Commerce, 1991.

TABLE 3-1. HOUSEHOLD EXPENDITURES ON COMMERCIAL LAUNDRY AND DRY CLEANING SERVICES 1980-1989 ($1989)

Year	Average Annual Household Expenditures ($/Household/Year)[a]	Increase (%)	Expenditures as a Share of Income (%)[b]	Total Annual Household Expenditures (10^6/yr)[c]	Increase (%)
1980	62.18	-	0.15	5,022	-
1981	57.58	-7.4	0.14	4,757	-5.3
1982	55.96	-2.8	0.14	4,675	-1.7
1983	58.95	5.3	0.14	4,947	5.8
1984	62.95	6.8	0.14	5,377	8.7
1985	67.70	7.5	0.15	5,876	9.3
1986	66.75	-1.4	0.15	5,905	0.5
1987	68.49	2.6	0.15	6,129	3.8
1988	67.35	-1.7	0.14	6,132	0.1
1989	66.50	-1.3	0.14	6,173	0.7

[a]Represents 25 percent of "Other Apparel Products and Services." Original data for 1980-1983 excluded rural consumers and were adjusted to include rural consumers. Converted to 1989 dollars using all items CPI.
[b]Based on before tax income. Income calculated by multiplying national personal income by the number of households.
[c]Average household expenditures multiplied by number of households.

Sources: 1980-1989 Consumer Expenditure Survey, U.S. (Department of Labor, 1991a); Economic Report of the President, 1990; Statistical Abstract of the United States, (U.S. Department of Commerce, 1990d); U.S. Department of Commerce, 1991).

cleaning expenditures remained fairly constant over time, the data characterize commercial laundry and dry cleaning expenditures fairly well. Approximately 85 percent of a typical consumer's commercial cleaning bill is dry cleaning, as opposed to laundry (U.S. Department of Commerce, 1991).

Notice that, in 1980, households spent $62 a year on average; in 1989 that figure had increased to $67, an 8 percent increase. Aggregating across the United States yields total expenditures of more than $5.0 billion in 1980 and $6.2 billion in 1989.

Two main factors affecting the growth of dry cleaning consumption are textile and lifestyle trends. During the 1970's, fashion trends demanded easy-care fabrics. Because these fabrics, normally synthetic or a synthetic blend, do not necessarily require dry cleaning, consumption of dry cleaning services decreased. Returning to more natural fibers and synthetic materials that require dry cleaning for proper care led to increased consumption in the 1980's (Fischer, 1987).

The demand for commercial dry cleaning services is also influenced by general economic conditions as well as fashion trends. Prevailing economic conditions influence the purchase of more expensive garments, which often require dry cleaning for proper care. Another factor that increased household demand for cleaning services is the increase in the number of women in the work force. The impact on commercial cleaning comes from both the increased opportunity cost of a working woman's time and the increase in the number of women working outside the home. Table 3-2 shows the change in the number of women in the work force and the median income for women for the period 1980-1989.

Consumption at coin-operated facilities is also strongly affected by general economic conditions, though sometimes for different reasons than commercial dry cleaning consumption. Historically, the cleaning volume at coin-operated facilities plants has fluctuated with the economy.

Data on coin-operated consumption are sparse. However, the Census of Services Industries does publish receipts for coin-operated laundry and dry cleaning facilities. Caution must be exercised when applying these data to the dry cleaning industry because the receipts include laundry receipts. In 1982, coin-operated laundry and dry cleaning establishments (with payroll) across the United States took in $1,501 million in constant (1989) dollars compared to $1,821 million in 1987 (U.S. Department of Commerce, 1990c). This increase amounts to 21 percent. Receipts also increased in per-capita terms. Per-capita expenditures expressed in constant dollars rose from $5.02 in 1982 to $6.83 in 1987.

TABLE 3-2. NUMBER AND MEDIAN INCOME OF WOMEN IN THE WORK FORCE 1980-1989 ($1989)

Year	Number of Women[a] (000)	Change (%)	Median Income[b] ($1989)	Change (%)
1980	42,117	-	17,443	-
1981	43,000	2.10	16,994	-2.57
1982	43,256	0.60	17,558	3.32
1983	44,047	1.83	18,038	2.73
1984	45,915	4.24	18,406	2.04
1985	47,259	2.93	18,730	1.76
1986	48,706	3.06	19,057	1.75
1987	50,334	3.34	19,173	0.61
1988	51,696	2.71	19,439	1.39
1989	53,027	2.57	N/A	-

[a]Includes working women over the age of 16.
[b]Data includes women over the age of 15 with full-time employment. Converted to 1989 dollars using the all items CPI.

Source: Economic Report of the President, 1990.

3.1.2 Characterization of Consumers

Although every individual probably owns at least a few garments that require dry cleaning for proper care, individuals who use dry cleaning services on a regular basis have identifiable characteristics. People's need for dry cleaning services depends on the clothing they own and their occupation, which may dictate their clothing choices. White collar workers are more likely to own clothing that requires dry cleaning for proper care. Similarly, individuals in professional positions would utilize dry cleaning

services more. By extension, individuals with higher incomes would be expected to use dry cleaning services more often.

Consumer Expenditure Survey data for 1989 support these contentions. Tables 3-3, 3-4, and 3-5 present data for two types of expenditures: (1) expenditures on laundry and dry cleaning, excluding coin-operated and (2) expenditures on coin-operated laundry and dry cleaning. These data are compiled by income levels (see Table 3-3), occupation (see Table 3-4), and location (see Table 3-5). As indicated above, the expenditures for the commercial sector are predominantly for dry cleaning services. This assumption does not necessarily hold for the coin-operated sector, where the majority of the expenditures are for laundry expenses. Caution must be exercised when interpreting the coin-operated data.

As expected, expenditures on commercial dry cleaning increase with income (see Table 3-3). An individual earning more than $50,000 a year spends more than four times on dry cleaning than an individual earning less than $30,000. These higher expenditures are induced by two factors. The first is the need to dry clean most professional career clothing. The second is the propensity for individuals with higher incomes to own luxury clothing (e.g., leather, suede), which requires dry cleaning for proper care. Also, as shown in Table 3-3, coin-operated expenditures decline with income, although laundry expenditures cannot be separated from the dry cleaning expenditures.

Figure 3-3 depicts this switch from coin-operated expenditures to commercial expenditures as income rises. A point of further interest is that expenditures on commercial cleaning are a relatively stable share of income across all income levels. This stability suggests that any one income class would not be more affected if prices increase.

Table 3-4 shows expenditures on commercial and coin-operated cleaning by occupation classification. Individuals whose occupations fall in the manager/professional category spend almost 83 percent more than any other job category on commercial cleaning services. Individuals with technical, sales, or clerical positions spend more than $75 a year on commercial cleaning, which is 135 percent more than any of the remaining categories.

TABLE 3-3. HOUSEHOLD EXPENDITURES ON COMMERCIAL AND COIN-OPERATED DRY CLEANING AND LAUNDRY SERVICES BY INCOME CATEGORY ($1989)

Income Category[b] ($000/yr)	Commercial Cleaning Services[a]		Coin-Operated Cleaning Services[a]	
	Average Annual Expenditure ($/Household/yr)	Expenditures as a Share of Income[b] (%)	Average Annual Expenditure ($/Household/yr)	Expenditures as a Share of Income[b] (%)
5-10	17.40	0.23	45.90	0.61
10-15	18.57	0.15	42.14	0.34
15-20	30.57	0.18	41.92	0.24
20-30	42.06	0.17	43.76	0.18
30-40	62.13	0.18	35.06	0.10
40-50	90.75	0.20	23.95	0.05
over 50	175.93	0.22	15.81	0.02

[a]Estimates of annual household expenditures are based only on those households that purchase these services and do not take into account those households that do not purchase each type of cleaning services. These estimates include both laundry and dry cleaning expenses. Expenditures at commercial establishments comprise mainly dry cleaning expenditures; only a small portion of expenditures at coin-operated establishments constitute dry cleaning expenditures.
[b]Based on before-tax income.

Source: 1980-1989 Consumer Expenditure Survey (U.S. Department of Labor, 1991a).

Finally, household cleaning expenditures differ greatly depending on the geographic location (see Table 3-5). Urban consumers spend three times as much on commercial cleaning than do their rural counterparts. This difference in expenditures probably reflects occupation choices.

The Consumer Expenditure Survey data reveal that the typical consumer of commercial dry cleaning services is a manager or professional, earns more than

TABLE 3-4. HOUSEHOLD EXPENDITURES ON COMMERCIAL AND COIN-OPERATED DRY CLEANING AND LAUNDRY SERVICES BY OCCUPATION CATEGORY

Occupation Category	Commercial Cleaning Services[a]		Coin-Operated Cleaning Services[a]	
	Average Annual Expenditure ($/Household/yr)	Expenditures as a Share of Income[b] (%)	Average Annual Expenditure ($/Household/yr)	Expenditures as a Share of Income[b] (%)
Manager/ Professional	138.28	0.28	27.14	0.06
Technical/ Sales/ Clerical	75.68	0.23	46.79	0.14
Service Workers	31.26	0.15	54.41	0.27
Construction/ Mechanics	32.25	0.10	37.61	0.12
Operators/ Labor	31.05	0.11	43.24	0.15

[a]Estimates of annual household expenditures are based only on those households that purchase these services and do not take into account those households that do not purchase each type of cleaning services. These estimates include both laundry and dry cleaning expenses. Expenditures at commercial establishments comprise mainly dry cleaning expenditures; only a small portion of expenditures at coin-operated establishments constitute dry cleaning expenditures.
[b]Based on before-tax income.

Source: 1980-1989 Consumer Expenditure Survey (U.S. Department of Labor, 1991a).

$20,000 a year, and lives in an urban area. Making generalizations about the coin-operated expenditure data is more difficult. But conversations with coin-operated industry experts provide a picture of the typical consumer of coin-operated dry cleaning. The typical patron is cost-conscious, probably in the lower income brackets but may be in the lower middle class as well. This patron is more likely to live in a rural location where commercial facilities are not available (Torp, 1991). The data do not refute this description.

3.1.3 Household Demand Function

Like any demand function, household demand for dry cleaning services is derived from utility maximization. Utility comes from commodities, not directly from goods and services. Households combine goods and services with time as inputs into a process that generates commodities. Thus, time spent on

TABLE 3-5. HOUSEHOLD EXPENDITURES ON COMMERCIAL AND COIN-OPERATED DRY CLEANING AND LAUNDRY SERVICES BY LOCATION CATEGORY

Location Category[b]	Commercial Cleaning Services[a]		Coin-Operated Cleaning Services[a]	
	Average Annual Expenditure ($/Household/yr)	Expenditures as a Share of Income[c] (%)	Average Annual Expenditure ($/Household/yr)	Expenditures as a Share of Income[c] (%)
Urban	72.9	0.22	37.24	0.11
Rural	23.5	0.10	16.90	0.07

[a]Estimates of annual household expenditures are based only on those households that purchase these services and do not take into account those households that do not purchase each type of cleaning services. These estimates include both laundry and dry cleaning expenses. Expenditures at commercial establishments comprise mainly dry cleaning expenditures; only a small portion of expenditures at coin-operated establishments constitute dry cleaning expenditures.
[b]An urban area is defined as an area within a Standard Metropolitan Statistical Area (SMSA) or one with a population of more than 2,500 persons. A rural area is an area outside of an SMSA and with a population of less than 2,500 persons
[c]Based on before-tax income.

Source: 1980-1989 Consumer Expenditure Survey (U.S. Department of Labor, 1991a).

nonwork activities is crucial to producing commodities (Becker, 1965). Commodities form the basis of the household utility function. That function is maximized subject to a budget constraint and a time constraint, both of which limit the goods, services, and commodities available to the household.

When choosing the combination of goods, services, and time that will be used to produce any given commodity, the household makes its decision based on the utility-maximizing option. Households have the option of substituting time for goods or services in the event that such substitution yields more utility. For example, a meal could be provided by combining groceries and time to produce a home-cooked meal or by eating out at a restaurant. How the household makes these choices depends on its value of time.

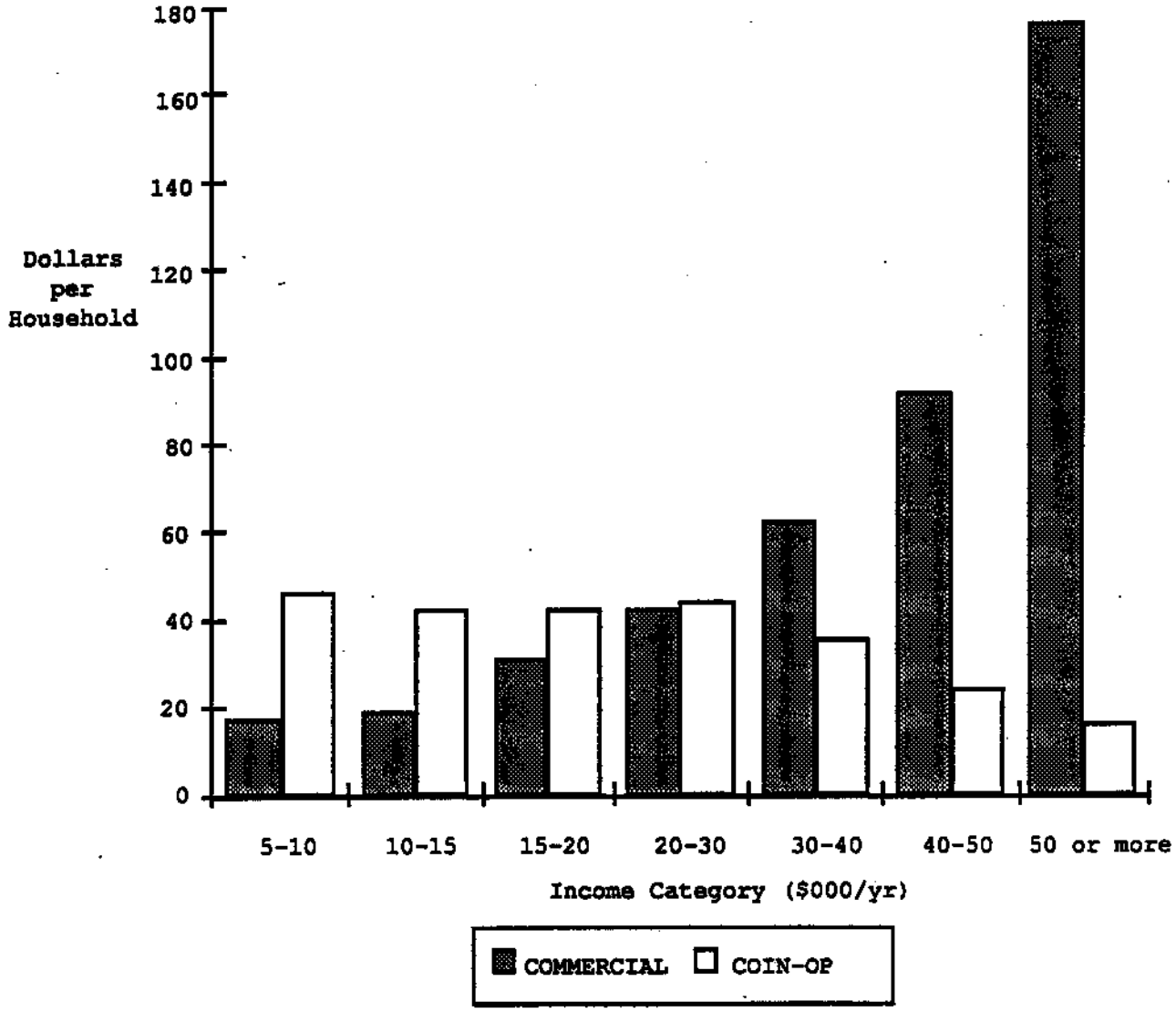

Figure 3-3. Average Annual Expenditures on Dry Cleaning and Laundry Services by Income Class ($1989)

Source: 1980-1989 Consumer Expenditure Survey, (U.S. Department of Labor, 1991a).

A household's production of clean, pressed clothing can be analyzed in this framework. If the garment requires dry cleaning, the household, in theory, has two choices: self-service dry cleaning (offered by self-service, coin-operated facilities) or employee-assisted dry cleaning (offered by commercial or coin-operated [plant-operated] facilities). In the balance of this section, employee-assisted dry cleaning will be referred to as commercial dry cleaning and self-service dry cleaning will be referred to as coin-operated. In the coin-operated production process, consumers pay for using the machines but clean and press the clothing themselves. In the commercial cleaning process, consumers use their time to deliver and pick-up the garments and pay for others to clean and press them. Although the market price of the coin-operated method is lower, it requires more of consumers' time. Assuming that consumer utility does not differ between clothes cleaned by household production and clothes cleaned by a commercial cleaner, the household's decision will depend on the opportunity cost of time.

A household production model similar to one developed by Gronau (1977) is used to show how a household makes the decision to use commercial or coin-operated dry cleaning. The household seeks to maximize the amount of cleaned, pressed clothes, commodity Z, which is produced by combining dry cleaning services, either commercial or coin-operated, (X) and consumption time (L).

$$Z = Z(X, L) \tag{3.1}$$

X includes both the value of market goods or commercially cleaned clothes (X_m) and the value of home goods or clean clothes produced by the consumer using machinery and time (X_h).

$$X = X_m + X_h \tag{3.2}$$

Home goods are produced by work at home: H represents the number of hours per day spent producing clean clothing at home.

$$X_h = f(H) \tag{3.3}$$

Utility is maximized subject to two constraints. The first is a budget constraint where W is a wage rate, N is time spent on market work, and V is other income.

$$X_m = WN + V \tag{3.4}$$

The second constraint is a time constraint (T).

$$T = L + H + N \tag{3.5}$$

Equations (3.1), (3.2), and (3.3) are then combined and maximized subject to equations (3.4) and (3.5).

$$G = Z\{[X_m + f(H)],\ L\} + \lambda(WN + V - X_m) + \delta(T - L - H - N) \tag{3.6}$$

Z is maximized when the marginal rate of substitution between time and goods is equal to the marginal product of home production and equal to the wage rate:

$$(dZ/dL) \ / \ (dZ/dX) = f' = W \tag{3.7}$$

In addition, the wage will equal the opportunity cost of time (W*) and the ratio of the marginal utilities of time and income.

$$W = W^* = \delta \ / \ \lambda \tag{3.8}$$

This model confirms earlier observations about the relationship between income and dry cleaning expenditures. Because the opportunity cost of time is higher for those with higher incomes, commercial expenditures should rise and coin-operated expenditures should fall as income rises.

3.1.4 The Value of Time and the Full-Cost Model

The relationship between the value of time and income or wages has been well established in literature. Becker (1965) demonstrated that time allocation is based on earnings. An increase in earnings results in a shift away from time-intensive consumption to goods-intensive consumption. A later study by Kooreman and Kapteyn (1987) confirmed that the amount of household

work performed by a member is a function of wage rate. In a study on queuing, Deacon and Sonstelie (1985) estimated the value of time to be roughly equivalent to the after-tax wage.

Data are not available to measure the value of time to an individual who chooses to use coin-operated dry cleaning facilities compared to an individual who utilizes a commercial cleaner. However, using the Consumer Expenditure Survey data gives an estimation of the relationship between dry cleaning expenditures and income.

Data at the household level were available and included expenditures on commercial and coin-operated dry cleaning, income, and other demographic information such as education, type of employment, family size, and an urban/rural designation. Two ordinary least squares (OLS) equations were estimated--one for commercial dry cleaning expenditures and one for coin-operated dry cleaning expenditures. The independent variables included income and the dummy variables for the remaining demographic data.[3] The coefficients for income are very significant and have the expected signs in both models (positive for commercial and negative for coin-operated). Many of the other demographic variables behave as expected. Unfortunately, the equations do not explain all of the influences on dry cleaning expenditures very well. But the equations do demonstrate the relationship between income and expenditures on commercial cleaning. The results are presented in Table 3-6. Because income plays such an influential role in consumers' choice of using commercial or coin-operated dry cleaning facilities, consumers are likely to switch from using a coin-operated facility to a commercial facility at a critical wage or value of time. Above a certain wage, consumers are likely to value their time enough to make the time-intensive coin-operated approach too costly when the value of their time is included in the calculation. A full-cost model for dry cleaning was developed that identifies the critical wage at which the switch from coin-operated to full service occurs. The full cost of a commodity is the sum of the prices of the goods and services consumed and of the time used in producing these commodities. Direct costs are the prices of the goods and

[3]The data set consists of four quarters of household data. Dummy variables for the quarters were also included in the equation to account for differences in the quarterly responses.

TABLE 3-6. REGRESSION ANALYSIS[a]

Variables	Dependent Variable: Commercial Expenditures	Dependent Variable: Coin-Operated Expenditures
C	-2.55 (-2.27)	4.79 (6.67)[a]
Income	0.0005 (41.77)[b]	-0.0001 (-13.49)[b]
Education Dummy (1 if college graduate)	11.03 (14.86)[b]	-2.25 (-4.75)[b]
White Collar Dummy (1 if manager or professional)	5.32 (8.50)[b]	2.26 (5.65)[b]
Family Size	-1.48 (-7.69)[b]	0.74 (6.01)[b]
Urban Dummy	4.97 (5.42)[b]	5.40 (9.22)[b]
2nd Quarter Dummy	-1.49 (-1.88)	-0.05 (-1.11)
3rd Quarter Dummy	-2.21 (-2.78)[b]	-0.78 (-1.55)
4th Quarter Dummy	-2.05 (-2.61)[b]	0.28 (0.56)
Adjusted R^2	0.160	0.02
F Value	442.12[b]	41.45[b]

[a]Regression analysis performed using data from the 1989 Consumer Expenditure Survey (U.S. Department of Labor, 1991a).
[b]Denotes significance at the one percent level.

services, and indirect costs are the total value of time. Indirect costs can also be thought of as foregone income. Both direct and indirect costs are included in the full cost of the commodity.

The full cost for dry cleaned clothing to the household, C, is defined as follows:

$$C = p*q + t*d + s*r \qquad (3.9)$$

where

- p = the unit price of dry cleaning services (commercial or coin-operated),
- q = the quantity of dry cleaning,
- t = the cost per mile of transportation to a dry cleaning facility,
- d = the distance in miles to a dry cleaning facility,
- s = the unit value or opportunity cost of time per hour, and
- r = the time in hours required to drop off and pick up clothing (plus the time required to clean and press clothing in a coin-operated facility).

This cost measures the cost of a single trip to a dry cleaner, which it will vary with quantity because consumers can take one garment or many garments to the cleaner in a single trip. In addition, the cost for coin-op consumers will vary with quantity not only in terms of the cost of using the facility but also with respect to the opportunity cost of time, which will also increase with quantity.

The critical wage is based on the full cost of dry cleaning at commercial and coin-operated facilities. The first component of the full cost is the direct cost or the price charged by the dry cleaning facility. This is $6.34 per kilogram for commercial facilities and $1.65 per kilogram for coin-operated facilities (see Section 2 for explanation).

The second component is the opportunity cost of the time an individual must spend to operate the machine and press the garment. That cost will vary from individual to individual and will depend on that individual's wage rate. One cycle in a 3.6 kilogram machine takes approximately 45 minutes to complete, which converts to 0.20625 hours per kilogram. Assuming an individual takes approximately 30 minutes to press a man's suit, total time spent would be 0.70625 hours/kilogram.

Assuming that the distances to a commercial facility and a coin-operated facility are the same eliminates any transportation costs from the calculation.

The critical wage can then be calculated by solving the equation below for x.

$$\$1.65 + 0.70625x = \$6.34 \qquad (3.10)$$

$$0.70625x = \$4.69$$

$$x = \$6.64$$

For individuals earning less than $6.64/hour, using the coin-operated facility would be more cost-effective. For individuals earning more than $6.64/hour, using the commercial facility would be more cost-effective.

The foregoing analysis is contingent on the relative price of coin-operated versus commercial dry cleaners. If the proposed regulation did not affect the coin-operated sector but raised the price of commercial cleaning services, then the critical wage at which consumers would switch from coin-operated to commercial would be higher. This higher wage implies that more consumers would utilize coin-operated facilities.

The individual's choice assumes that both types of facilities are readily accessible, but this may not be the case for some smaller or rural communities. These locations may have only one cleaning facility, and the value of time may be irrelevant. Coin-operated facilities are not distributed uniformly throughout the United States but tend to be concentrated in the southeastern and mid-atlantic states. Despite the concentration of facilities, consumers in these areas, depending on the elasticity of demand for dry cleaning, may choose not to dry clean. The sensitivity to price of dry cleaning is discussed below.

3.1.5 Sensitivity To Price

Consumers' sensitivity to the price of dry cleaning services depends on other alternatives, which can vary from garment to garment. Some fabrics require dry cleaning for proper care, whereas others can also be cleaned with detergent and water. Specialty fabrics like leather, suede, and silk are usually labeled "dry clean only." Consumers are often uncertain about which fabrics can safely be laundered without being damaged. Therefore, the importance of dry cleaning services to consumers varies with the ease with

which another cleaning process can be substituted for dry cleaning and the consumer's knowledge of the possibilities of substitution.

A few indirect substitutes are available to replace dry cleaning. In the long run, consumers could replace the stock of clothes requiring dry cleaning for proper care with water-washable garments. In the short run, they could reduce the frequency of wearing dry-cleaned clothing or increase the number of times a garment is worn before it is cleaned. The only direct substitute available for dry cleaning is laundering with water and detergent, but this method is not a perfect substitute.

The price elasticity of demand is one way of measuring consumers' sensitivity to price changes. Demand is said to be price elastic if an increase (or decrease) in price causes a proportionately greater decrease (or increase) in purchases. Thus, elasticity of demand measures consumers' responsiveness to price changes. Section 4 presents price elasticity estimates and results.

3.2 INDUSTRIAL DEMAND

Many industries provide uniforms for their employees typically renting these uniforms from an industrial launderer. The industrial customer is charged a price per-uniform change and receives clean, delivered uniforms on a regular basis. Unlike households, however, industrial customers are indifferent to whether the uniforms are water washed or dry cleaned. They pay the same price regardless of how the garment is cleaned.

Historically, changes in general economic conditions have affected industrial cleaners less dramatically than coin-operated and commercial sectors. As industrial production and employment increase, so does the demand for industrial uniform rentals, the main item leased and cleaned by the industrial sector (Betchkal, 1987a).

3.2.1 Consumption and Trends

Data are not available on the consumption of industrial dry cleaning services. The fact that customers are indifferent to the cleaning method and pay the same price for uniforms laundered in water and detergent as they do

for uniforms cleaned in PCE probably explains the lack of information. Furthermore, dry cleaning is typically a very small part of an industrial launderer's business. Total industry receipts are available from the 1987 Census of Service Industries (U.S. Department of Commerce, 1990b). For the years 1982 and 1987, receipts of industrial launderers totalled $2,435 million and $2,947 million in constant (1989) dollars. This increase amounted to over 21 percent.

3.2.2 Characterization of Demanders

Customers of industrial cleaners encompass many industries. Industries that typically rent uniforms include auto dealerships and independent garages, construction, hotels, restaurants, security firms, food processing, and other manufacturing industries. Even traditionally white collar industries such as banking or real estate may rent blazers for their employees. Many types of additional industries are likely to lease the other items offered by industrial cleaners, such as mats, mops, towels, and cloths. All of these firms use these products as inputs in their production process.

3.2.3 Derived Demand

Unlike the demand for commercial and coin-operated dry cleaning services, the demand for industrial cleaning services is a derived demand. Customers of industrial cleaning view clean uniforms as inputs into their production processes, so demand for these inputs is said to be derived because it depends on the demand for the final good. Additional inputs are purchased in anticipation of increasing production of the final good. As discussed in Section 3.2.4, the elasticity of demand for an input is related to the elasticity of demand for the final product.

In such a scenario, producers would maximize profits. Presumably, the full-cost model for industrial dry cleaning services would be as follows:

$$C = p*q + T \qquad (3.11)$$

where

p = the unit price of dry cleaning services

q = the quantity of dry cleaning services

T = transaction costs associated with purchasing dry cleaning services.

Transportation costs do not play a role here because industrial launderers deliver the uniforms and do not charge different prices based on distance.

3.2.4 Sensitivity to Price

The elasticity of demand for industrial dry cleaning services is not estimated for this analysis due to a lack of data. However, a theoretical model is developed that expresses the elasticity within a range of values. This model is based on the concept of the elasticity of substitution for inputs and the cost share of inputs.

The elasticity of substitution measures the ease with which a producer can substitute between inputs, holding final output constant. When substitution is difficult (i.e., when changing the input mix does not improve the efficiency of the inputs), the elasticity of substitution will be less than one. In a fixed proportion production function, the elasticity of substitution is zero because inputs must be used in a fixed ratio, and altering that ratio would be inefficient. The customers of industrial dry cleaners encompass many types of final products, so generalizing about the elasticity of substitution with respect to inputs of clean uniforms is difficult. However, clean uniforms will probably be used in fixed proportions, or, at the very least, difficult to substitute. The elasticity of substitution with respect to clean uniforms must fall between zero and one.

The second concept used in the model is the cost share of inputs. The cost share simply represents the cost of a specific input as a percentage of the total cost. The framework established by Allen (1962) suggests a theoretical estimation of the elasticity of demand for an input. In the following equation, the elasticity is expressed as a proportional change.

$$E(Q_a) \;/\; E(P_a) = (\Delta Q_a/Q_a) \;/\; (\Delta P_a/P_a) \qquad (3.12)$$

$$= -\,(k_b\delta + k_a\lambda_x)$$

where

a = inputs of clean uniforms

b = all other inputs

Q_a = the quantity of clean uniforms

P_a = the price of clean uniforms

k_b = the cost share of all other inputs

δ = the elasticity of substitution between uniforms and other inputs

k_a = the cost share of clean uniforms

λ_x = the elasticity of demand for the final product.

The cost share of all inputs other than clean uniforms is quite large, and the cost share of clean uniforms is nearly zero. The elasticity of substitution is most likely zero. Whatever the value of k_b, the first term in the above equation is zero or a very small number. k_a will be nearly zero and will limit the value of the second term of the equation to nearly zero. The sum then is a small number, certainly less than one in absolute terms. Thus, the elasticity of demand for industrial dry cleaning services is somewhat inelastic.

One additional point merits mention. Empirical studies have shown that the elasticity of demand for final goods is generally greater than demand for intermediate goods (Martin, 1982). The elasticity estimation of the demand for dry cleaning services for households and for industrial consumers is consistent with that finding.

SECTION 4

MARKET STRUCTURE IN THE DRY CLEANING INDUSTRY

A causal flow occurs from demand and supply conditions to market structure and from market structure to conduct of firms (Sherer, 1980). Economic theory provides a framework for analyzing the links between the demand and supply conditions an industry faces, its market structure, and the typical behavior of firms in that industry. This section examines market structure in the dry cleaning industry and develops an approach for estimating the impacts of an increase in the cost of supplying dry cleaning services due to regulation. Certain aspects of market structure--including the existence of barriers to entry, the number of sellers in a market area, and the geographic distribution of consumers and producers--are particularly relevant for determining the way consumers and suppliers would react to a change in the costs of providing dry cleaning services.

Fundamental to the analysis of market structure in the dry cleaning industry is an understanding of the geographic scope of the market area. To facilitate this understanding, this section begins with a brief description of the facility location decision, which is determined by the basic supply and demand conditions outlined in previous sections. The section then describes market structure in the three sectors prior to developing the model markets.

4.1 FACILITY LOCATION DECISION

Determinants of facility location differ by industry sector. In the commercial and coin-operated sectors, dry cleaning markets are small in geographic size. Depending on the number of sellers in a particular place and the population density, markets may cover an area as small as a few city blocks. In contrast, industrial facilities operate in geographic markets that are much larger. Factors such as the income distribution of the customer base, traffic patterns, and number of competing firms in an area contribute to the location decision in each sector. The determinants of the facility location characteristic of each industry sector are discussed below.

4.1.1 Commercial Dry Cleaners

The service provided by commercial dry cleaners is effective, fast, and requires little effort by the customer. These establishments sell a convenience good that, like toothpaste and gasoline, does not typically justify comparison shopping because the benefit of price comparison does not compensate for the cost of the search (Sherer, 1980; Steinhoff and Burgess, 1989). An important determinant of the convenience of dry cleaning is the proximity of the facility to the customer's home. The market that commercial dry cleaners serve extends over a local area although the geographic size will vary depending on population density.

The profit-maximizing dry cleaner evaluates multiple dimensions when choosing the location of a new facility (Steinhoff and Burgess, 1989). Some considerations are highly specific to the community and, while they are crucial to the firm's potential success, have little bearing on the economic impact analysis because they do not provide insight into the responses to regulation. Among these dimensions are the availability of parking, types of surrounding firms, traffic density, and side of the street for the facility. Other dimensions such as rent, availability of labor, the local business climate, and the share of the population in professional or managerial occupation categories are also important to the potential for success, but again they are unlikely to be significant for the impact analysis.

The significant dimensions of the location decision for commercial dry cleaning facilities are the size of the consumer base and the efficiency of the existing firms. An increasing population in the area under consideration may provide the basis for a new firm. In the absence of an expanding market, the presence of inefficient firms may instead provide the basis. In either case, the potential customer base must be at least large enough to generate sufficient revenues to justify investment in the minimum size facility.

The minimum size facility implies a minimum population requirement, which, because of limits on the size of dry cleaning equipment, may be several thousand people (the population requirement would increase as average income decreases). The technology of dry cleaning is "lumpy": dry cleaning machines used by the commercial sector are available in about six sizes. The smallest

machine used in this sector has a capacity of 11.3 kilograms per load. The operation of a dry cleaning facility also requires labor for staffing the front counter, preparing clothing for cleaning, operating the dry cleaning machine, and processing the clean clothing for return to the customer. In reality, labor is also unavailable in an infinitely divisible quantity. Facility size is therefore imperfectly variable.

A potential owner of a dry cleaning facility confronts a definite lower limit on the revenue that is necessary for profitable operation. In choosing a location for a dry cleaning facility, the profit-maximizing potential owner must consider the minimum customer base that this lower limit on revenue implies. Owners who misjudge their customer base, either because of miscalculation or over-confidence in their ability to attract customers away from an existing facility, may be unable to cover their fixed costs or even their variable costs. Inability to cover fixed costs can lead to financial failure of the firm. Inability to cover variable costs can lead to closure of the facility.

4.1.2 Coin-operated Dry Cleaners

Many of the determinants of the facility location decision that are characteristic of the commercial sector are also characteristic of the coin-operated sector. In particular, coin-operated laundries that offer plant-operated services provide a convenience good that is virtually indistinguishable from the service offered by the commercial sector. Like commercial facilities, coin-operated facilities serve a local market area and typically locate in places that are convenient to consumers.

One important difference does exist, however. As discussed in Section 2, dry cleaning services are offered as an auxiliary to the regular laundry operations at coin-operated facilities. Because dry cleaning activity accounts for only about 10 percent of receipts at coin-operated facilities with dry cleaning operations, the location decision is based on the determinants relevant for locating a laundromat rather than for a dry cleaning facility. Once the decision to locate the coin-operated laundry is made, the owner must decide whether to provide dry cleaning services in addition to the regular laundry services. Relevant factors in this secondary decision include

the proximity of other dry cleaning facilities, the size of the costumer base, and the income distribution of residents within the community.

4.1.3 Industrial Dry Cleaners

Industrial cleaners serve a much larger geographic area than do commercial or coin-operated cleaners. For example, the operator of one industrial facility indicated that his facility served industrial and commercial users located as far away as 100 miles (Coor and Grady, 1991). Services provided by industrial cleaners are not considered convenience goods. Consumers in this sector view the services provided by industrial cleaners as an input into their production process. Because the cleaner delivers the cleaned items, consumers are generally more concerned with dependability of service than with convenience.

The profit-maximizing industrial cleaner locates where costs of production are minimized. According to one facility operator, the ideal location is a small town that is centrally located to several large cities where the customer base is located (Coor and Grady, 1991). Small towns typically do not have the traffic congestion characteristic of larger cities. Traffic congestion ties up delivery vehicles, which increases the cost of delivery and may reduce customer satisfaction. In addition, small towns tend to have less expensive land and building costs and labor costs. Because industrial launderers clean most of the items they process in water and detergent, a cheap, abundant water supply is also an important determinant of location.

4.2 MARKET STRUCTURE

Within each sector of the industry many localized geographical markets exist where only neighboring firms compete directly. These submarkets are only loosely tied to a national market, but economic decisions by individual firms are jointly related to national trends. The existing market structure reflects fundamental market forces that are likely to be an enduring feature of the dry cleaning industry. The economic impact analysis uses the differences in market structure and pricing practices of dry cleaning facilities to predict the market responses to the candidate regulatory

alternatives. To simplify the analysis, a model market approach is used to differentiate markets by

- the market sector,
- the number of suppliers in each market area, and
- the share of suppliers potentially affected under each regulatory alternative.

An important economic impact associated with promulgation of the candidate regulations is the total welfare loss (gain) attributable to market adjustments in the dry cleaning industry. A neoclassical supply/demand analysis is developed for each sector and model market. The economic impacts are analyzed for each sector and model market individually and the results are then aggregated to determine total welfare effects.

4.2.1 Market Structure in the Commercial Sector

Two basic market structures are prevalent in the commercial sector. The first is a competitive structure, which is found predominantly in urban and suburban areas and characterized by the existence of many dry cleaning facilities in each market area and no barriers to entry. Approximately 90 percent of the commercial facilities are in urban/suburban market areas. The second type of market structure is characterized by a single facility in a rural market area. Because consumers are unwilling to drive long distances to purchase dry cleaning services, the owner of a single facility in a remote area does not behave as if in a perfectly competitive market.

Urban/Suburban Markets. Given the number of commercial facilities in urban and suburban areas and the size distribution of those facilities, it is assumed that a competitive market structure exists for these facilities. The competitive model is based on the hypothesis that no facility individually can influence market equilibrium, but the behavior of all producers taken together determines the position of the market supply curve. In addition, the cost of producing the last unit of output, the marginal cost, along with market demand determines equilibrium price and output. Furthermore, at a stable equilibrium price, each individual facility can sell any level of output desired, with no perceptible effect on equilibrium values. As a result, each facility faces an

implicit demand curve that is perfectly elastic (horizontal) at the current market equilibrium price.

Initially, imposing controls on a facility will alter the costs of producing the same level of output as before the control. This production cost change will induce a shift of that facility's supply curve. Because the supply curve for a well-defined market is the horizontal summation of individual facility supply curves for all facilities participating in that market, the shift in the market supply curve can be determined from knowledge of facility-specific shifts. If the regulation results in a production cost change for the marginal supplier within the market area, a change in the equilibrium price and output will occur.

Precise estimates of the quantitative changes in price and output require information on the position and slope of the market supply and market demand curves both prior to and after the adjustment. Predicting the position and slope of the market supply and demand curves is, therefore, crucial to estimating the economic impacts. The changes in price and output lead to consumer and producer welfare changes that can be measured as areas within the supply/demand plane. The neoclassical supply/demand analysis applied to this study is introduced below.

The position of the market demand curve is critical to determining the change in equilibrium price and output resulting from a regulatory-induced shift in the market supply curve. The slope of the demand curve measures the responsiveness of quantity demanded to a change in the price of the service. The elasticity of demand is a relative measure of demand responsiveness and as a policy tool is generally preferred to the demand curve slope. The elasticity of demand is measured as the percentage change in quantity demanded of a good or service resulting from a one-percent change in its price. Post-regulatory equilibrium price and output values and the resulting welfare changes can be calculated if the baseline price and output values, the relative shift of the market supply curve, and estimates of demand and supply elasticities are available.

A priori, predicting the elasticity of demand for commercial dry cleaning services is difficult because many variables contribute to its value. If data are unavailable to estimate a demand elasticity, a unitary elastic

(η = -1.0) demand curve could be used to estimate impacts, but considerable uncertainty would be associated with the price and output adjustments and the welfare loss estimates. Any market-measured value of the demand elasticity would obviously be superior to an unsubstantiated simplification. The supply and demand functions for the commercial dry cleaning sector are estimated simultaneously to derive corresponding elasticity estimates.

A neoclassical supply/demand model is a system of interdependent equations in which the price and output of a product are simultaneously determined by the interaction of producers and consumers in the market. In simultaneous equation models, where variables in one equation feed back into variables in another equation, the error terms are correlated with the endogenous (price, output) variables. In most circumstances, single-equation ordinary least-squares estimation of individual equations in a simultaneous equation model can lead to biased and inconsistent parameter estimates. Furthermore, the supply and demand equations must be econometrically identified prior to initiating a simultaneous equation regression procedure. An equation is identified if obtaining values of the parameters from the reduced-form equation system is possible. Put simply, identification requires that at least one original exogenous (shifter) variable is contained in each equation of the supply/demand system.

Section 2 presented data on average base prices and total output for the commercial sector from 1974 to 1988. These data represent equilibrium points of intersection between supply and demand curves for each of those years. Estimating a supply or demand curve equation from these data would be difficult because information is insufficient to completely identify the supply/demand system. However, with the aid of intuitively acceptable supply and demand shift variables, the price and output data can be used to econometrically estimate the commercial sector supply and demand functions and corresponding elasticities.

Gross population levels for the U.S. and the producer price index for service industries from 1974 to 1988 were chosen as the demand and supply shifters, respectively. Population levels are commonly used as demand shift variables in regression equations. The producer price index is suitable for the supply function because it is a good proxy for production costs. Table 4-1 lists the time-series data used in the supply/demand estimation.

TABLE 4-1. DATA USED IN THE SUPPLY/DEMAND ESTIMATION

Year	Price ($/kg)[a]	Output (10^6 kg/yr)[b]	P.P. Index	Population (10^6)
1974	4.02	570	53.5	213.9
1975	4.42	506	58.4	216.0
1976	4.46	499	61.1	218.0
1977	4.36	521	64.9	220.2
1978	4.87	493	69.9	222.6
1979	4.90	499	78.7	225.1
1980	5.32	475	89.8	227.8
1981	5.63	444	98.0	230.1
1982	5.72	522	100.0	232.5
1983	5.87	527	101.3	234.8
1984	5.98	525	103.7	237.0
1985	6.13	522	103.2	239.3
1986	6.14	608	100.2	241.6
1987	6.05	603	102.8	243.9
1988	6.08	596	106.9	246.1

[a]All dollar figures converted to 1989 dollars through the Consumer Price Index for Apparel and Upkeep.
[b]See Table 2-8.

Source: Faig (1990); Survey of Current Business (U.S. Department of Commerce 1989b); Statistical Abstracts of the U.S. (U.S. Department of Commerce 1989a).

Supply and demand equations for the commercial sector were econometrically estimated by using the instrumental variables regression procedure. Base price and total output were first converted to natural logarithm form to ensure constant supply and demand elasticity estimates. The structural models for the supply/demand system are the following:

$$\text{Supply:} \qquad Ln(Q_t^S) = a_1 + a_2 Ln(P_t) + a_3 PPI_t + d_t, \tag{4.1}$$

$$\text{Demand:} \qquad Ln(Q_t^d) = b_1 + b_2 Ln(P_t) + b_3 Pop_t + u_t, \tag{4.2}$$

$$Ln(Q_t^S) = Ln(Q_t^d), \tag{4.3}$$

where Q = output, P = price, Pop = population, and PPI = producer price index. The supply equation (4.1), demand equation (4.2), and equilibrium condition (4.3) determine the market price and the quantity supplied (demanded) when the market is in equilibrium. For this reason, the variables $Ln(Q_t^S)$, $Ln(Q_t^d)$, and $Ln(P_t)$ are endogenous because they are determined within the system of equations, while Pop and PPI are exogenous variables. The parameter estimates and regression statistics from the simultaneous system estimation are reported in Table 4-2.

With Durbin-Watson statistics of 1.54 for both the supply and demand equations, the null hypothesis of no serial correlation cannot be rejected at the 0.01 level of significance. Overall, the significance of the parameter estimates and the low standard errors indicate that base prices, dry cleaning output, population levels, and the producer price index are effective in predicting the supply/demand relationship.

Parameter estimates were also developed using a time variable instead of population in an attempt to determine whether a simple time trend would be a more suitable demand shifter. The results of that regression are reported in Table 4-3. The parameter estimates are very similar to the regression with population as an explanatory variable, but the population specification had a slightly better fit. As a result, all future references to the elasticity estimates will apply to the population specification.

The predicted elasticity of supply and demand can be derived directly from the parameter estimates of the regression system. Regression equations for the supply and demand functions appear in estimated form as

$$Ln(Q_t^S) = -0.012 + 1.558 Ln(P_t) - 0.023(PPI_t), \tag{4.4}$$

$$Ln(Q_t^d) = -6.351 - 1.086 Ln(P_t) + 0.036(Pop_t). \tag{4.5}$$

TABLE 4-2. PARAMETER ESTIMATES AND REGRESSION STATISTICS FROM THE SUPPLY/DEMAND ESTIMATION

Parameter	Value	Std. err.	t-stat	95% conf. int.
Supply Curve				
Intercept	0.120	0.064	1.882	-
Price	1.558	0.291	5.361	0.924 to 2.192
P.P. Index	-0.023	0.005	-5.057	-0.033 to -0.013
Sum sq. res.		Std. err.		DW test
0.031		0.051		1.54
Demand Curve				
Intercept	-6.351	1.289	-4.927	-
Price	-1.086	0.240	-4.530	-1.608 to -0.564
Population	0.036	0.007	5.057	0.020 to 0.051
Sum sq. Res.		Std. err.		DW test
0.031		0.051		1.54

The first derivative of the supply equation with respect to the logarithm of price (1.558) is an estimate of the supply elasticity for dry cleaning services in the commercial sector. The interpretation of this estimate is that the quantity supplied of dry cleaning services will increase by 1.558 percent for every 1 percent increase in the price for that service. The t-statistic value of 5.361 allows rejection of the null hypothesis so that the estimate is not significantly different from zero at the 0.05 level of significance.

The estimated elasticity of demand is the first derivative of the demand equation with respect to the logarithm of price, or -1.086. The interpretation of this value is that the demand for dry cleaning services will decrease by 1.086 percent for every 1 percent increase in the price of that service. The t-statistic value of -4.530 allows rejection of the null hypothesis that the estimate is not significantly different from zero at the 0.05 level of significance.

TABLE 4-3. PARAMETER ESTIMATES AND REGRESSION STATISTICS FROM THE SUPPLY/DEMAND ESTIMATION (TIME-TREND SPECIFICATION)

Parameter	Value	Std. err.	t-stat	95% conf. int.
Supply Curve				
Intercept	0.123	0.067	1.825	–
Price	1.512	0.305	4.959	0.848 to 2.176
P.P. Index	-0.022	0.005	-4.670	-0.033 to -0.012
Sum Sq. Res.		Std. Err.		DW test
0.345		0.054		1.46
Demand Curve				
Intercept	1.082	0.208	5.198	–
Price	-0.989	0.239	-4.141	-1.509 to -0.469
Time	0.077	0.016	4.670	0.041 to 0.112
Sum Sq. Res.		Std. Err.		DW test
0.345		0.054		1.46

The credibility of the demand elasticity estimate can be confirmed with a demand elasticity point estimate computed by Houthakker and Taylor (1970). These authors examined consumer demand relationships for many different goods and services. The demand elasticity for a category of products they refer to as "clothing upkeep and laundering in establishments" was estimated at 0.9293. This value is contained in the 95 percent confidence interval for the demand elasticity estimate reported in Table 4-2 (-1.608 to -0.564). In addition, it is very close to the point estimate itself (-1.086).

If the regulation results in a change in the marginal supplier's cost of providing dry cleaning services, then price and quantity impacts will occur in the short run. Using the demand and supply elasticities estimated above, projecting changes in short run equilibrium price and quantity associated with each regulatory alternative is possible. As noted in Section 2, the baseline

price in the market is equivalent to the marginal cost of providing dry cleaning services (before the regulation) and the average total cost of building a new facility. An increase in the marginal costs projected under the regulatory alternatives would result in an increase in price in the short run. As price rises above the average total cost of a new facility, new entry is encouraged. The average total cost of the new facility, however, is not affected under any of the alternatives considered because virtually all new dry cleaning machines have built-in vent controls. Consequently, in the long run, price and quantity adjustments are zero. In the absence of regulation, the current stock of uncontrolled PCE machines would have been replaced by new machines with vent controls, further supporting the position that long-run price and output adjustments are zero. Therefore, price and output adjustments in the balance of this analysis refer to short-run effects.

Not all commercial facilities in a market area are affected under the candidate regulatory alternatives. Only those facilities that use PCE and that do not have the required vent controls in the baseline will experience a change in production costs. It is not known whether facilities that are potentially affected are more or less likely to be the price-setting marginal facility in the market. Without detailed information on individual supplier's production costs, determining whether the marginal supplier will incur regulatory costs is impossible. Therefore, it is assumed that the likelihood of a shift in the marginal supplier's costs is directly related to the proportion of facilities experiencing the cost increase.

Suppose that a given market area includes facilities that are potentially affected by the regulation (PCE facilities that do not have the required vent controls) as well as those that are unaffected (PCE facilities that have the required vent controls or non-PCE facilities). If the unaffected facilities dominate, then price and output adjustments are unlikely. The impact in markets where unaffected facilities dominate falls exclusively on the affected suppliers whose profits are reduced by the cost of the regulation. Conversely if affected facilities dominate in a particular market area, then the regulation is likely to result in an equilibrium price and output adjustment for that market. Price would rise, but not by the full amount of the cost increase, until demand and supply are in equilibrium. Put

differently, the market supply curve will shift along a (stationary or shifting) market demand curve with equilibrium changes in price and output determined once the curves stabilize.

Rural Markets. Considering the minimum-size customer base, as described in Section 4.1.1, is critical for owners planning to open a facility in a remote area served by a single facility. Areas with a lower population density can sustain a lower density of dry cleaners than areas with a higher population density. The existence of a minimum customer base explains the pattern observed in the data set: sparsely populated areas are served by a single facility and densely populated areas by multiple facilities.

The outstanding characteristic of the structure of the dry cleaning industry in rural communities is the prevalence of markets that are served by a single facility. Another salient characteristic of rural dry cleaning facilities is that annual revenues are typically below $25,000. The small scale of the market in rural communities requires the operation of a minimally sized facility. Consequently, the smallest facility would use an 11.3 kilogram machine. A new entrant would at a minimum add another 11.3 kilograms of capacity. The only option available to a new entrant, therefore, is to double (at the minimum) capacity in the market.

Although these single-facility markets are not perfectly competitive, the ease of entry into the dry cleaning industry implies that the threat to long-run profits from new entrants is keen and persistent. The optimal pricing strategy is to set a profit-maximizing price that is low enough to deter entry. Therefore, to model the economic impact of the proposed regulations, it is assumed that the owners of firms in single-facility rural markets follow a limit pricing strategy. The assumptions of potential large-scale entry and output maintenance allow application of the theory of limit pricing developed by Bain, Sylos-Labini, and Modigliani (Sherer, 1980).

Any price above the average total cost of a new facility would encourage new entry into the market. The existence of a second facility in the market would decrease the market share and the total revenue of the initial supplier. Assuming that the productivity of dry cleaning equipment has been increasing over time, owners of new equipment would tend to have lower marginal costs

than owners of older equipment. Therefore, the market price would probably decline with the entrance of a second facility, further decreasing the total revenue of the existing supplier. Furthermore, if the assumption of increased productivity is correct, owners of new facilities may be able to set prices at a level where initial suppliers would not be able to cover their costs of production. If the price set by the new supplier fell below the variable costs of production for the initial supplier, then the initial supplier would cease operations. If the initial supplier could cover variable costs but not all the fixed costs of production, then the facility would continue to operate in the short run but would face potential financial failure. Facing this potential erosion in profits and/or financial failure, the owner of an existing facility is most likely to adopt the pricing strategy that presents the strongest deterrent to a potential entrant to ensure that his market share is not eroded.

Even in the pre-regulatory baseline, the new entrant's long-run average cost curve already reflects the cost of compliance associated with the candidate regulatory alternatives because the manufacturers of dry cleaning machines have incorporated the requisite air pollution control devices into the basic design (Federal Register, 1989). Therefore the pre-regulatory and post-regulatory costs of potential new entrants are the same, implying that the limit price set by an existing facility would not change under any of the regulatory alternatives.

Two types of rural markets must be analyzed: those with an unaffected facility and those with a potentially affected facility. In market areas with a single unaffected facility, costs do not change because the dry cleaning machines either already comply with the alternatives or they use a solvent other than PCE. Only in those market areas with a single potentially affected facility where regulatory costs are projected, does a potential exist for economic impacts.

The theory of limit pricing to deter large-scale entry implies that the established firm sets a price just below that at which a new entrant would find entry profitable. An established dry cleaner cannot raise its price without inducing entry and eroding its profits. Even when its costs rise, the established owner does not have an incentive to adjust price and quantity

because new entry would occur and the market price would fall. Therefore, in rural, single-facility markets in which the alternatives considered for proposal have an economic impact, the impact falls exclusively on the established dry cleaners whose profits fall by the amount of the compliance cost.

4.2.2 Market Structure in the Coin-operated Sector

Conversations with industry representatives indicate that a perfectly competitive market structure is an accurate representation of current conditions in the coin-operated sector. In addition, the characteristics of supply and demand for coin-operated dry cleaning services and the determinants of facility location decision are similar to those described for the commercial sector, which is predominantly characterized by a competitive market structure. Therefore, a competitive market structure is used to estimate impacts in the coin-operated sector.

Coin-operated (plant-operated) facilities provide the same services to the same consumers at approximately the same prices as commercial facilities. Therefore the demand and supply elasticities estimated for the commercial sector are used to compute impacts in this sector. The service offered by self-service coin-operated facilities is different from that offered by commercial facilities or plant-operated facilities. As described in Section 2, the dry cleaning service offered by self-service facilities does not include pre-spotting, pressing, or finishing. However, historical data on price and output are not collected in a structured format for the coin-operated sector. As a result econometrically estimating supply and demand elasticities for self-service coin-operated dry cleaning is impossible. One option is to assume that the elasticity estimates for the commercial sector are representative of the market conditions characteristic of self-service dry cleaning. Another option is to compute a rough estimate of demand elasticity for self-service dry cleaning using the market price and output for self-service dry cleaning and the market price for commercial dry cleaning. This second option is described below.

First, a "choke price"--the price at which the quantity of self-service coin-operated dry cleaning demanded is zero--is estimated. As discussed in

Section 3, the consumer's full cost of obtaining dry cleaning services includes the price paid to the supplier plus the consumer's opportunity cost of time. Assuming that no consumer values time below the minimum wage rate, the minimum opportunity cost of time is the product of the minimum wage rate (4.25 per hour) and the time required to produce a clean suit ready to wear (0.70625 hours). Under these assumptions, the minimum opportunity cost of time associated with self-service dry cleaning is $3.00.

Commercial dry cleaning services, as well as the services offered by plant-operated facilities in the coin-operated sector, are a perfect substitute for the services offered by self-service coin-operated facilities. In other words, if the consumer's full cost of producing clean clothing using self-service cleaning rises above the full cost of producing clean clothing using the services of a commercial cleaner, then the consumer will use the services of the commercial cleaner. Presumably no consumer is willing to pay more than $3.34 per kilogram--the commercial dry cleaning price ($6.34) less the minimum opportunity cost of time ($3.00)--for self-service dry cleaning. This is the choke price or the price above which quantity of self-service dry cleaning demanded falls to zero.

Figure 4-1 shows the demand curve implied by the choke price and the market price and quantity. This interpretation of the demand curve assumes that demand is linear. This choke price combined with the market price and quantity for self-service dry cleaning can be used to compute demand elasticity in the following manner:

$$\eta = \frac{\Delta Q}{\Delta P} * \frac{P}{Q} \qquad (4.6)$$

where η is the absolute value of demand elasticity, Q is the market quantity, and P is the market price. Because demand is downward sloping, elasticity is negative. At the market price of $1.65 per kilogram, market quantity of 577,239 kilograms, and a choke price of $3.34, demand elasticity is -0.9476.

Because consumers have a perfect substitute for self-service dry cleaning, even small increases in price are likely to result in large quantity reductions. In other words, the existence of a perfect substitute implies

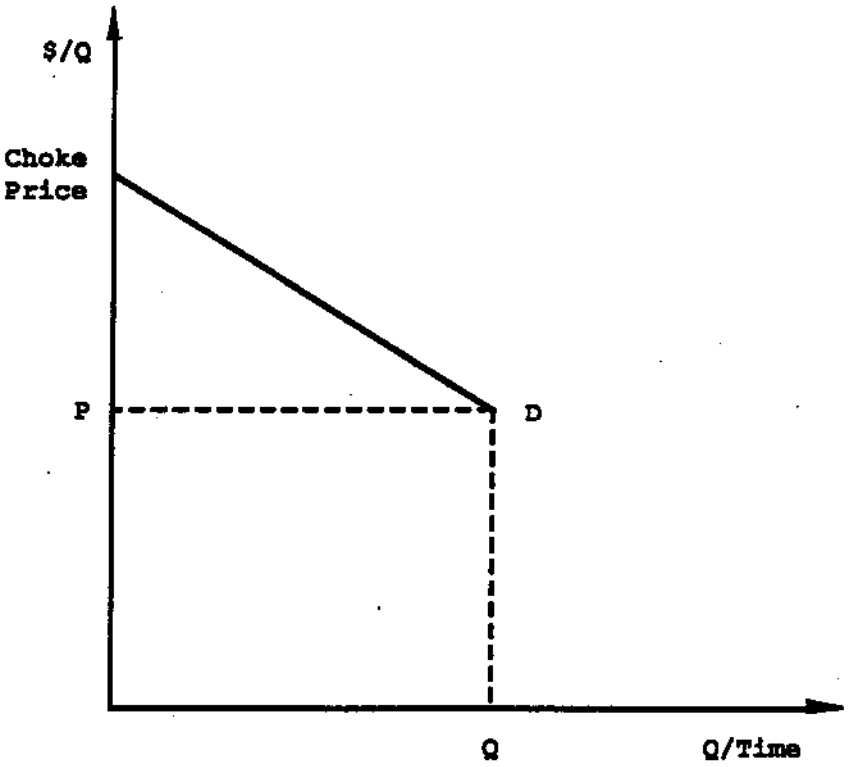

Figure 4-1. Demand for Self-Service Dry Cleaning

that the demand for self-service dry cleaning is likely to be more elastic than the demand for commercial or coin-operated (plant-operated) services. The estimate computed above, however, implies that the demand for self-service dry cleaning is slightly less elastic than the demand for commercial dry cleaning. The reason for the counterintuitive result may lie in the assumptions used to compute the demand elasticity.

First, the demand for self-service dry cleaning is assumed to be linear. To the extent that this assumption does not specify the demand curve, the elasticity estimate may also be miscalculated. In addition, the minimum opportunity cost of time may be underestimated. A higher opportunity cost of time would yield a lower choke price and a higher elasticity estimate (in absolute value). Because of these limitations, the demand and supply elasticity estimates computed for the commercial sector are used to compute impacts for self-service coin-operated facilities.

Data are not available on the number of facilities in this sector operating in markets where unaffected facilities dominate or vice versa. Therefore it is assumed that each market area has the same distribution of affected and unaffected facilities. Virtually all self-service dry cleaning and more than half of the plant-operated facilities in the coin-operated sector are uncontrolled. Therefore, the marginal cost of providing coin-operated dry cleaning services is likely to increase resulting in price and output adjustments for this sector.

The magnitude of the price and output adjustments in the coin-operated sector is limited by the adjustments in the commercial sector. These adjustments are computed separately for self-service and plant-operated facilities because of the difference in the type of service offered and the base price charged by these facilities. Plant-operated facilities are limited in the price increase that may be passed along to consumers because these facilities operate in markets dominated by commercial facilities. Price effects at self-service facilities are also limited by the projected price adjustments in the commercial sector. The post-regulatory price at self-service facilities may not exceed the choke price based on the post-regulatory price charged by commercial facilities. The post-regulatory choke price is the post-regulatory commercial price less the estimated minimum opportunity cost of time ($3.00) computed above.

4.2.3 Market Structure in the Industrial Sector

Industrial facilities also operate in perfectly competitive markets. However, no price and output adjustments are likely to occur in this sector for several reasons. First, water and detergent are near-perfect substitutes for PCE because virtually all of the garments dry cleaned by industrial facilities are water-washable. Because consumers do not dictate the cleaning method used, facilities facing a regulatory cost with continued PCE usage would likely substitute water washing for dry cleaning assuming sufficient capacity is available. Second, industrial cleaners do not charge different prices for garments cleaned in water and detergent and garments cleaned in PCE (Coor and Grady, 1991); also, over 92 percent of the output from industrial facilities is from regular laundry operations. This second factor is evidence that the cost of producing the marginal unit of output in the market area is

not likely to increase under any of the alternatives considered for proposal. For these reasons, producers would not be able to pass along any regulatory cost in the form of a price increase.

4.3 MODEL MARKETS

To facilitate computing impacts of the regulatory alternatives, actual dry cleaning facilities have been allocated among model markets. The methodology used to develop the model markets is discussed below.

4.3.1 Commercial Sector Markets

Six model markets represent the commercial sector and are differentiated by

- rural and urban areas,
- the proportion of affected and unaffected facilities,
- the income distribution of facilities represented, and
- the behavioral response to a cost increase.

Data from American Business Information (ABI) (1991) compiled from telephone yellow pages provided the location of commercial dry cleaning establishments in the United States. Population data from the 1988 City and County Data Book (U.S. Department of Commerce, 1988) were merged with the establishment data from ABI to determine the portion of facilities in rural and urban areas.[1] Additional data on the extent of current state regulations, the percentage of facilities that use PCE in the dry cleaning process, and the share of PCE facilities that have machines with baseline vent controls were used to allocate facilities to each model market (Radian, 1991c; Safety-Kleen, 1986; Radian, 1991c).

Table 4-4 reports the total number of facilities and the number of facilities potentially affected and unaffected by the regulation in each model market of the commercial sector. An estimated 3,149 facilities (10.32 percent of all commercial facilities) are located in rural areas. Rural markets are represented by Model Markets A and B. It is assumed that all facilities in

[1]A rural area is defined as a locale with a population of 2,500 or less that is not part of a metropolitan statistical area.

these model markets are small establishments that receive $25,000 or less in annual revenue. In addition, it is assumed that these small rural areas have only one facility providing commercial dry cleaning services for the entire market area. Market A represents those areas with a single facility that is unaffected under the alternatives considered for proposal. No economic impacts are estimated for markets represented by Market A. Market B represents those areas with a single facility that is potentially affected

TABLE 4-4. PROFILE OF MODEL MARKETS IN THE COMMERCIAL SECTOR

Market Model	Market Description[a]	Proportion of Affected and Unaffected Facilities	Total Number Facilities[b]	Number of Potentially Affected Facilities[c]	Number of Unaffected Facilities[d]
A	Rural	Unaffected Only	1,543	0	1,543
B	Rural	Affected Only	1,606	1,606	0
C	Urban/ Suburban	Unaffected Only	1,157	0	1,157
D	Urban/ Suburban	Unaffected Dominate	10,432	287	10,145
E	Urban/ Suburban	Affected and Unaffected Evenly Distributed	8,073	4,038	4,035
F	Urban/ Suburban	Affected Dominate	7,683	4,298	3,385
Total			30,494	10,229	20,265

[a]Rural markets are defined as locales with population of 2,500 or less that are not part of a metropolitan statistical area. For this analysis, rural markets have only one facility per market area.

[b]Facilities are distributed to Modal Markets based on the share of facilities located in urban and rural areas (ABI, 1991), the share of facilities that use PCE in the dry cleaning process (Safety-Kleen, 1986), and existing state regulations (Radian, 1991b).

[c]Potentially affected facilities are defined here as those that use PCE in the cleaning process and do not have vent controls in place (Radian, 1991c). The total is equivalent to the number of potentially affected facilities under Regulatory Alternatives I and II. Note that PCE facilities with baseline vent controls that do not meet the requirements of Alternative III are not included in the estimate of potentially affected facilities reported in this table.

[d]Unaffected facilities either do not use PCE in the cleaning process or have baseline vent controls.

under the candidate alternatives. These facilities may incur costs because of the regulation. However, as discussed in Section 4.2.2, no price increase is projected because facilities in this type of market practice limit pricing to deter new entry.

The share of facilities assigned to Markets A and B is estimated using data on the share of small facilities with baseline vent controls (Radian, 1991c) and data on the share of facilities that use PCE (Safety-Kleen, 1986). Of the 3,149 facilities in rural market areas, approximately 49 percent or 1,543 either have baseline vent controls or do not use PCE. These facilities are assigned to Market A. The remaining 1,606 facilities are assigned to Market B.

Urban/suburban commercial markets are represented by Model Markets C through F. These model markets are characterized as having more than one facility in each market area. Facilities of every income level operate in market areas represented by these urban/suburban model markets. Market C represents those urban/suburban markets where no commercial dry cleaning facilities are affected under the alternatives considered for proposal. Market D describes those areas where the unaffected facilities dominate. Potentially affected and unaffected facilities represented in Market E are roughly equivalent in number, and in Market F potentially affected facilities dominate.

Approximately 38 percent of all commercial dry cleaning facilities or about 11,589 facilities are located in states with stringent PCE requirements. Markets C and D are used to characterize the market for commercial dry cleaning services in these states. The number of facilities in markets represented by Market C is assumed to be one tenth of the facilities in states with strict PCE emissions standards or about 1,157. The remaining facilities located in states with strict PCE emission standards (10,432) are assigned to Market D. Price and quantity adjustments are assumed to be zero in these two model markets where unaffected facilities dominate.

Those facilities located in states that regulate only very large facilities are assigned to Market E. Market E represents 8,073 facilities or about 26 percent of all commercial establishments. Locales with no state

regulations requiring vent controls for commercial facilities are allocated to Market F. In these two markets, some portion of the regulatory cost would be passed on to consumers in the form of a price increase. The price increases projected for Markets E and F are computed using the average cost increase per unit of output (kilograms of clothes cleaned) for the model facilities in the market area.

Facilities in each model plant category operating at each income level are allocated proportionally to each model market described above based on the total number of potentially affected and unaffected facilities assigned to each market. For example, Market A represents 1,543 facilities with annual receipts below $25,000. A total of 8,026 commercial facilities have annual receipts below $25,000. Therefore 1,543 out of 8,026 or 19 percent of the facilities receiving less than $25,000 in each model plant category are allocated to Market A. Facilities are allocated to Markets B through F in a similar manner. Using the model plants to represent average facilities in each market simplifies the analysis of impacts. Any shift in the model plant supply curve is augmented by the number of facilities in the market to determine the market supply curve shift.

4.3.2 Coin-operated Sector Markets

One model market represents all facilities in the coin-operated sector. Essentially two kinds of coin-operated plants are represented in the model market: self-service and plant-operated. The distribution between the two kinds of plants was based on actual plant information (Radian, 1991c). Seven percent of the facilities (or 213) are self service, and the remaining 93 percent (2,831) are plant-operated.

In the coin-operated market, the price and output adjustments computed for the regulatory alternatives are based on the average cost increase per unit of output measured in kilograms of clothing cleaned. The price adjustment in this sector is limited by the maximum adjustment computed for the commercial sector as discussed in Section 4.2.1. The highest price adjustments for the commercial sector are projected in commercial Market F where potentially affected facilities dominate. Consequently, projected price

and output adjustments computed for Market F define the maximum adjustments for coin-operated facilities.

4.3.3 Industrial Sector Markets

One model market is used to compute impacts in the industrial sector. As discussed in Section 4.2.3, any regulatory costs are not passed along to the consumer in the form of price adjustments. Rather, the entire change in costs is absorbed by the producers.

SECTION 5

FINANCIAL PROFILE OF COMMERCIAL DRY CLEANING FIRMS

The dry cleaning NESHAP will potentially impact business entities that own commercial dry cleaning facilities. Behrens (1985) defines a business entity as a legal being that is recognized by law as having the capacity to conduct business transactions. The Census of Service Industries defines a firm as a "business organization or entity consisting of one domestic establishment or more under common ownership or control," and an establishment is in turn defined to be "a single physical location at which business is conducted."

A profile of the baseline financial condition of commercial dry cleaning firms will facilitate an assessment of the affordability, cost, and firm financial impacts of the dry cleaning NESHAP. The potential financial impacts on small businesses are of particular concern for two reasons. First, the dry cleaning industry is dominated by small businesses. Most firms have annual receipts of less than $100,000, and many have receipts totaling under $25,000. Second, the absolute control equipment costs are constant enough over machines of various sizes that the capital requirements may be disproportionately high for small businesses.

5.1 FIRM FINANCES AND FACILITY ECONOMICS

A facility, or establishment, is a site of land with a plant and equipment that combine inputs like materials, energy, and labor to produce outputs, like dry cleaning services. Firms are legal business entities that, in this context, own one or more facilities. This distinction between facilities and firms is an important one in economic and financial impact analyses.

The conventional theory of the "firm" is really a theory of the "establishment." The operator/manager of a facility--usually directly or indirectly the owner of a firm--maximizes short-run profit by setting the rate of output where marginal cost equals marginal revenue (price in perfect competition) as long as marginal revenue at least covers average variable

cost. Economic failure describes the situation in which the decision maker closes the facility if marginal revenue/price is below marginal cost.

Altman (1983) draws the distinction between economic failure and bankruptcy. Economic failure is the inability of invested capital (facility) to continually cover its variable costs through revenues. Altman notes that a firm can be an economic failure for years as long as it never fails to meet its legal obligations because of the absence or near absence of enforceable debt, thus continuing to operate as a firm. Alternatively, a firm may own perfectly viable assets in an economic sense but earn insufficient profits to meet enforceable debts.

Because viable facilities can be owned by nonviable companies and viable companies can own nonviable facilities, a regulation that closes a facility may leave the company that owns it virtually unaffected. Alternatively, a regulation that would leave a facility viable after compliance may nonetheless cause a firm to become bankrupt or force it to sell the facility. The number of facilities closed by a regulation may exceed or be less than the number of firms forced to sell facilities and/or go bankrupt.

5.2 POPULATION OF POTENTIALLY AFFECTED FIRMS

Facilities subject to regulation under the NESHAP are generally classified in one of three four-digit Standard Industrial Classifications (SICs): 7215 (Coin-operated laundries and dry cleaning), 7216 (Dry cleaning plants, except rug cleaning), and 7218 (Industrial launderers). Nearly all industrial laundering facilities (SIC 7218) are already in compliance with the regulatory alternatives considered for proposal. In addition, those facilities that might be affected have a near-perfect substitute for dry cleaning--water laundering. Consequently, the financial impacts on industrial launderers are likely to be small, so these firms' finances are not characterized in this report.

A financial profile of coin-operated dry cleaning firms is also not presented, but for a very different reason. The economic impact analysis indicates that each of the alternatives considered would cause substantial price impacts and quantity impacts unless EPA exempts small facilities. EPA

will thus probably exempt small coin-operated facilities, effectively exempting them all. Consequently, coin-operated dry cleaning firms will experience no financial impacts.

Effectively, this leaves commercial dry cleaning plants (SIC 7216) as the potentially affected population. A financial impact analysis of this industry is important for the following reasons:

- the economic impact analysis indicates that a significant number of facilities will be affected under each of the regulatory alternative unless a size exemption is established;
- most commercial dry cleaning firms are single-facility firms, so an affected facility is tantamount to an affected firm; and
- most dry cleaning firms have limited internal and external sources of funds because they are small businesses.

5.3 LEGAL OWNERSHIP OF COMMERCIAL DRY CLEANING FACILITIES

Business entities that own commercial dry cleaning facilities—hereafter "dry cleaning firms" or just "firms"—will generally be one of three types of entities:

- sole proprietorships,
- partnerships, and
- corporations.

Each type has its own legal and financial characteristics that may have a bearing on how firms are affected by the regulatory alternatives and on how the firm-level analysis of the NESHAP might be approached.

5.3.1 Sole Proprietorship

A sole proprietorship consists of one individual in business for himself who contributes all of the equity capital, takes all of the risks, makes the decisions, takes the profits, or absorbs the losses. Behrens (1985) reports that sole proprietorships are the most common form of business. Gill (1983) reports that approximately 78 percent of businesses are sole proprietorships. The 1987 Census of Service Industries reports that 8,494 of the 18,322 firms with payroll in this industry, or 46 percent, are sole proprietorships. The 1991 population includes another 7,500 dry cleaning facilities are without

payroll. Although no evidence is available, presumably most of these nonpayroll facilities are small, are owned by single-facility firms, and are sole proprietorships. Assuming that 7,500 nonpayroll, sole proprietorship firms exist, of the 27,332 commercial dry cleaning firms in 1991, 16,694 (61 percent) are proprietorships (see Table 5-1).

Legally, the individual and the proprietorship are the same entity. From a legal standpoint, personal and business debt are not distinguishable. From an accounting standpoint, however, the firm may have its own financial statements that reflect only the assets, liabilities, revenues, costs, and taxes of the firm, aside from those of the individual.

Particularly relevant to the NESHAP analysis is that when a lender lends money to a proprietorship, the proprietor's signature obligates him or her personally and all of his/her assets. A lender's assessment of the likelihood of repayment based on the firm and personal financial status of the borrower is considered legal and sound lending practice because they are legally one-and-the-same. The inseparability of the firm and the individual complicates the assessment of credit availability and terms. Credit might be available to a financially distressed "firm" if the financial status of the individual is substantially strong to compensate. Alternatively, credit might be unavailable to a financially health "firm" if the financial status of the individual is sufficiently weak.

5.3.2 Partnerships

About 8 percent of U.S. business entities are partnerships (Gill, 1983). The 1987 Census of Service Industries reports that 1,666 of the 18,322 firms with payroll in 1987 in this industry, or 9 percent, are partnerships. An estimated 1,803 of all 27,332 dry cleaning firms operating in 1991 are partnerships (see Table 5-1).

A partnership is an association of two or more persons to operate a business. In the absence of a specific agreement, partnerships are general—with each partner having an equal voice in management and an equal right to profits, regardless of the amount of capital each contributes. A partnership pays no federal income tax. All tax liabilities are passed through to the

TABLE 5-1. LEGAL FORM OF ORGANIZATION OF DRY CLEANING FIRMS--NUMBER AND PERCENT

	Legal Organization			
Total Firms	Proprietorships	Partnerships	Corporations	Other
18,322[a]	8,494 (46.4%)	1,666 (9.1%)	8,147 (44.5%)	15 (0.1%)
27,332[b]	16,694 (61.1%)	1,803 (6.6%)	8,818 (32.3%)	17 (<0.1%)

[a]Payroll firms only 1987.
[b]1991 estimate; Payroll and non-payroll firms assuming payroll firms "added" since 1987 are distributed as 1987 payroll firms, and non-payroll firms are all proprietorships. There are an estimated 7,500 nonpayroll firms (Radian, 1991a).
Source: 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990b); 1987 Census of Service Industries, Nonemployer Statistics (U.S. Department of Commerce, 1990a).

individuals and are reflected on individual tax returns. Particularly germane is that each partner is fully liable for all debts and obligations of the partnership (Behrens, 1985). Thus, many of the qualifications and complications present in analyses of proprietorships (e.g., capital availability) are present--in some sense magnified--in analyses of partnerships.

5.3.3 Corporations

Even though only 14 percent of U.S. businesses are corporations, they produce approximately 87 percent of all business revenues (Gill, 1983). The 1987 Census of Service Industries reports that 8,147 of the 18,322 firms with payroll in this industry, or 44 percent, are corporations. Including the 7,500 nonpayroll proprietorships, 32 percent of all dry cleaning firms operating in 1991 are corporations (see Table 5-1).

Unlike proprietorships and partnerships, a corporation is a legal entity separate and apart from its owners or founders. Financial gains from profits and financial losses are borne by owners in proportion to their investment in the corporation. Analysis of credit availability to a corporation must recognize at least two features of corporations. First, they have the legal ability to raise needed funds by issuing new stock. Second, institutional

lenders (e.g., banks) to corporations assess credit worthiness solely on the basis of the financial health of the corporation--not its owners. A qualification of note is that lenders can require (as a loan condition) owners to agree to separate contracts obligating them personally to repay loans.

5.4 DISTRIBUTION OF COMPANIES BY RECEIPTS SIZE

The U.S. has an estimated 27,332 commercial dry cleaning firms in 1991. An estimated 19,832 (73 percent) of these are firms with payroll; the balance (7,500 or 27 percent) includes firms without payroll. Estimating the distribution of dry cleaning firms by receipts size assumes that all seasonal, with-payroll firms have under $25,000 receipts and that 5,625 and 1,875 nonpayroll establishments are owned by as many nonpayroll firms with under $25,000 receipts and $25,000-$50,000 receipts, respectively (Radian, 1990c).

These estimates are presented in Table 5-2. Approximately three-fifths of all commercial dry cleaning firms have annual receipts of $100,000 or less. Almost one-quarter of the total have annual receipts below $25,000 (assuming all seasonal and most nonpayroll firms are included in this category). Only about 2 percent of all dry cleaning firms have annual receipts over $1 million.

Industry concentration is a good summary indicator of firm size distribution (see Table 5-3). The fifty largest commercial dry cleaning companies earn only about 9 percent of total industry receipts. This "fifty firm concentration ratio" is much lower than those for linen supply (63.1%), coin-operated laundries (30.5%), power laundries (28.5%), or industrial launderers (67.3%).

Firm size is likely to be a factor in the distribution of financial impacts of the NESHAP on dry cleaning firms. Dry cleaning firms differ in size for one or both of the following reasons:

- First, dry cleaning facilities vary widely by receipts (see Section 9.1 and Table 9-27). All else being equal, firms with large facilities are larger than firms with small facilities.
- Second, dry cleaning firms vary in the number of facilities they own. All else being equal, firms with more facilities are larger than those with fewer facilities (see Section 5.5).

TABLE 5-2. RECEIPTS OF DRY CLEANING FIRMS

Receipts Range ($000)	No. of Firms[a]	Receipts per Firm	No. of Establishments	Receipts per Establishment
<25	6,690	17,736	6,690	17,736
25-50	4,187	40,545	4,187	40,545
50-75	2,581	67,021	2,581	67,021
75-100	2,581	93,829	2,581	93,829
subtotal	16,039	–	16,039	–
100-250	6,823	171,219	7,032	166,130
250-500	2,870	366,915	3,382	311,368
500-1,000	1,122	722,394	1,836	441,463
1,000-2,500	389	1,504,998	1,130	518,092
2,500-5,000	60	3,640,043	424	515,100
>5,000	29	10,973,635	651	488,841
subtotal	11,293	–	14,455	–
Total	27,332	–	30,494	–

[a]1991 Estimate; Payroll and Non-Payroll Firms (includes plants that use PCE as well as those that use other solvents.). Nonpayroll firms include 5625 below 25,000 in annual receipts and 1875 with 25,000 to 50,000 in annual receipts (Radian, 1991a).
Source: 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990); Table 2-1.

TABLE 5-3. CONCENTRATION BY LARGEST DRY CLEANING FIRMS

	Percent of Industry Receipts[a]
4 Largest Firms	2.4%
8 Largest Firms	3.6%
20 Largest Firms	5.8%
50 Largest Firms	9.1%

[a]Payroll firms only, 1987.
Source: 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990b).

5.5 DISTRIBUTION OF COMPANIES BY NUMBER OF FACILITIES

The financial impacts of the NESHAP on two firms of equal size might depend significantly on their facility composition because substantial control economies of scale exist. The costs of controlling larger machines are not proportionately higher than the costs of controlling smaller ones. Also, the effective impacts on more fully utilized dry cleaning machines are smaller than on under-utilized dry cleaning machines. Because machine size and utilization underlie facility receipts, facility impacts will be greater for smaller than for larger facilities.

Control economies are facility-related rather than firm-related. Hypothetically, a firm with ten uncontrolled facilities of a given size may face approximately twice the control capital requirements of a firm with five uncontrolled facilities of the same size. Alternatively, two firms with the same number of facilities facing approximately the same control capital costs may be financially affected very differently if the facilities of one are larger than those of another.

An estimated 27,332 firms own 30,494 commercial dry cleaning establishments in 1991: an average of 1.12 facilities per firm. An estimated 95 percent of all commercial dry cleaning firms own a single facility. Table 5-4 reports the distribution of firms by number of dry-cleaning establishments owned, assuming that all 7,500 nonpayroll establishments (Radian, 1991a) are owned by single-facility firms. Even in the $500K to $1M firm receipts range, the average number of facilities per firm is below two. At the other extreme, 29 firms own about 22 facilities each.

The implication of this distribution are as follows. Up to a point, firm receipts grow because machine sizes increase and/or machine capacity utilization increases. Note that $75K-$100K firms have an average $93,829 of receipts accruing to their single facility, while <$25K firms have an average only $17,736 accruing to their single facility (Table 5-2). Since capital costs of control devices are similar for machines of all sizes and utilization rates, capital requirement impacts fall fairly proportionately as firm size increases--up to a point (see Section 7). After some point, receipts per

TABLE 5-4. NUMBER OF COMMERCIAL DRY CLEANING FACILITIES PER FIRM BY INCOME CATEGORY

Receipts Range ($000)	Facilities Per Firm
<25	1.00
25-50	1.00
50-75	1.00
75-100	1.00
100-250	1.03
250-500	1.18
500-1,000	1.64
1,000-2,500	2.90
2,500-5,000	7.07
>5,000	22.45

Source: 1987 Census of Service Industries, Subject Series (U.S. Department of Commerce, 1990b).

establishment stabilize at about $500,000 (see Table 5-2) and firms grow only by adding more facilities (see Table 5-3). Control economies of scale essentially cease to exist for firms larger than $1 million.

5.6 VERTICAL INTEGRATION AND DIVERSIFICATION

Vertical integration is a potentially important dimension in firm-level impacts analysis because a vertically integrated firm could be indirectly as well as directly affected by the NESHAP. For example, if a dry cleaning firm is vertically integrated in the manufacture and/or distribution of perchloroethylene (PCE), it could be indirectly and adversely affected by the NESHAP if demand for PCE diminishes after the regulation.

Ignoring for now that some dry cleaning facilities also engage in operations other than dry cleaning, a dry cleaning firm is considered vertically integrated if it also owns facilities that sell goods or services used as inputs by the dry cleaning industry and/or facilities that purchase

dry cleaning services as inputs. Forward integration is unlikely because nearly all dry cleaning services are provided to individuals, not firms. Backward integration is unlikely because the main inputs in the dry cleaning industry are a building, dry cleaning machinery, energy, and PCE, all dissimilar to dry cleaning services.

Intra-firm diversification, sometimes referred to as horizontal integration, is a potentially important dimension in firm-level impact analysis for either or both of two reasons.

- First, a diversified firm could be indirectly as well as directly affected by the NESHAP. For example, if a dry cleaning firm is diversified in the manufacture of emissions control equipment (an unlikely scenario), it could be indirectly and favorably affected by the NESHAP.

- Secondly, a diversified dry cleaning firm may own facilities in unaffected industries like carpet cleaning, linen supply, power laundering, or shoe repair—a more realistic situation. This type of diversification would help mitigate the financial impacts of the NESHAP.

Intra-facility diversification is also a relevant consideration because dry cleaning facilities commonly engage in activities other than dry cleaning. Many dry cleaning facilities do alterations work, repair shoes, clean draperies, store garments, and sell other goods and services. This is another type of diversification that could mitigate the impact of the dry cleaning NESHAP on certain dry cleaning firms. Indeed, the prominence and magnitude of intra-facility diversification in the industrial dry cleaning industry is partly the reason for not including those firms at all in this financial impacts analysis.

5.7 FINANCIAL CHARACTERISTICS OF FIRMS IN REGULATED INDUSTRY(IES)

This section characterizes the financial condition of commercial dry cleaning firms. Clark (1989) investigated the suitability of available small business financial data bases for EPA's use in its economic analyses. He concludes that two main financial data bases are appropriate: Internal Revenue Service (IRS) data and Dun and Bradstreet (D&B) data. Although each of the data bases has its comparative merits, the Dun and Bradstreet data are better for characterizing the finances of dry cleaning firms. The D&B data

are more recent than the IRS data, are available for the dry cleaning industry, and are probably based on a larger (though nonrandom) sample than the IRS data. The financial condition of dry cleaning firms can be characterized using Dun and Bradstreet's 1989-1990 Industry Norms and Key Business Ratios (Duns Analytical Services, 1990).

The D&B data base contains 991 commercial dry cleaning establishments. Clark (1989) notes that the financial information provided to D&B is supplied by the businesses to obtain favorable credit ratings; therefore, the businesses have an incentive to make their net worth and income look as good as possible. Companies that are not doing well financially have an incentive to keep their financial information out of D&B's data base. Thus the financial data reported therein are based on a possibly nonrepresentative sample of firms.

Industry Norms and Key Business Ratios unfortunately does not characterize the finances of firms by firm size. Consequently, informal assumptions are necessary to estimate the number of firms in each of the seven receipts ranges in below-average, average, and above-average financial condition. Two alternative assumptions are employed in this analysis.

One assumption (financial scenario I) reflects the high probability that firms in below-average financial condition are disproportionately small since the capacity utilization of their machines is so low. Dry cleaning machine capacity utilization at facilities with annual receipts under $25,000 is only about 7 percent, and that of facilities with annual receipts of $25,000 to $50,000 is only about 15 percent. Capacity utilization approaches 80 percent only when facility receipts approach $100,000.

Table 5-5 presents estimated numbers of firms by size and baseline financial condition assuming a positive relationship between the two. The result is that all 6,834 firms in below-average financial condition have annual receipts below $50,000, that all 13,664 firms in average financial condition have annual receipts between $25,000 and $250,000, and that all 6,834 firms in above-average financial condition have annual receipts above $100,000.

TABLE 5-5. NUMBER OF DRY CLEANING FIRMS, BY SIZE AND BASELINE FINANCIAL CONDITION

Receipts Range ($000)	Total	Baseline Financial Condition		
		Below Average	Average	Above Average
<25	6,690	6,690	0	0
25-50	4,187	144	4,043	0
50-75	2,581	0	2,581	0
75-100	2,581	0	2,581	0
100-250	6,823	0	4,459	2,364
250-500	2,870	0	0	2,870
>500	1,600	0	0	1,600
Total	27,332	6,834	13,664	6,834

Source: Table 5-2 and Duns Analytical Services (1990), Financial Scenario I.

Table 5-6 uses the D&B data to characterize the population and shows the number of dry cleaning firms in each of seven receipts categories and each of three financial conditions under an alternative assumption that there is no relationship between firm size and financial condition (financial scenario II). Fifty percent of all firms are, regardless of size, allotted in the "average financial condition" grouping, and 25 percent of all firms in each of the "below-average" and "above-average" financial condition groupings.

Dun and Bradstreet data are employed to derive financial profiles of dry cleaning firms in below-average, average, and above-average financial conditions. Income statements and balance statements are the two basic financial reports kept by firms. The former reports the results of a firm's operation during a period of time--usually one year in practice. The latter is a statement of the financial condition of the firm at a point in time--usually December 31 or the last day of the firm's fiscal year.

TABLE 5-6. NUMBER OF DRY CLEANING FIRMS, BY SIZE AND BASELINE FINANCIAL CONDITION

Receipts Range ($000)	Total	Baseline Financial Condition		
		Below Average	Average	Above Average
<25	6,690	1,673	3,344	1,673
25-50	4,187	1,047	2,093	1,047
50-75	2,581	645	1,291	645
75-100	2,581	645	1,291	645
100-250	6,823	1,706	3,411	1,706
250-500	2,870	718	1,434	718
>500	1,600	400	800	400
Total	27,332	6,834	13,664	6,834

Source: Table 5-2 and Duns Analytical Services (1990), Financial Scenario II.

The income statements and balance sheets of dry cleaning firms of different sizes and financial conditions are presented in Appendix A (Tables A-1 through A-3). The five sales categories are largely selected for cut-off analysis purposes. All other lines in the two statements derive, directly or indirectly, from "sales" relationships given in D&B. Several examples will clarify how the statements are derived.

An estimated 11,293 dry cleaning firms have receipts over $100,000. The estimated average receipts for these firms total $367,510, which is reported as "sales" in the income statement. D&B reports that the average dry cleaning firm in the data base has a net profit of 7 percent of sales. This ratio multiplied by the sales estimate of $367,510 yields the estimated "net profit" of $25,725 in the income statement. The three other lines in the income statement are analogously derived by applying D&B ratios multiplied by sales.

Balance sheet items are derived in an analogous manner. D&B reports that the average dry cleaning firm in the data base has about $480 of total assets for every $1,000 dollars of sales. This ratio multiplied by the sales

estimate of $367,510 yields estimated total assets of $177,257. D&B reports that the average dry cleaning firm has about $369 of current assets, $373 of fixed assets, and $258 of other noncurrent assets per $1,000 of total assets. These ratios multiplied by the total assets estimate yield the estimates presented for those variables in the tables In the liabilities section of the balance sheet, "total liabilities and net worth" must equal "total assets," and the component parts are computed using D&B ratios multiplied by the total.

To project the potential financial impacts of the NESHAP on firms of different sizes in below-average financial condition, baseline financial profiles of representative less healthy firms are required. Unfortunately, Dun and Bradstreet does not rank businesses in a particular industry in their data base from "most healthy" to "least healthy" and then report the financial ratios of the firm that falls in the lower quartile of that distribution. Instead, D&B calculates each ratio of interest (e.g., current assets/current liabilities) for the 991 firms and then ranks these ratios from "best" to "worst." D&B then reports the lower quartile for each of these ratios individually. Consequently, constructing the financial statement of the lower quartile firm is not possible.

Constructing pro forma financial statements of a firm that yield financial ratios closely resembling the D&B lower quartile ratios is possible. Appendix A presents the income statements and balance sheets of dry cleaning firms in below-average financial condition. D&B reports that the lower quartile profit-to-sales ratio of commercial dry cleaning firms in its data base is about one percent, which is consistent with the income statement entries. Other lower-quartile ratios reported by D&B and employed in the construction of these pro forma statements include assets-to-sales of approximately 70 percent, fixed assets-to-net worth of approximately 155 percent, and a return on net worth of approximately 3.5 percent.

To project the potential financial impacts of the NESHAP on firms of different sizes in above-average financial condition, baseline financial profiles of representative healthy firms are required. For reasons described above, constructing the financial statements of the upper-quartile firm is not possible. Again, constructing pro forma financial statements of a firm that yield financial ratios closely resembling the D&B upper-quartile ratio is

possible. Appendix A presents the income statements and balance sheets of dry cleaning firms in the same size categories, all in above-average financial condition.

5.8 KEY BUSINESS RATIOS OF DRY CLEANING FIRMS

Financial ratio analysis is a widely accepted way of summarizing the financial condition of a firm. Financial ratios include four fundamental types:

- indicators of liquidity,
- activity,
- leverage, and
- profitability.

The baseline financial status of dry cleaning firms is characterized below by means of financial ratio analysis.

Liquidity indicates the ability of the firm to meet its near-term financial obligations as they come due. A common measure of liquidity is the current ratio, which divides the firm's current assets by its current liabilities. Current assets include cash, accounts receivable, inventories, or other assets that represent or can be converted to cash within one year. Current liabilities are essentially bills that must be paid within the year (including current maturities of long-term debt). Higher ratios are generally more desirable than lower ratios, because they indicate greater liquidity or solvency.

Activity indicates how effectively the firm is using its resources. The ratio of firm sales to fixed assets (plant and equipment), the fixed asset turnover ratio, measures how well the firm uses its capital equipment to generate sales. Higher ratios are generally more desirable than lower ratios.

Leverage indicates the degree to which the firm's assets have been supplied by, and hence are owned by, creditors versus owners. Leverage should be in an acceptable range indicating that the firm is using enough debt financing to take advantage of the lower cost of debt, but not so much that

current or potential creditors are uneasy about the ability of the firm to repay its debt. The debt ratio is a common measure of leverage that divides all debt, long and short term, by total assets.

Profitability measures the return, usually as net income after all costs, debt repayment, and taxes, to the firm over some time period, usually one year. Profitability is most commonly, though perhaps not most relevantly, expressed as a return to sales. Because net worth is a measure of the value of the firm to its owners, profitability-to-net worth is a measure of the annual return to owners expressed as a percent.

Financial ratio indicators of liquidity, activity, leverage, and profitability among dry cleaning firms in below-average, average, and above-average financial health are presented in Table 5-7. Clearly, as financial status improves, firms become more liquid. Note particularly that below-average firms are only marginally able, at best, to meet current obligations with their cash and other current assets.

Also as expected, firms in better financial health generate more sales with their plant and equipment. In the context of the dry cleaning industry, this condition may indicate that firms with higher machine capacity utilization are more financially sound than those with lower machine capacity utilization. Sales per dollar of fixed assets are more than twice as high among firms in average financial condition than among those in below-average financial condition. This lends support to financial scenario I of a positive relationship between firm size and financial health, that in turn underlies the estimates presented in Table 5-5.

Leverage analysis of dry cleaning firms in the three different financial states is more difficult than liquidity, activity, or profitability analysis. The "mean firm" in the D&B data base is about 46 percent debt financed (and 54 percent equity financed). As explained above, less debt is not necessarily "better" because a firm using too little debt is not minimizing its cost of capital. From a creditor's point of view though, less debt is probably better than more debt, on balance. D&B reports are creditor-oriented, which probably explains why in D&B's judgment a low debt ratio is desirable. Because a main

TABLE 5-7. BASELINE FINANCIAL RATIOS OF DRY CLEANING FIRMS

	Financial Condition		
	Below Average	Average	Above Average
Liquidity			
Current ratio (times)	0.80	1.73	5.10
Activity			
Fixed asset turnover ratio (times)	2.30	5.56	7.54
Leverage			
Debt ratio (percent)	60.00	45.90	15.00
Profitability			
profit to sales (percent)	1.00	7.00	13.00
profit to assets (percent)	1.40	14.50	32.50
profit to NW (percent)	3.60	26.80	38.20

Source: Duns Analytical Services, 1990.

objective of this analysis is to evaluate a dry cleaning firm's ability to obtain and its cost of obtaining credit to purchase control equipment, this interpretation is satisfactory.

Profitability analysis is useful because it helps evaluate both the incentive and the ability of dry cleaning firms to incur equipment and operating costs required for compliance.[1] More profitable firms have more incentive than less profitable firms to comply because the annual returns to doing business are greater. In the extreme, a single-facility firm earning zero profit (price equals average variable cost) has no incentive to comply with a regulation imposing any positive cost unless it can pass along the

[1]Dry cleaning firms that are either unwilling or unable to comply with the NESHAP must sell the facility, switch solvents, or discontinue their dry cleaning operations at the noncompliant facility.

entire cost of the regulation to its customers. This same firm is also less able to comply because it is less able to obtain a loan.

The relationship between profitability and firm health is clearly demonstrated in Table 5-7. One-quarter of the dry cleaning firms in D&B's data base are only marginally profitable by all three measures. If some or all of the estimated 6,690 commercial dry cleaning firms with annual receipts under $25,000 are among the lower quartile in profitability, they are generating annual profits of only several hundred dollars. Average dry cleaning firms are seven times more profitable (related to sales) than below-average firms, and above-average firms are about twice as profitable as average firms.

These financial ratios suggest that the NESHAP requirements may have a disproportionate impact on small firms and firms in below-average financial health. The financial ratios of below-average firms are sometimes substantially worse than those of average firms. These baseline ratios will be used as a basis of comparison in Section 7 when the potential financial impacts of the NESHAP on dry cleaning firms are considered.

5.9 AVAILABILITY AND COSTS OF CAPITAL

Without exception, affected dry cleaning facilities would have to purchase control equipment to meet the regulatory alternatives or discontinue dry cleaning operations ("closure"). In addition, many affected facilities would incur recurring operating and maintenance costs that exceed their solvent recovery credits. The availability and costs of capital to dry cleaning firms of different sizes, types, and financial conditions will influence the financial impacts of the dry cleaning NESHAP.

Hastsopoulos (1991) clearly states that in making investments, companies use two sources of funds: equity and debt. Each source differs in its exposure to risk, in its taxation, and its cost. Equity financing involves obtaining additional funds from owners: proprietors, partners, or shareholders. Partners and shareholders, in turn, can be existing owners or new owners. Obtaining new capital from existing owners can be further dichotomized into internal and external financing. Using a firm's retained

earnings is equivalent to internal equity financing. Obtaining additional capital from the proprietor, one or more existing partners, or existing shareholders constitutes external equity financing.

Debt financing involves obtaining additional funds from lenders who are not owners; they include buyers of bonds, banks, or other lending institutions. Debt borrowing involves a contractual obligation to repay the principal and interest on an agreed-upon schedule. Failure by the firm to meet the obligation can result in legal bankruptcy.

The dry cleaning industry is dominated by small firms for whom selling stocks and bonds is not a very realistic option. Steinhoff and Burgess (1989) list a large number of sources of funding for small businesses, but most fit a description of either debt or equity reasonably well:

- personal funds and/or retained earnings,
- loans from relatives and friends,
- trade credit,
- loans or credit from equipment sellers,
- mortgage loans,
- commercial bank loans,
- Small Business Administration loans,
- small business investment company loans,
- government sponsored business development companies,
- partners,
- venture capital funding, and
- miscellaneous sources.

Using personal funds and/or retained earnings, obtaining loans from relatives and friends, obtaining funds from partners, and obtaining venture capital funding effectively constitute equity financing because they generally do not involve a legal contract for repayment. This type of borrowing is considered more risky for the lender than for the borrowing firm because in

the event of bankruptcy, the lenders have claim to the dissolved assets of the firm only after those of debt lenders.

Trade credit, loans or credit from equipment sellers, mortgage loans, commercial bank loans, Small Business Administration loans, small business investment company loans, and government-sponsored business development company loans generally constitute debt financing because they involve contractual promises to repay the principal and some agreed-to interest. In the event of firm bankruptcy, which can be initiated by a lender whose loan terms are not being honored by the firm, debt lenders are paid out of the assets of the firm before equity lenders. Thus, debt borrowing is considered more risky for the firm's owners than equity borrowing.

One important difference then between debt and equity financing is its cost. The expected or anticipated rate of return required by equity lenders is higher than the required rate of return to debt lenders because of the relative riskiness of equity. A second important difference between the two sources of funds is tax related. Interest payments on debt are deductible to the firm as a cost of doing business for state and federal income tax purposes. Returns to owners are not tax deductible. Thus, borrowing debt has a distinct tax-related cost advantage. For two reasons, then, the cost of debt is normally lower than the cost of equity.

In this analysis, a simplifying assumption is made that dry cleaning firms have two possible sources of capital: bank loans (debt) and retained earnings (equity). The availability and cost of capital is evaluated in that context.

A firm's cost of capital is a weighted average of its cost of equity and after-tax cost of debt:

$$WACC = W_d \cdot (1-t) \cdot K_d + W_e \cdot K_e, \qquad (5.1)$$

where

WACC = weighted average cost of capital

W_d = weighting factor on debt

t = marginal effective state and federal corporation/individual tax rate

K_d = the cost of debt or interest rate

W_e = weighting factor on equity

K_e = cost (required rate of return) of equity.

A real (inflation-adjusted) cost of capital is desired, so employing the GNP implicit price deflator for the seven year period 1982-1989 adjusts nominal rates to real rates. Using an adjustment factor of 4 percent assumes that the inflation premium on real rates for the next seven years is the actual rate of inflation averaged over the last seven years (1990 Economic Report of the President).

Based on conversations with a business loan officer at a large commercial bank (Bass, 1991), seven-year prime-plus variable interest rate bank loans for control equipment are assumed to be available to qualifying firms on the following cost terms:

- best applicants: prime plus one-half percent
- typical health applicants: prime plus one percent
- below-average but still-sound applicants: prime plus 2 percent

According to Bass, actual loan terms are negotiated on a case-by-case basis, but the guidelines given above are reasonable. Particularly germane to this analysis is his insistence that bank loans are not made to firms <u>at any cost</u> unless expectations are high that they well be repaid according to the terms of the loan. This is why the risk premium spread from one-half percent to 2 percent is so narrow.

Between 1982 and 1989 the prime rate varied around a mean of approximately 10.5 percent, nominal. Using the inflation premium discussed above, and assuming that the nominal prime rate will average about 10.5 percent over the next seven years, the expected <u>real</u> prime rate is about 6.5 percent. Then following Bass's guidelines for loan risk premium, the following real before-tax debt costs are computed and employed:

- best applicants: 7 percent
- typical health applicants: 7.5 percent

- below-average but still-sound applicants: 8.5 percent

Because debt interest is deductible for state and federal income tax purposes, the cost of debt has to be adjusted downward. An approximate effective marginal state and federal tax rate of 38 percent is computed using data from The Tax Foundation (1991). Applying this rate to the real costs of debt computed earlier derives after-tax real debt costs for dry cleaning firms in three different financial conditions:

- above-average financial condition: 4.3 percent
- average financial condition: 4.7 percent
- below-average financial condition: 5.3 percent

The cost of equity, K_e, can be estimated by adding an equity risk premium to a risk-free required rate of return (Jones, 1991). Using the 1982-1989 average return on 10-year federal treasury securities as the risk-free rate, and assuming it is applicable for the next seven years, a nominal risk-free rate of 10 percent is obtained.

Jones (1991) reports that common practice is to use the Standard and Poor 500 long-run average equity risk premium of about 8 percent as a first basis for computing the cost of equity in conjunction with the risk-free rate. Thus, the S&P 500 nominal equity yield is about 18 percent, which is an estimate of the average cost of equity for all publicly traded stocks (Van Horne, 1980).

Jones indicates that still another risk premium has to be added for firms that are more risky than the S&P 500 average, and that dry cleaning firms probably generally fall in this category. Even though the assumption is necessarily arbitrary, dry cleaning firm equity risk premiums are employed as follows:

- dry cleaning firms in above-average health: 0 percent
- dry cleaning firms in average health: 2 percent
- dry cleaning firms in below-average health: 6 percent

Adding these dry cleaning firm equity risk premiums and simultaneously subtracting inflation premiums result in the following set of real equity costs for dry cleaning firms of different financial states:

- above-average financial condition: 14 percent
- average financial condition: 16 percent
- below-average financial condition: 20 percent

These estimates appear reasonable in view of a study by Anderson, Mims, and Ross (1987) which estimated real equity costs of 11 percent, 14 percent, and 19 percent for firms with Moody Bond Ratings of AAA (the highest rating), BBB, and BB, respectively.

Weighting the debt and equity cost components is difficult for several reasons. First, market value weights are more theoretically correct than book value weights, but only the latter are observable for privately owned dry cleaning firms (Bowlin, Martin, and Scott, 1990). Second, target weights, not historical weights, are appropriately used for estimating the cost of capital (Bowlin, Martin, and Scott, 1990). Again, only historical weights are observable. Third, marginal costs of capital, not historical average costs, are appropriate hurdle rates for new investments (Bowlin, Martin, and Scott, 1990).

For this analysis, the industry average debt/equity structure is the optimal/target structure for all dry cleaning firms and book-value weights approximate market-value weights (Bowlin, Martin and Scott, 1990). The debt and equity weights of the mean dry cleaning firm in the Dun and Bradstreet data base are 31 percent and 69 percent, respectively. Using these weights and the component costs of capital derived above gives the weighted average costs of capital for dry cleaning firms in the three financial states:

- above-average financial condition: 11 percent
- average financial condition: 12.5 percent
- below-average financial condition: 15.4 percent

These cost of capital estimates are not presented as actual costs to particular firms. Likewise, they are not meant to imply that firms within a

financial condition category all have the same cost of capital, or that borrowed funds will necessarily be available to all firms. In particular, recognize that 25 percent of all firms are in "below-average financial condition." Within this range, some firms will be far more financially distressed than others. The 15.4 percent real rate may overestimate the cost of capital for some of these dry cleaning firms and underestimate some unusually distressed firms.

Adequate control capital funds are probably unavailable through normal channels to small, particularly distressed firms. Bass (1991) indicates that most commercial banks will not lend money to financially distressed firms, and retained earnings at small, distressed firms may be inadequate to pay for control capital. Bass also stated that his institution, and others, won't lend money to dry cleaning firms without first conducting an "environmental audit" to protect the bank in the event that environmental contamination is present or foreseeable at the time of the loan. One can never discount the possibility that funds would be available from owners' personal funds, new partners, friends, relatives, or other sources.

SECTION 9

REFERENCES

Abowd, John M. and Orley Ashenfelter. 1981. "Anticipated Unemployment, Temporary Layoffs, and Compensating Wage Differentials." In Studies in Labor Markets. pp 141-170. Sherwin Rosen, ed. Chicago, IL: University of Chicago Press.

Allen, R.G.D. 1962. Mathematical Analysis for Economists. London: MacMillan & Co.

Altman, Edward I. 1983. Corporate Financial Distress. pp 4-7. New York: John Wiley and Sons.

American Business Information (ABI). 1991. Data Base of Dry Cleaning Facilities. Prepared for Research Triangle Institute.

Anderson, D. W., and Ram V. Chandran. 1987. "Market Estimates of Worker Dislocation Costs." Economics Letters 24:381-384.

Anderson, Donald W., Mims, Howard H., and Ross, A. Scott. 1987. Industry Supply, Cost and Availability of Capital, and Closure Analysis. Prepared by Research Triangle Institute for U.S. Environmental Protection Agency. September 30.

Bass, Archie. 1991. Commercial Loan Officer, Central Carolina Bank, March 22, 1991. Personal communication with Donald W. Anderson, Research Triangle Institute.

Becker, Gary S. 1965. "A Theory of the Allocation of Time." Reprinted from the Economic Journal 75:493-517. September.

Behrens, Robert H. 1985. Commercial Loan Officer's Handbook. Boston: Banker's Publishing Company.

Betchkal, Mark. 1987a. Institute of Industrial Launderers, with Lisa McNeilly. February 19, 1987. Personal communication with Research Triangle Institute.

Betchkal, Mark. 1987b. Institute of Industrial Launderers, with Lisa McNeilly. March 2, 1987. Personal communication with Research Triangle Institute.

Blinder, Alan S. 1988. "The Challenge of High Unemployment." Richard T. Ely Lecture printed in the American Economic Review 78(2):1-15.

Bowlin, Oswald D., Martin, John D., and Scott, David F. 1990. Guide to Financial Analysis. pp 229-233. New York: McGraw-Hill.

Busler, C. 1980. "Characteristics of Dry Cleaning Solvents." International Fabricare Institute Technical Bulletin No. T-536.

Chemical Marketing Reporter. 1986. "Chemical Profile: Perchloroethylene." 229(5):50, February 3.

Clark, Lyman H. 1989. Small Business Financial Data Bases. Prepared for the Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency.

Code of Federal Regulations. 1991. "Business Credit and Assistance." Revised as of January 1, 1991. National Archives and Records Administration.

Coor, Kenneth R., Division President, and Grady Kenneth W., Production Manager, Textilease Corporation. February 19, 1991. Personal communication with Brenda L. Jellicorse, Research Triangle Institute.

Deacon, Robert T. and Jon Sonstelie. 1985. "Rationing by Waiting and the Value of Time: Results from a Natural Experiment." Journal of Political Economy 93(4):627-647.

Duns Analytical Services. 1990. Industry Norms and Key Business Ratios. Dun and Bradstreet Business Credit Services. 1989-1990.

Economic Report of the President. 1990. Washington, DC: United States Government Printing Office. February.

Faig, Kenneth. 1990. International Fabricare Institute. March 14, 1990. Personal communication with Brenda L. Jellicorse, Research Triangle Institute.

Faig, Kenneth. 1991. International Fabricare Institute, February 25, 1991. Personal communication with Brenda L. Jellicorse., Research Triangle Institute.

Federal Register. 1989. "Occupational Safety and Health Administration, 29 CFR Part 1910, Air Contaminants." 54(12):2812. January 19.

Fischer, E. 1987. Editor of American Drycleaner. February 6, 1987. Personal communication with Lisa McNeilly, Research Triangle Institute.

Fisher, William. 1987. International Fabricare Institute, February 13, 1987. Personal communication with Lisa McNeilly, Research Triangle Institute.

Fisher, William. 1990a. . International Fabricare Institute. March 6, 1990. Personal communication with Brenda L. Jellicorse, Research Triangle Institute.

Fisher, William. 1990b. International Fabricare Institute, October 10, 1990. Teleconference with EPA staff, Radian Corporation staff, and Brenda L. Jellicorse, Research Triangle Institute.

Flaim, Paul O. 1984. "Unemployment in 1982: The Cost to Workers and Their Families." Monthly Labor Review Feb.:30-37

Gordon, Robert J. 1978. Macroeconomics. pp 271-275. Boston: Little Brown and Company.

Gronau, Reuben. 1977. "Leisure, Home Production, and Work--the Theory of the Allocation of Time Revisited." Journal of Political Economy 85(6):1099-1123.

Hamermesh, Daniel S. 1989. "What Do We Know About Worker Displacement in the U.S.?" Industrial Relations 28(1):51-59.

Hatsopoulos, George N. 1991. "Cost of Capital: Reflections of a CEO." Business Economics. 26(2):7-13.

Houthakker, H. S., and Taylor, L. D. 1970. Consumer Demand in the United States: Analysis and Projections. Cambridge, MA: Harvard Univ. Press.

ICF, Inc. 1986. Costs of Substitutes for Chlorinated Solvents in Dry Cleaning. Draft Report to U.S. Environmental Protection Agency. April.

International Fabricare Institute. 1989. "Results of IFI Survey of 1988 Operating Costs." IFI Fabricare News. September.

Jones, C.P. Dr. 1991. Professor of Economics and Business, North Carolina State University, March 22, 1991. Personal communication with Donald W. Anderson, Research Triangle Institute.

Kooreman, Peter and Arie Kapteyn. 1987. "A Disaggregated Analysis of the Allocation of Time within the Household." Journal of Political Economy 95(2):223-249.

Martin, Stephen. 1982. "Industry Demand Characteristics and the Structure-Performance Relationship." Journal of Economics and Business 34:59-65.

Mason, Charles, and Clifford Butler. 1987. "New Basket of Goods and Services being Priced in Revised CPI." Monthly Labor Review. January.

Maxwell, Nan L. 1989. "Labor Market Effects from Involuntary Job Losses in Layoffs, Plant Closings: The Role of Human Capital in Facilitating Reemployment and Reduced Wage Losses." American Journal of Economics and Sociology 48(2):129-141.

Moore, Michael J. and W. Kip Viscusi. 1990. Compensation Mechanics for Job Risks. Princeton, NJ: Princeton University Press.

Radian Corporation. 1990a. "National Cost Impacts of Regulatory Alternatives for the Hazardous Air Pollutant Dry Cleaning NESHAP." Memorandum from Carolyn Norris and Kim Kepford to U.S. Environmental Protection Agency, Chemical and Petroleum Branch. January 25.

Radian Corporation. 1990b. "Revised Estimates of National Hazardous Air Pollutant Consumption by the Dry Cleaning Industry." Memorandum from Carolyn Norris and Kim Kepford to U.S. Environmental Protection Agency, Chemical and Petroleum Branch. December 14.

Radian Corporation. 1990c. "Revised Model Machine Selection for the Dry Cleaning NESHAP." Memorandum from Carolyn Norris and Kim Kepford to U.S. Environmental Protection Agency, Chemical and Petroleum Branch. December 14.

Radian Corporation. 1990d. "Updated Control Costs and Cost-Effectiveness Estimates for Hazardous Air Polluttant (HAP) Dry Cleaners." Memorandum from Carolyn Norris and Kim Kepford to U.S. Environmental Protection Agency, Chemical and Petroleum Branch. December 14.

Radian Corporation. 1991a. "Documentation of Growth Rates for the Dry Cleaning Industry." Memorandum from Carolyn Norris and Kim Kepford to U.S. Environmental Protection Agency, Chemical and Petroleum Branch. March 11.

Radian Corporation. 1991b. "Existing State Exemption Levels." Memorandum from Kim Kepford to Brenda L. Jellicorse, Research Triangle Institute. January 7.

Radian Corporation. 1991c. "Modelling the Low Income Sector of the HAP Dry Cleaning Industry." Memorandum from Carolyn Norris and Kim Kepford to U.S. Environmental Protection Agency, Chemical and Petroleum Branch. March 1.

Safety-Kleen. 1986. Analysis of Dry Cleaning Industry.

Sherer, F.M. 1980. Industrial Market Structure and Economic Performance. 2nd ed., Chicago: Rand McNally College Publishing Company.

Sluizer, Bud. 1990. Institute of Industrial Launderers, March 12, 1990. Personal communication with Brenda L. Jellicorse, Research Triangle Institute.

Steinhoff, Dan and Burgess, John F. 1989. Small Business Management Fundamentals. 5th ed.. New York: McGraw-Hill.

Tax Foundation 1991. Facsimile from Gregg Leong, The Tax Foundation, Washington, DC.

Topel, Robert H. 1984. "Equilibrium Earnings, Turnover, and Unemployment: New Evidence." Journal of Labor Economics 2(4):500-522.

Torp, Richard. 1990. Coin Laundry Association, February 27, 1990. Personal communication with Brenda L. Jellicorse, Research Triangle Institute.

Torp, Richard. 1991. International Fabricare Institute. February 8, 1991. Personal communication with Kristy Mathews, Research Triangle Institute.

U.S. Department of Commerce, Bureau of Census. 1985. 1982 Census of Service Industries, Miscellaneous Subjects. Washington, DC: U.S. Government Printing Office. December.

U.S. Department of Commerce, Bureau of Census. 1988. County and City Data Book 1988. Washington, DC: U.S. Government Printing Office.

U.S. Department of Commerce, Bureau of the Census. 1989a. Statistical Abstract of the United States. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce, Bureau of Census. 1990a. 1987 Census of Service Industries, Non Employer Statistics Series. Washington, DC: U.S. Government Printing Office. March.

U.S. Department of Commerce, Bureau of Census. 1990b. 1987 Census of Service Industries, Subject Series. Washington: U.S. Government Printing Office. April.

U.S. Department of Commerce, Bureau of the Census. 1990c. 1987 Census of Service Industries, Geographic Area Series. Washington, D.C.: Government Printing Office.

U.S. Department of Commerce, Bureau of the Census. 1990d. Statistical Abstract of the United States. Washington, DC: U.S. Government Printing Office.

U.S. Department of Commerce, Bureau of the Census. 1991. Current Population Surveys Branch, April 15, 1991. Personal communication with Kristy Mathews, Research Triangle Institute.

U.S. Department of Commerce, Bureau of Economic Analysis. 1989b. Survey of Current Business. Washington, DC: U.S. Government Printing Office. March.

U.S.Department of Labor, Bureau of Labor Statistics, 1991a. 1980-1989 Consumer Expenditure Survey. Washington, DC: United States Government Printing Office.

U.S. Department of Labor, Bureau of Labor Statistics. 1991b. Employment and Earnings. Washington, DC: U.S. Government Printing Office. April.

U.S. Environmental Protection Agency. 1982. "EPA Implementation of the Regulatory Flexibility Act." Memorandum from Anne M. Gorsuch to EPA Administrators and Office Directors. February 9.

Van Horne, James C. 1980. Financial Management and Policy. 5th ed. Englewood Cliffs: Prentiss Hall.

TABLE A-1. BASELINE FINANCIAL STATEMENTS OF DRY CLEANING FIRMS IN BELOW-AVERAGE FINANCIAL CONDITION

Company Sales Range	< $25K	$25-50K	$50-75K	$75-100K	> $100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods sold	8,288	18,948	31,320	43,848	171,746
gross profit	9,448	21,597	35,701	49,981	195,764
other expenses and taxes	9,270	21,192	35,030	49,042	192,090
net profit	177	405	670	938	3,675
Balance Sheet					
cash	315	720	1,190	1,666	6,526
accounts receivable	1,225	2,799	4,627	6,478	25,373
cash plus accounts receivable	1,539	3,519	5,817	8,144	31,900
other current assets	924	2,112	3,490	4,887	19,140
total current assets	2,463	5,630	9,308	13,031	51,039
fixed assets	7,698	17,597	29,087	40,722	159,500
other non-current assets	2,255	5,154	8,520	11,928	46,718
total assets	12,415	28,382	46,915	65,680	257,257
accounts payable	665	1,520	2,513	3,518	13,779
loans payable	58	132	218	306	1,198
notes payable	795	1,817	3,004	4,206	16,474
other current liabilities	1,561	3,569	5,899	8,259	32,349
total current liabilities	3,079	7,039	11,635	16,289	63,800
non-current liabilities	4,370	9,990	16,514	23,119	90,554
total liabilities	7,449	17,029	28,149	39,408	154,354
net worth	4,966	11,353	18,766	26,272	102,903
capital	9,336	21,343	35,280	49,392	193,457
Total Liabilities and Net Worth	12,415	28,382	46,915	65,680	257,257

TABLE A-2. BASELINE FINANCIAL STATEMENTS OF DRY CLEANING FIRMS IN AVERAGE FINANCIAL CONDITION

Company Sales Range	< $25K	$25-50K	$50-75K	$75-100K	> $100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods sold	7,786	17,799	29,422	41,191	161,337
gross profit	9,950	22,746	37,599	52,638	206,173
other expenses and taxes	8,709	19,908	32,907	46,070	180,448
net profit	1,241	2,838	4,691	6,568	25,725
Balance Sheet					
cash	1,548	3,540	5,851	8,191	32,083
accounts receivable	650	1,486	2,457	3,439	13,471
cash plus accounts receivable	2,198	5,026	8,308	11,630	45,554
other current assets	958	2,190	3,620	5,069	19,853
total current assets	3,157	7,216	11,928	16,699	65,407
fixed assets	3,191	7,295	12,057	16,880	66,117
other non-current assets	2,207	5,045	8,340	11,676	45,732
total assets	8,555	19,556	32,325	45,255	177,257
accounts payable	394	900	1,487	2,082	8,154
loans payable	34	78	129	181	709
notes payable	471	1,076	1,778	2,489	9,749
other current liabilities	924	2,112	3,491	4,888	19,144
total current liabilities	1,822	4,165	6,885	9,639	37,755
non-current liabilities	2,105	4,811	7,952	11,133	43,606
total liabilities	3,927	8,976	14,837	20,772	81,361
net worth	4,628	10,579	17,488	24,483	95,895
capital	6,732	15,391	25,440	35,616	139,501
Total Liabilities and Net Worth	8,555	19,556	32,325	45,255	177,257

TABLE A-3. BASELINE FINANCIAL STATEMENTS OF DRY CLEANING FIRMS IN ABOVE-AVERAGE FINANCIAL CONDITION

Company Sales Range	< $25K	$25-50K	$50-75K	$75-100K	> $100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods sold	7,284	16,651	27,524	38,533	150,928
gross profit	10,452	23,894	39,497	55,296	216,582
other expenses and taxes	8,147	18,624	30,784	43,098	168,806
net profit	2,305	5,270	8,713	12,198	47,776
Balance Sheet					
cash	1,379	3,152	5,211	7,295	28,574
accounts receivable	267	611	1,010	1,414	5,538
cash plus accounts receivable	1,646	3,763	6,221	8,709	34,112
other current assets	753	1,720	2,844	3,981	15,594
total current assets	2,399	5,484	9,065	12,691	49,706
fixed assets	2,352	5,377	8,887	12,442	48,732
other non-current assets	2,344	5,358	8,857	12,399	48,566
total assets	7,095	16,218	26,808	37,532	147,004
accounts payable	102	232	384	537	2,105
loans payable	9	20	33	47	183
notes payable	121	278	459	643	2,517
other current liabilities	238	545	901	1,262	4,942
total current liabilities	470	1,075	1,777	2,488	9,746
non-current liabilities	594	1,358	2,244	3,141	12,305
total liabilities	1,064	2,433	4,021	5,630	22,051
net worth	6,030	13,785	22,787	31,902	124,953
capital	6,624	15,143	25,031	35,043	137,258
Total Liabilities and Net Worth	7,095	16,218	26,808	37,532	147,004

TABLE A-4. FINANCIAL STATEMENTS OF FIRMS IN BELOW-AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE I

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	8,288	18,948	31,320	41,191	43,848
gross profit	9,448	21,597	35,701	49,981	195,764
other expenses and taxes	9,608	21,464	35,216	49,179	191,990
net profit	-161	133	485	801	3,774
Balance Sheet					
cash	-7,200	-6,582	-5,614	-5,667	-10,011
accounts receivable	1,225	2,799	4,627	6,478	25,373
cash plus accounts receivable	-5,975	-3,783	-987	811	15,362
other current assets	924	2,112	3,490	4,887	19,140
total current assets	-5,052	-1,671	2,504	5,697	34,502
fixed assets	15,212	24,899	35,891	48,055	176,037
other non-current assets	2,255	5,154	8,520	11,928	46,718
total assets	12,415	28,382	46,915	65,680	257,257
accounts payable	665	1,520	2,513	3,518	13,779
loans payable	58	132	218	306	1,198
notes payable	795	1,817	3,004	4,206	16,474
other current liabilities	1,561	3,569	5,899	8,259	32,349
total current liabilities	3,079	7,039	11,635	16,289	63,800
non-current liabilities	4,370	9,990	16,514	23,119	90,554
total liabilities	7,449	17,029	28,149	39,408	154,354
net worth	4,966	11,353	18,766	26,272	102,903
capital	9,336	21,343	35,280	49,392	193,457
Total Liabilities and Net Worth	12,415	28,382	46,915	65,680	257,257

TABLE A-5. FINANCIAL STATEMENTS OF FIRMS IN AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE I

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	7,786	17,799	29,422	41,191	161,337
gross profit	9,950	22,746	37,599	52,638	206,173
other expenses and taxes	10,667	21,754	34,560	47,789	183,915
net profit	-717	991	3,038	4,849	22,258
Balance Sheet					
cash	1,548	3,540	5,851	8,191	32,083
accounts receivable	650	1,486	2,457	3,439	13,471
cash plus accounts receivable	2,198	5,026	8,308	11,630	45,554
other current assets	958	2,190	3,620	5,069	19,853
total current assets	3,157	7,216	11,928	16,699	65,407
fixed assets	10,706	14,596	18,861	24,214	82,655
other non-current assets	2,207	5,045	8,340	11,676	45,732
total assets	16,069	26,858	39,129	52,589	193,794
accounts payable	394	900	1,487	2,082	8,154
loans payable	34	78	129	181	709
notes payable	2,091	2,650	3,245	4,071	13,315
other current liabilities	924	2,112	3,491	4,888	19,144
total current liabilities	3,443	5,740	8,353	11,221	41,322
non-current liabilities	8,863	11,378	14,071	17,728	58,479
total liabilities	12,306	17,118	22,424	28,949	99,801
net worth	3,764	9,740	16,705	23,640	93,993
capital	12,627	21,118	30,777	41,368	152,472
Total Liabilities and Net Worth	16,069	26,858	39,129	52,589	193,794

TABLE A-6. FINANCIAL STATEMENTS OF FIRMS IN ABOVE-AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE I

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	7,284	16,651	27,524	38,533	150,928
gross profit	10,452	23,894	39,497	55,296	216,582
other expenses and taxes	10,079	20,445	32,414	44,791	172,216
net profit	373	3,449	7,083	10,504	44,366
Balance Sheet					
cash	1,379	3,152	5,211	7,295	28,574
accounts receivable	267	611	1,010	1,414	5,538
cash plus accounts receivable	1,646	3,763	6,221	8,709	34,112
other current assets	753	1,720	2,844	3,981	15,594
total current assets	2,399	5,484	9,065	12,691	49,706
fixed assets	9,867	12,678	15,691	19,775	65,270
other non-current assets	2,344	5,358	8,857	12,399	48,566
total assets	14,609	23,520	33,612	44,865	163,542
accounts payable	102	232	384	537	2,105
loans payable	9	20	33	47	183
notes payable	1,716	1,827	1,903	2,199	6,026
other current liabilities	238	545	901	1,262	4,942
total current liabilities	2,065	2,625	3,221	4,045	13,256
non-current liabilities	7,341	7,913	8,352	9,725	27,152
total liabilities	9,406	10,538	11,574	13,770	40,408
net worth	5,204	12,982	22,039	31,095	123,134
capital	12,544	20,895	30,391	40,821	150,286
Total Liabilities and Net Worth	14,609	23,520	33,612	44,865	163,542

TABLE A-7. FINANCIAL STATEMENTS OF FIRMS IN BELOW-AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE II

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	8,288	18,948	31,320	43,848	171,746
gross profit	9,448	21,597	35,701	49,981	195,764
other expenses and taxes	11,059	22,663	35,828	50,140	193,894
net profit	-1,611	-1,065	-127	-160	1,871
Balance Sheet					
cash	-6,367	-5,893	-5,261	-5,114	-8,696
accounts receivable	1,225	2,799	4,627	6,478	25,373
cash plus accounts receivable	-5,142	-3,094	-634	1,364	16,678
other current assets	924	2,112	3,490	4,887	19,140
total current assets	-4,219	-982	2,856	6,251	35,818
fixed assets	14,379	24,209	35,539	47,502	174,722
other non-current assets	2,255	5,154	8,520	11,928	46,718
total assets	12,415	28,382	46,915	65,680	257,257
accounts payable	665	1,520	2,513	3,518	13,779
loans payable	58	132	218	306	1,198
notes payable	795	1,817	3,004	4,206	16,474
other current liabilities	1,561	3,569	5,899	8,259	32,349
total current liabilities	3,079	7,039	11,635	16,289	63,800
non-current liabilities	4,370	9,990	16,514	23,119	90,554
total liabilities	7,449	17,029	28,149	39,408	154,354
net worth	4,966	11,353	18,766	26,272	102,903
capital	9,336	21,343	35,280	49,392	193,457
Total Liabilities and Net Worth	12,415	28,382	46,915	65,680	257,257

TABLE A-8. FINANCIAL STATEMENTS OF FIRMS IN AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE II

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	7,786	17,799	29,422	41,191	161,337
gross profit	9,950	22,746	37,599	52,638	206,173
other expenses and taxes	11,938	22,804	35,096	48,630	185,535
net profit	-1,988	-59	2,503	4,008	20,638
Balance Sheet					
cash	1,548	3,540	5,851	8,191	32,083
accounts receivable	650	1,486	2,457	3,439	13,471
cash plus accounts receivable	2,198	5,026	8,308	11,630	45,554
other current assets	958	2,190	3,620	5,069	19,853
total current assets	3,157	7,216	11,928	16,699	65,407
fixed assets	9,872	13,907	18,509	23,660	81,339
other non-current assets	2,207	5,045	8,340	11,676	45,732
total assets	15,236	26,168	38,777	52,035	192,478
accounts payable	394	900	1,487	2,082	8,154
loans payable	34	78	129	181	709
notes payable	1,911	2,502	3,169	3,951	13,032
other current liabilities	924	2,112	3,491	4,888	19,144
total current liabilities	3,263	5,591	8,277	11,101	41,038
non-current liabilities	8,114	10,758	13,754	17,231	57,296
total liabilities	11,377	16,349	22,031	28,332	98,334
net worth	3,859	9,819	16,746	23,703	94,145
capital	11,973	20,577	30,500	40,934	151,440
Total Liabilities and Net Worth	15,236	26,168	38,777	52,035	192,478

TABLE A-9. FINANCIAL STATEMENTS OF FIRMS IN ABOVE-AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE II

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	7,284	16,651	27,524	38,533	150,928
gross profit	10,452	23,894	39,497	55,296	216,582
other expenses and taxes	11,353	21,497	32,951	45,635	173,841
net profit	-901	2,397	6,546	9,661	42,741
Balance Sheet					
cash	1,379	3,152	5,211	7,295	28,574
accounts receivable	267	611	1,010	1,414	5,538
cash plus accounts receivable	1,646	3,763	6,221	8,709	34,112
other current assets	753	1,720	2,844	3,981	15,594
total current assets	2,399	5,484	9,065	12,691	49,706
fixed assets	9,033	11,989	15,338	19,222	63,954
other non-current assets	2,344	5,358	8,857	12,399	48,566
total assets	13,776	22,831	33,260	44,312	162,226
accounts payable	102	232	384	537	2,105
loans payable	9	20	33	47	183
notes payable	1,539	1,681	1,828	2,081	5,747
other current liabilities	238	545	901	1,262	4,942
total current liabilities	1,888	2,479	3,147	3,927	12,977
non-current liabilities	6,592	7,294	8,036	9,228	25,970
total liabilities	8,481	9,773	11,182	13,156	38,947
net worth	5,295	13,058	22,077	31,156	123,279
capital	11,888	20,352	30,113	40,384	149,249
Total Liabilities and Net Worth	13,776	22,831	33,260	44,312	162,226

TABLE A-10. FINANCIAL STATEMENTS OF FIRMS IN BELOW-AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE III

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	8,288	18,948	31,320	43,848	171,746
gross profit	9,448	21,597	35,701	49,981	195,764
other expenses and taxes	11,108	22,772	36,151	50,489	194,835
net profit	-1,660	-1,175	-450	-509	930
Balance Sheet					
cash	-6,386	-5,931	-5,360	-5,163	-8,747
accounts receivable	1,225	2,799	4,627	6,478	25,373
cash plus accounts receivable	-5,162	-3,132	-733	1,315	16,626
other current assets	924	2,112	3,490	4,887	19,140
total current assets	-4,238	-1,020	2,758	6,202	35,766
fixed assets	14,399	24,248	35,637	47,551	174,773
other non-current assets	2,255	5,154	8,520	11,928	46,718
total assets	12,415	28,382	46,915	65,680	257,257
accounts payable	665	1,520	2,513	3,518	13,779
loans payable	58	132	218	306	1,198
notes payable	795	1,817	3,004	4,206	16,474
other current liabilities	1,561	3,569	5,899	8,259	32,349
total current liabilities	3,079	7,039	11,635	16,289	63,800
non-current liabilities	4,370	9,990	16,514	23,119	90,554
total liabilities	7,449	17,029	28,149	39,408	154,354
net worth	4,966	11,353	18,766	26,272	102,903
capital	9,336	21,343	35,280	49,392	193,457
Total Liabilities and Net Worth	12,415	28,382	46,915	65,680	257,257

TABLE A-11. FINANCIAL STATEMENTS OF FIRMS IN AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE III

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	7,786	17,799	29,422	41,191	161,337
gross profit	9,950	22,746	37,599	52,638	206,173
other expenses and taxes	11,991	22,922	35,441	48,990	186,487
net profit	-2,041	-177	2,158	3,648	19,686
Balance Sheet					
cash	1,548	3,540	5,851	8,191	32,083
accounts receivable	650	1,486	2,457	3,439	13,471
cash plus accounts receivable	2,198	5,026	8,308	11,630	45,554
other current assets	958	2,190	3,620	5,069	19,853
total current assets	3,157	7,216	11,928	16,699	65,407
fixed assets	9,892	13,945	18,607	23,709	81,391
other non-current assets	2,207	5,045	8,340	11,676	45,732
total assets	15,256	26,207	38,875	52,084	192,530
accounts payable	394	900	1,487	2,082	8,154
loans payable	34	78	129	181	709
notes payable	1,916	2,510	3,190	3,962	13,043
other current liabilities	924	2,112	3,491	4,888	19,144
total current liabilities	3,267	5,600	8,298	11,112	41,049
non-current liabilities	8,131	10,792	13,843	17,274	57,342
total liabilities	11,399	16,392	22,141	28,386	98,391
net worth	3,857	9,815	16,735	23,698	94,139
capital	11,988	20,607	30,577	40,972	151,481
Total Liabilities and Net Worth	15,256	26,207	38,875	52,084	192,530

TABLE A-12. FINANCIAL STATEMENTS OF FIRMS IN ABOVE-AVERAGE FINANCIAL CONDITION: REGULATORY ALTERNATIVE III

Company Sales Range	$0-25K	$25-50K	$50-75K	$75-100K	$ >100K
Income Statement					
Sales	17,736	40,545	67,021	93,829	367,510
cost of goods	7,284	16,651	27,524	38,533	150,928
gross profit	10,452	23,894	39,497	55,296	216,582
other expenses and taxes	11,406	21,615	33,295	45,994	174,793
net profit	-954	2,279	6,202	9,302	41,790
Balance Sheet					
cash	1,379	3,152	5,211	7,295	28,574
accounts receivable	267	611	1,010	1,414	5,538
cash plus accounts receivable	1,646	3,763	6,221	8,709	34,112
other current assets	753	1,720	2,844	3,981	15,594
total current assets	2,399	5,484	9,065	12,691	49,706
fixed assets	9,053	12,027	15,437	19,271	64,006
other non-current assets	2,344	5,358	8,857	12,399	48,566
total assets	13,796	22,869	33,358	44,360	162,278
accounts payable	102	232	384	537	2,105
loans payable	9	20	33	47	183
notes payable	1,544	1,689	1,849	2,092	5,758
other current liabilities	238	545	901	1,262	4,942
total current liabilities	1,893	2,487	3,167	3,938	12,988
non-current liabilities	6,610	7,329	8,124	9,272	26,017
total liabilities	8,503	9,815	11,292	13,210	39,004
net worth	5,293	13,054	22,067	31,151	123,273
capital	11,903	20,382	30,191	40,423	149,290
Total Liabilities and Net Worth	13,796	22,869	33,358	44,360	162,278