AN EVALUATION OF THE EFFECTIVENESS AND COSTS
OF REGULATORY AND FISCAL POLICY INSTRUMENTS
ON PRODUCT PACKAGING

Final Report

ACKNOWLEDGMENTS

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Chapter 1: SUMMARY

1.1 Objective

Packaging is the largest single product class in municipal solid
waste, accounting for an estimated 40 percent of all municipal solid
waste, and costing over $1 billion in 1970 for collection and disposal.
About two-thirds of the weight of packaging solid waste is consumer
products packaging.

This study provides an evaluation of the costs and effectiveness
of two types of government policy instruments that may be used to
influence the quantity and composition of consumer products packaging
and the use of recycled materials in consumer product package manufacture.
The policy instruments considered are a regulation requiring the use of
recycled materials in packaging and several types of taxes on packaging.
The analysis provides an initial basis for policy decisions regarding
the desirability of these policy instruments as possible means for
reducing the generation of packaging wastes, increasing the use of
recycled materials in packaging manufacture, and reducing the natural
resource utilization of packaging.

1.2 Methodology

Four government policy instruments were selected for analysis--one
regulatory and three fiscal (price) incentives. The selected policy
instruments were:

(a) A regulation requiring the use of recycled materials in all
consumer products package manufacture, by share of package
weight;

(b) A tax on the weight of consumer products packaging;

(c) A tax on the weight of consumer products packaging with an
exemption for recycled materials (i.e., a tax on the weight
of virgin materials in a package); and

(d) A tax on all rigid containers used to package consumer products.

All selected policy instruments have the effect of changing the cost and
hence the use of packaging materials; however, the impacts vary depending
on the packaging material and consumer product application.

The impact of any policy instrument on the cost of packaging materials
is calculated either directly--if the instrument is a tax on packaging

weight or containers--or indirectly when the resource costs of packaging
are affected. In the first case, 1970 data on the weight of packaging
and cost per unit of weight or per container for each of nine packaging
materials in each of 30 consumer products was used to develop revised
estimates of packaging cost after application of the tax. Data on the
virgin material content and costs of each packaging material were used
to estimate the impact on the cost of packaging when the policy instrument
altered the resource costs of packaging.

Estimates of the demand and supply of recycled materials from postcon-
sumer waste for each material were based, respectively, on the cost of
virgin materials inputs to each packaging material and on the cost of
operation of recycling facilities of varying capacities. It was assumed
that properly sorted and graded recycled materials would be perfect sub-
stitutes for virgin materials up to a technological limit depending on
the package material. This procedure provides only a first approximation
of this market since complete data on the economics of recovery, transpor-
tation, and reuse of recyclable materials are not available.

Induced changes in the utilization of packaging by material and consumer
product due to higher packaging costs were estimated from statistical analy-
ses of the responsiveness (elasticity of substitution) of the use of packaging
by material type in each of the 30 consumer product applications to changes
in the relative cost of the materials.

Changes in the quantity demanded of each consumer product were based
on estimates of the share of product price accounted for by packaging,
estimates of the increases in price due to application of the policy
instrument, and estimates of the elasticity of demand for each consumer
product.

The analysis as described above is incorporated in a programmed model
which uses 1970 values as a base. The model, after estimating changes in
the utilization of packaging and in the demand for each consumer product,
provides an estimate of the cost and effectiveness of each policy instrument.

The primary measure of the cost of a policy instrument is based on the
increase in consumer product price caused by a policy instrument. The
measure employed is "losses in consumer surplus" which may be interpreted
as the maximum amount of money that consumers would offer in order not to
have an increase in consumer products prices. For an example, suppose

one impact of a 1-cent-per-pound tax on packaging was a 1.2-percent increase in the price of canned goods. Suppose further that consumers would be willing to pay up to $73 million annually to avoid the price increase. The $73 million is then taken to represent the cost of the tax to consumers of canned foods. This cost is developed from estimates of the price impact and elasticity of demand for each of the 30 consumer products, using 1970 expenditures before the application of the policy instrument as the baseline.

With currently available data, there is no completely satisfactory way to measure the dollar value of the benefits to society of changes in the quantity and composition of packaging or of the use of recycled materials in package manufacture. The measures used in this study are, therefore, labeled as measures of effectiveness. Primary emphasis is on physical quantities.

The measures of effectiveness employed were:

(a) Reductions in consumer product packaging solid waste generation,

(b) Increases in the consumption of postconsumer waste materials in consumer product package manufacture,

(c) Reductions in the primary raw materials and energy used in consumer product package manufacture.

These reductions, measured in physical units* (ref. 1), were divided into the estimate of cost to provide a relative measure across policy instruments of the cost-effectiveness of each instrument.

1.3 Findings

A summary of the estimated effectiveness and costs of the four policy instruments at alternative rates is shown in table 1. Within a policy instrument, effectiveness is directly related to the rate, higher rates yielding higher values for effectiveness.

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*All units of weight presented in this study, unless specifically identified otherwise, are in metric measures. Defined as the Système International d' Unités (SI), the basic unit of mass (weight) is the kilogram (ref. 1). All other units of weight are officially decribed as multiples or fractions of a kilogram.

Factors for converting from metric to currently conventional U.S. measures of weight are shown below:

To convert from:	to:	Multiply by:
tonne	ton (short, 2,000 pounds)	1.102
kilogram	pound	2.205
kilogram	tonne	$1(10^{-3})$

"Tonne" is used to distinguish the metric "ton" (1,000 kg) from the English ton (2,000 pounds).

Table 1. Summary of the effectiveness and costs of regulatory and fiscal policy instruments for control of product packaging

	Recycling regulation (percentage recycled materials as a share of packaging weight)			Tax rate (dollars per tonne of packaging)			
	10	20	30	$10	$22	$50	$100
Effectiveness							
Reductions in solid waste generation (thousand tonnes)	87	173	259	201	441	988	1,930
Increases in the consumption of postconsumer waste materials (thousand tonnes)	2,774	5,529	8,272	0	0	0	0
Reductions in raw materials consumption (thousand tonnes)	4,191	8,352	12,486	273	597	1,348	2,627
Reductions in energy utilization (equivalent million kWh)	247	494	740	529	1,157	2,596	5,078
Cost (million dollars)							
Losses in consumer surplus	$216	$431	$645	$274	$598	$1,338	$2,599
Tax payments (million dollars)	0	0	0	$273	$597	$1,337	$2,582

	Tax on packaging with exemption for recycled materials (dollars per tonne)				Tax rate (cents per container)			
	$10	$22	$50	$100	0.5	1.0	1.5	2.0
Effectiveness								
Reductions in solid waste generation (thousand tonnes)	198	395	783	1,402	1,549	2,317	2,766	3,183
Increases in the consumption of postconsumer waste materials (thousand tonnes)	3,894	5,911	8,742	9,703	0	0	0	0
Reductions in raw materials consumption (thousand tonnes)	4,880	7,660	12,688	15,744	1,950	3,019	3,719	4,413
Reductions in energy utilization (equivalent million kWh)	518	1,031	2,050	3,675	3,897	5,956	7,287	8,530
Cost (million dollars)								
Losses in consumer surplus	$268	$531	$1,062	$1,906	$1,652	$3,160	$4,685	$6,200
Tax payments (million dollars)	$237	$472	$913	$1,670	$1,651	$3.138	$4,622	$6,073

(Source: Research Triangle Institute.)

Comparing across policy instruments, the tax on containers--being of a significant magnitude and affecting heavy, resource intensive packaging--induces the largest reductions in solid waste generation and energy utilization of the policy instruments examined. The regulation requiring the use of recycled materials in packaging manufacture and the tax on packaging with an exemption dictate, in the first case and induce in the second, substantial increases in the consumption of postconsumer waste* and reductions in raw materials consumption. The tax on packaging has about the same effectiveness in reducing solid waste generation and energy utilization as the tax on packaging with an exemption for recycled material. But the tax without an exemption is substantially less effective in reducing raw materials consumption and ineffective in increasing the consumption of postconsumer waste material.

Ideally, the evaluation of each policy instrument would involve the estimation of the dollar value of the benefits and costs to society of alterations in the composition or amount of packaging. However, since there are not currently satisfactory dollar measures of the value to society of the effectiveness of each policy instrument, such an ideal comparison of costs and benefits is not possible. However, some insight regarding the relative cost and effectiveness of each policy instrument can be gained by dividing the cost by each value of effectiveness. This has been done in table 2 using one average value for each policy instrument since the values are not very sensitive to the various rates.

Reductions in solid waste generation and energy utilization are achieved at the low cost per tonne and per thousand kilowatt hour with taxes. Increases in the consumption of postconsumer waste materials and reductions in raw materials consumption are achieved at the lowest cost per tonne for the regulation requiring the use of recycled materials in packaging manufacture and for the tax on packaging with an exemption for recycled materials. Overall, the tax with an exemption for recycled materials provides more effectiveness at lower cost than any of the other three policy instruments.

Since tax payments increase the cost of packaging manufacture and are assumed to be passed along to consumers of the final product, they

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*The terms "postconsumer waste" or "municipal waste" are used synonymously to distinguish this waste from that generated in production, which is already frequently recycled.

Table 2. Summary of the costs per unit of effectiveness
(losses in consumer surplus per unit of effectiveness*)

Measure of effectiveness	Regulation requiring the use of recycled materials	Tax on packaging	Tax on packaging with an exemption for recycled materials	Tax on containers
Reductions in solid waste generation (dollars per tonne)	$2,485	$1,355	$1,345	$1,365
Increases in the consumption of postconsumer waste materials (dollars per tonne)	80	--	90	--
Reductions in raw materials consumption (dollars per tonne)	50	1,000	70	1,050
Reductions in energy utilization (dollars per thousand kWh)	875	515	515	530

*Approximate values, not additive.

contribute to the increases in the price of the packaged consumer product. As discussed in section 1.2 above, the price increases are used to calculate the losses in consumer surplus. For consumers of packaged products, these losses in consumer surplus represent the costs of the policy instrument. From the perspective of the entire society, however, tax payments do not represent losses to society but are redistributions of income from consumers of the affected products to government. The so-called deadweight cost to society of a tax is the difference between the losses in consumer surplus and the total tax payments. Using this measure of cost, taxes become an even more attractive means of controlling packaging than direct regulation.

These results are not surprising since taxes can in theory provide improvements in environmental quality at minimum cost to society because they permit adjustments by individuals through the operation of the market. The case for regulation over taxation usually rests on the predictability and swiftness with which regulations can produce results.

Throughout this discussion, informational and enforcement costs have been ignored. These costs, if known, should be added to the costs of a policy instrument. However, the required information is not available at this time. It is likely, however, that the informational costs of a tax

on packaging or containers would be the lowest of the four policy instruments. Both a regulation to use recycled materials and a tax on packaging, with an exemption for recycled materials, are likely to have higher informational and enforcement costs. Of the two policy instruments, the regulation is likely to have the higher costs due to the typically higher enforcement costs of regulation.

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1. The International System of Units, Physical Constants, and Conversion Factors, E. A. Mechtly, Office of Technology Utilization, National Aeronautics and Space Administration, Washington, D.C., 1969.

Chapter 2: Introduction

2.1 Background

In 1971, an estimated 113 million tonnes of municipal solid waste were generated, or about 1.51 kilograms daily per capita.* The costs of solid waste collection and disposal vary from city to city, depending on such factors as the quality and frequency of the collection service and the mode and quality of disposal. On a national average, however, unit costs of solid waste management are estimated to be $19.80 per tonne for collection and $4.40 per tonne for disposal. Using these values, and assuming that 95 percent of the estimated generation of solid waste were collected, the total cost for collection and disposal of the 113 million tonnes (table 3) of municipal solid waste in 1971 was about $2.6 billion*.

A complete accounting of the costs to society of solid waste generation, collection, and disposal, would not, however, be limited to those monetary measures discussed above. Such a complete accounting would also include the external or social costs which are not incorporated as a part of product prices, and therefore not borne directly by consumers, but which instead are borne by society as a whole and sometimes by future generations. These social costs are found when solid waste is generated, collected, and/or disposed of.

The generation of solid wastes is evidence of the consumption of natural resources. Most resources are of a nonreplenishable nature (with the notable exception of timber used to make paper packaging); hence, it is conceivable that continued extraction of mineral resources at current rates may preempt their use by all future generations. Under such conditions, government intervention may be desirable in order to represent the interests of future generations.

The collection of solid wastes frequently results in increases in noise levels and congestion caused by sanitation vehicles plus reductions in the amenities dimension of the environment when refuse containers are lined up at curbside for collection.

The disposal of solid wastes may result in increases in air, water, or land pollution. For example, air pollution may be generated during

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*From data developed by the Environmental Protection Agency.

Table 3. Municipal solid waste generation by material
(tonnes per year)

Material	1970*	1971+
Paper	34.2	35.5
Glass	10.6	11.0
Metals	(10.3)	(10.7)
Ferrous	9.3	9.6
Aluminum	0.7	0.7
Other nonferrous	0.3	0.4
Plastics	3.5	3.8
Rubber and leather	2.9	3.0
Textiles	1.6	1.6
Wood	4.0	4.2
Food wastes	19.3	20.0
Product totals	(86.4)	(89.8)
Yard wastes	21.1	21.9
Misc. inorganics	1.6	1.6
Total waste	109.1	113.3

*Assumes 3.5 percent annual growth during 1970-71.
+Environmental Protection Agency.

Table 4. Packaging solid wastes
(million tonnes)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Average annual growth rate (percent)
Consumer products packaging	16.6	17.8	17.9	18.7	19.6	19.8	20.9	21.8	23.2	24.3	25.3	26.9	27.8	4.39
Shipping* packaging	10.1	11.4	11.0	11.3	11.7	12.3	12.8	13.5	14.3	14.3	15.1	15.9	15.8	3.80
Total packaging	26.7	29.2	28.9	30.0	31.3	32.1	33.7	35.3	37.5	38.6	40.4	42.8	43.6	4.17

*Based on recycling of corrugated boxes at 26 percent annual production, estimated by Midwest Research Institute, in Salvage Markets for Materials in Solid Waste. Prepared for the U.S. Environmental Protection Agency. Washington, U.S. Government Printing Office, 1972.

Source: Compiled by Research Triangle Institute.

refuse incineration. Water pollution may result if leaching occurs in landfills or if wastes are dumped into the oceans. Land pollution may result from the use of estuarine land, marshland,* or other land for waste disposal, from the optic and olfactory offenses associated with disposal sites, or from the littering of wastes over the countryside.

Discarded packaging is an important component of the waste stream because of its large proportion of the total solid wastes generated and because the packaging industry consumes large proportions of several materials. The packaging wastes from industrial, commercial, and residential sources were an estimated 43.6 million tonnes in 1970 (table 4) which represented about 40 percent of all municipal solid waste generated. Using the average collection and disposal cost estimates presented above, 1970 solid waste management costs for all packaging totaled $1.1 billion.

Consumer products packaging discarded to solid waste--the primary focus of this study--represents about 64 percent of all packaging wastes. In 1970, consumer products packaging waste amounted to an estimated 27.8 million tonnes and cost $673 million for collection and disposal. On a per capita basis, the amount of consumer products packaging entering solid waste was an estimated 131 kilograms annually, or 0.36 kilograms daily.

Discarded consumer products packaging contributes to the social costs incurred by solid waste generation, collection, and disposal. For example, the resource utilization (and loss) associated with 1970 consumer products packaging is depicted in table 5.

Since 1958, the weight of consumer products packaging has increased at an average annual rate of 4.39 percent. Continuation of this trend implies a doubling in packaging every 17 years and an increasing burden on the Nation's natural resources and solid waste systems. Current systems of production, distribution, and consumption encourage sustained growth in packaging.

Historically, packaging's primary and, frequently, only function was to provide protection for products on their way to the marketplace

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*Estuarine lands and marshlands frequently have a low value in private markets and, therefore, are particularly attractive from a financial viewpoint as disposal sites. Their value to society, however, may be understated by their market price due to the "public good" nature of their services.

Table 5. Natural resource consumption for consumer product packaging, 1970 (thousand tonnes)

Packaging material		Natural resource inputs
Paper	Raw materials	
	Wood pulp	6,406
	Chlorine	125
	Caustic	144
	Soda ash	77
	Sodium sulfate	317
	Lime	154
	Energy (equivalent million kWh)	23,497
Plastics	Raw materials	
	NLG feed stocks	1,766
	Field condensates	104
	Refinery feed stocks	1,082
	Energy (equivalent million kWh)	1,942
Glass	Raw materials	
	Glass sand	6,802
	Limestone	2,224
	Soda ash	2,214
	Feldspar	775
	Prepared saltcake	10
	Energy (equivalent million kWh)	26,334
Steel	Raw materials	
	Iron ore and agglomerates	5,905
	Coke	2,372
	Fluxes	1,360
	Mill cinder and scale	168
	Energy (equivalent million kWh)	19,374
Aluminum	Raw materials	
	Bauxite	2,266
	Lime makeup	62
	Soda ash makeup	250
	Petroleum coke	264
	Pitch	85
	Cryolite	22
	Aluminum trifloride	13
	Energy (equivalent million kWh)	8,859
Summary totals		
Weight of raw materials (thousand tonnes)		40,685
Amount of energy (equivalent million kWh)		80,005

Source: Developed by Research Triangle Institute from input-materials ratios presented elsewhere in this study.

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and from there to the consumers' homes. In today's industrial society
which utilizes extensive specialization and mass distribution of products,
packaging--especially consumer products packaging--is also a marketing
tool. One observer has stated the situation this way: "Affluence tends
to create needs for packaging beyond the direct requirements of product
perfection and distribution--a major factor in the steady per capita
increase in the consumption of many packaging materials. These needs
are frequently related to brand competition. Whether the consumer public
really, in fact, needs the extra packaging is irrelevant. The fact
remains that extra packaging often helps to move goods, and that is
certainly one of packaging's most legitimate functions" (ref. 1). The
result has been an absolute increase in the quantity of total packaging
and an increase in the relative use of packaging (measured on a weight
basis) for most consumer products.

This study examines several policies designed to reduce the solid
waste management burdens posed by the growth of consumer products
packaging.

As a subset of municipal solid wastes, packaging wastes may be a
reasonable classification for development of specific solid waste policies.
This is due not only to their significant proportion of solid wastes
but also because they represent a category for which a policy may have
predictable solid waste effects. Intrapackaging substitutions appear
significantly more extensive than substitution between packaging and
other elements in an industry's production function; therefore, a
specific policy on packaging would not be expected to increase the
generation of nonpackaging wastes. Such a policy, however, should not
preclude other efforts to deal with the solid waste problem in general
or with other specific subsets.

2.2 Rationale for Packaging Control

Under the assumptions of perfect competition, prices established
in free markets convey all the information necessary to producers and
consumers such that resources are allocated in a manner so as to
maximize economic welfare.

This assumption is not warranted, however, if the costs that
producers face for packaging (private costs) understate the value
of packaging to society (social cost). In such a case, packaged products

are underpriced and, assuming that demand varies inversely with price, more packaged products are produced than is socially optimal. Differences between the marginal social cost and the marginal private cost of pack-aging may exist because of the nonmarket costs that society must bear today and perhaps in the future. These costs may arise in the production, distribution, and/or disposal of packaging.

For example, the private costs of packaging do not reflect the costs imposed on society in the collection and disposal of solid waste. Furthermore, the long-run value to society of the natural resources used to make packaging may not be fully registered in the private costs of these resources either because of ignorance of the effects of current consumption rates or because the demand of future generations is not fully manifested in today's markets. When a divergence exists between private and social costs, government intervention may be justifiable when it is unlikely that private negotiation between the parties that impose the costs and those that bear them will internalize all social costs, and when the transactions (administrative and enforcement costs) of the intervention are not so large that the status quo implies lower costs.

Government intervention may take several forms. However, two policy instruments, regulation and taxation, are most commonly proposed. For example, assume in figure 1(A) that the demand for packaging (derived from the demand for packaged consumer goods) is D and the supply of packaging (representing only the private costs of production) is S. The market price is P_0 and the production of packaging per unit of time is Q_0. Now assume that the difference between the private and social costs of packaging is a constant amount (C) per unit of product at all
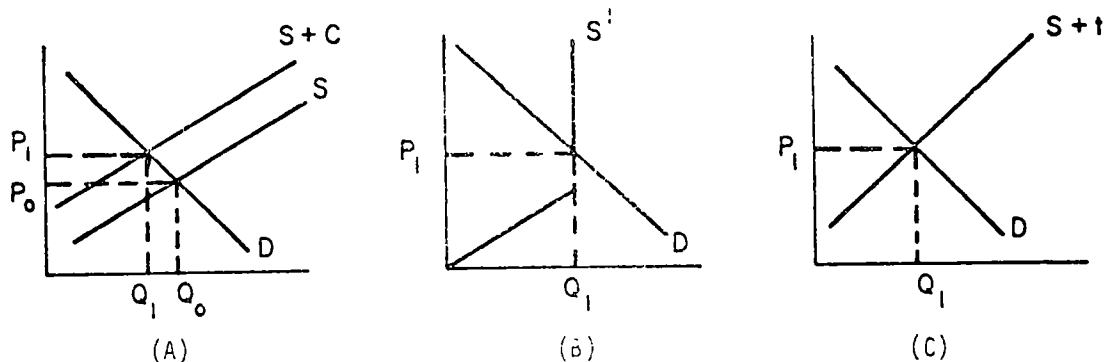
Figure 1. Hypothetical packaging market.

levels of production. Incorporation of these costs into the cost of packaging would cause a reduction in quantity demanded from Q_0 to Q_1. At this point, the price that producers are willing to pay for packaging would equate the marginal social benefit function (D) with the marginal social cost function (S+C).

Reductions in the production of packaging per unit of time from Q_0 to the socially optimum level Q_1 can be achieved by either regulation or taxation. Government could, for example, set a limit on packaging production at Q_1 (fig. 1(B)). The supply function would become perfectly inelastic at this point (S'). Producers would raise prices to P_1 in order to ration production. Alternatively, government could impose a tax of rate t equal to C, shifting the supply curve to S+t in figure 1(C), relying on the market adjustment to reduce production to Q_1.

Action on environmental problems, however, need not await and has not always awaited accurate estimates of social costs. In practice, such estimates are very difficult to develop. It may be reasonable to establish interim standards for environmental quality and to select a policy instrument that will achieve the standard at minimum cost to society.

2.3 Objectives of a Packaging Policy

In terms of the scope of this study, two general approaches exist for reducing the environmental problems associated with the generation, collection, and disposal of packaging solid waste. These approaches, which can be pursued separately or in concert, are (1) source reduction and (2) resource recovery.

Source reduction is designed to reduce the consumption of packaging materials generated per unit of time. This objective may be achieved by reducing the amount of packaging per dollar of consumer expenditures, by altering the distribution of consumer expenditures toward goods and services with less packaging, by directly reusing packaging (e.g., refillable bottles), or by reducing the absolute level of consumer expenditures. Figure 2 shows the packaging solid waste and consumer expenditure coordinates for consumer products for which packaging estimates have been prepared.

Resource recovery is the utilization of materials, energy, and
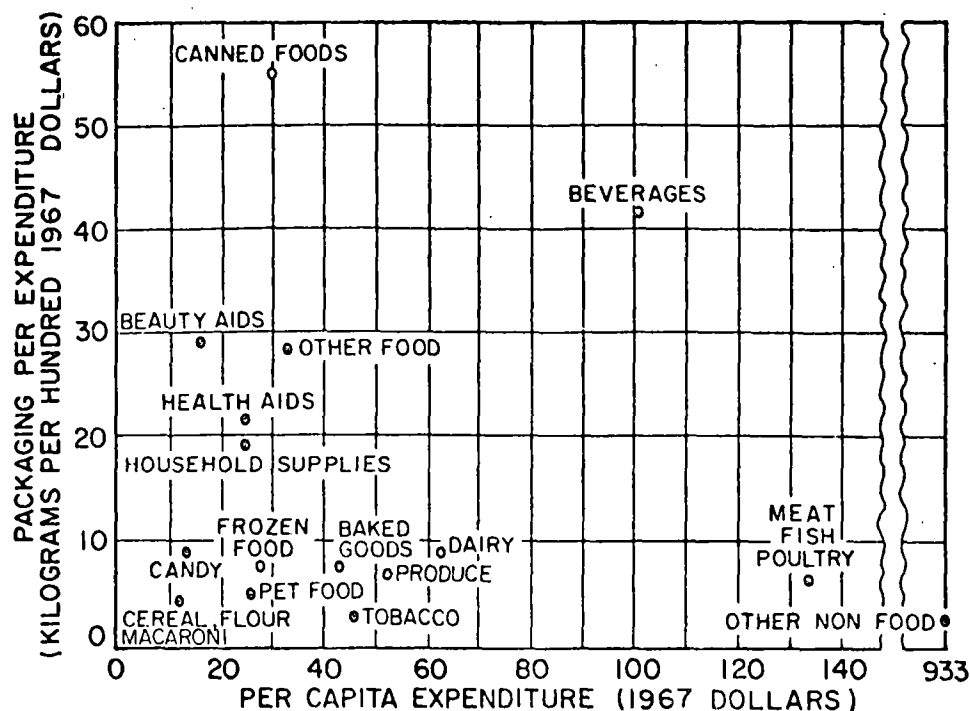
Figure 2. Packaging and expenditure
for consumer products, 1970.
(Source: Research Triangle Institute.)

products in solid wastes in the manufacture of packaging. It can include
such options as the reuse of waste materials in package fabrication
(e.g., cullet to make new glass bottles), or the use of packaging wastes
in some nonpackaging application (e.g., waste plastics combustion for
energy production).

2.4 Government Options for Meeting Objectives

Two broad classes of government legislative options exist for
promoting source reduction of packaging, or for promoting the reuse of
packaging or use of recycled materials in product packaging: (1) the
imposition of regulations on the amounts or types of product packaging
and (2) the establishment of fiscal (price) incentives on packaging
materials or finished packages.

Regulations include the use of bans and standards on product pack-
aging. Regulations may be an attractive option for meeting the objectives

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of a packaging policy because of the generally high predictability of their immediate impacts and because of the directness with which they attack a problem. The desirability of regulations generally must be evaluated in terms of the nature of the damages to be controlled, the ability to properly define the regulations, the equity of the regulation vis-a-vis other products which may produce comparable damage, the administrative costs, and enforceability (ref. 2).

Fiscal incentives include the use of taxes, credits, and subsidies to provide an economic motive for industry or consumers to behave in a desired manner. Fiscal incentives are attractive because of their broad nature and because they leave the market free to allocate resources within a new set of economic conditions. Fiscal incentives pose problems in determining the level of incentive and in predicting the magnitude and timing of their impacts.

Four possible government strategies were selected (ch. 4) as having potential for reducing the environmental problems caused by packaging. These are:

1.   A regulation requiring the use of recycled materials in package manufacture by share of package weight;

2.   A tax on packaging weight;

3.   A tax on packaging weight with an exemption for recycled materials;

4.   A tax on containers.

An analysis of each is presented in chapter 5.

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1.   R. L. Dickens. "The Future of Packaging for the Retail Market." Packaging Report, No. 6910, 1969, p. 4.

2.   Management and Behavioral Science Center. A Systems Approach to the Problems of Solid Waste and Litter. Philadelphia: Wharton School of Finance and Commerce, University of Pennsylvania, September 1971, p. 26.

Chapter 3: THE MATERIALS STRUCTURE OF CONSUMER PRODUCTS PACKAGING

3.1 Introduction

In order to evaluate alternative government strategies for promoting packaging source reduction or resource recovery, data and information describing the materials structure of packaging have been gathered and are presented in this chapter. Subsequent chapters provide an examination of the sensitivity of this structure to exogenous shifts in the relative prices of packaging materials and incorporate the evidence into a model designed to evaluate selected alternative government strategies.

3.2 Structure of Packaging

The "structure of packaging" is a complete accounting of the amounts of the various packaging materials used to package a consumer product. It identifies the proportions in which packaging materials are combined as inputs in the production of packaged products. In this analysis the usage of nine materials (table 6) in packaging 30 consumer products (table 7) was studied. Selection of the materials categories was based on homogeneity with respect to physical properties and packaging applications. The consumer product categories were defined to include products with similar packaging considerations. Data availability also dictated some of the material and product definitions. (See appendix A for a complete discussion of the data collection.)

The basic form of presentation of the structure of packaging is a 9 × 30 matrix detailing the amounts of the nine materials used in each of the 30 consumer products. Table 8 presents the data for 1970 measured in thousands of tonnes of material. Across each row, one reads the amounts of a given material utilized to package each consumer product. Reading down each column, one finds the amounts of each of the nine materials used to package a given consumer product. For example, column 1 shows that, in 1970, 207 thousand tonnes of flexible paper, 101 thousand tonnes of flexible plastics, and so forth, were used to package Baked Goods. The last row in the matrix is the total amount of consumer expenditures on each product in 1970 measured in millions of 1967 dollars.

Dividing each element in a column by the constant dollar expenditure, one obtains a set of coefficients that shows the use of each packaging material

Table 6. Packaging materials
(SIC number in parentheses)

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1. Flexible paper and paper closures
    Waxed and oiled paper (26412)
    Laminated paper (26415)
    Bag paper (26431)
    Glassine (2643)
    Paper closures (26451/81)

2. Flexible plastics and plastic closures
    Cellophane (2821)
    Polyethylene (2821)
    Polypropylene (2821)
    Plastic sheet (2821)
    Polystyrene and other thermoformed (2821)
    Plastic closures (30794/71)

3. Metal closures
    Metal caps (34616)
    Metal crowns (34617)

4. Flexible aluminum
    Aluminum foil--flexible (3352)

5. Rigid paper
    Folding boxes (2651)
    Setup boxes (2652)
    Sanitary food board (2654)
    Fibre cans, tubes (2655)

6. Rigid plastics
    Plastic bottles (3079)
    Plastic cups, jars, tubes, boxes, baskets (3079)

7. Glass
    Jars (3221)
    Refillable bottles (3221)
    Nonrefillable bottles (3221)

8. Steel
    Cans (3411)
    Aerosol cans (3411)

9. Rigid aluminum
    Aluminum plates (3352)
    Cans (3411)
    Collapsible tubes (3496)

Table 7. Consumer product categories

A. Food and kindred products
    Perishables--
      1. Baked Goods
         bread and rolls; crackers and cookies; sweet goods
      2. Dairy Products
         cheese; eggs; milk; butter
      3. Frozen Foods
         ice cream; frozen desserts and baked goods; meat, fish, poultry; prepared foods; vegetables, fruits, juices, drinks
      4. Fresh and Cured Meat
      5. Fresh and Cured Fish and Seafood
      6. Fresh and Cured Poultry
      7. Produce
    Beverages--
      8. Distilled Spirits
      9. Wine
     10. Beer
     11. Soft Drinks
     12. Prepared Beverages
         cocoa; coffee; tea; breakfast drinks
    Nonperishables and kindred products--
     13. Candy and Chewing Gum
     14. Canned Foods
         canned vegetables; canned meat, fish, and poultry; canned fruits and vegetables; canned soups; canned baby foods, canned juices and fruit drinks; canned milk
     15. Cereals, Flour, and Macaroni
     16. Pet Foods
     17. Tobacco Products
     18. Other Foods

B. General merchandise
    Household supplies--
     19. Soaps and Detergents
     20. Other Cleaning Supplies
         dry cleaners; laundry supplies; waxes and polishes; other cleaners and cleansers
     21. Pesticides
     22. Other Household Supplies
    Health and beauty aids--
     23. Packaged Medications
     24. Oral Hygiene Products
     25. Cosmetics and Hand Products
     26. Hair Products
     27. Shaving Products
     28. Other Beauty Aids
     29. Other Health Aids
    Other general merchandise--
     30. Other General Merchandise

Table 8. Packaging consumption by consumer product, 1970
(thousand tonnes)

	Baked Goods 1	Dairy Products 2	Frozen Foods 3	Fresh and Cured Meat 4	Fresh and Cured Fish and Seafood 5	Fresh and Cured Poultry 6
(1) Flexible paper and paper closures	206.57	311.26	124.20	575.44	13.34	79.02
(2) Flexible plastics and plastic closures	100.56	40.62	30.74	56.56	1.32	7.76
(3) Metal closures	5.17	7.62	3.08	14.33	0.36	2.00
(4) Flexible aluminum	7.68	5.64	36.92	0.44	0.02	0.06
(5) Rigid paper	390.91	715.05	235.06	839.61	19.61	115.21
(6) Rigid plastics	0.00	22.04	0.00	0.00	0.00	0.00
(7) Glass	0.00	14.61	0.00	0.00	0.00	0.00
(8) Steel	2.52	26.67	1.63	0.00	0.00	0.00
(9) Rigid aluminum	26.31	0.00	15.88	0.00	0.00	0.00
(10) Total (packaging materials)	740.23	1103.57	455.50	1486.40	36.45	204.07
(PCE) Personal consumption expenditures (million 1967 dollars)	8641.14	12681.57	5524.80	22800.98	525.02	3396.68

	Produce 7	Distilled Spirits 8	Wine 9	Beer 10	Soft Drinks 11	Prepared Beverages 12
(1) Flexible paper and paper closures	256.19	149.78	0.00	0.00	35.65	32.02
(2) Flexible plastics and plastic closures	96.12	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.00	0.00	169.10	40.19	1.81
(4) Flexible aluminum	0.00	0.00	0.00	2.81	0.00	1.72
(5) Rigid paper	389.64	149.60	0.00	130.08	68.40	105.33
(6) Rigid plastics	0.00	0.00	0.00	0.80	0.00	5.22
(7) Glass	0.00	496.75	284.93	1717.91	3239.35	847.40
(8) Steel	0.00	0.00	0.00	826.31	708.93	148.18
(9) Rigid aluminum	0.00	0.00	0.00	169.88	95.30	0.06
(10) Total (packaging materials)	741.95	796.13	284.93	3024.09	4187.92	1141.76
(PCE) Personal consumption expenditures (million 1967 dollars)	10267.41	7060.95	1288.77	6279.16	3148.74	2762.72

	Candy and Chewing Gum 13	Canned Foods 14	Cereals, Flour, and Macaroni 15	Pet Foods 16	Tobacco Products 17	Other Foods 18
(1) Flexible paper and paper closures	79.20	0.00	46.27	9.53	95.89	103.06
(2) Flexible plastics and plastic closures	63.91	0.00	10.76	0.00	26.22	46.03
(3) Metal closures	0.00	3.72	4.26	4.26	0.00	3.99
(4) Flexible aluminum	6.40	0.00	0.00	3.63	7.09	20.50
(5) Rigid paper	117.75	112.13	46.09	0.00	116.12	258.91
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	131.73
(7) Glass	0.00	913.15	0.00	0.00	0.00	1289.36
(8) Steel	0.00	2249.76	0.00	257.07	0.00	68.57
(9) Rigid aluminum	0.00	59.15	0.00	0.11	0.00	7.56
(10) Total (packaging materials)	267.31	3337.91	101.06	274.60	346.12	1929.71
(PCE) Personal consumption expenditures (million 1967 dollars)	2040.16	6107.80	2217.63	1031.09	4093.96	6709.09

	Soaps and Detergents 19	Other Cleaning Supplies 20	Pesticides 21	Other Household Supplies 22	Packaged Medications 23	Oral Hygiene Products 24
(1) Flexible paper and paper closures	35.67	15.02	0.00	15.88	33.57	15.06
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	4.17	0.64	3.27	6.53	2.90
(4) Flexible aluminum	1.81	0.00	0.00	0.00	0.34	0.27
(5) Rigid paper	480.36	15.88	0.00	133.00	0.00	0.00
(6) Rigid plastics	53.12	23.09	0.00	23.77	4.01	2.18
(7) Glass	0.00	9.87	5.11	25.57	222.01	98.62
(8) Steel	0.00	27.65	10.25	33.02	1.36	0.64
(9) Rigid aluminum	0.00	0.00	0.00	0.00	4.35	9.07
(10) Total (packaging materials)	570.76	96.28	16.00	236.50	273.98	128.74
(PCE) Personal consumption expenditures (million 1967 dollars)	1654.72	946.21	149.91	2454.32	1603.28	693.46

	Cosmetics and Hand Products 25	Hair Products 26	Shaving Products 27	Other Beauty Aids 28	Other Health Aids 29	Other General Merchandise 30
(1) Flexible paper and paper closures	21.50	26.76	12.97	16.70	72.67	1040.10
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	360.70
(3) Metal closures	4.17	5.17	2.56	2.69	14.06	15.69
(4) Flexible aluminum	0.00	0.00	0.00	0.91	1.27	15.97
(5) Rigid paper	0.00	0.00	0.00	209.02	217.10	1302.19
(6) Rigid plastics	18.33	22.86	11.02	9.07	10.43	272.61
(7) Glass	135.14	168.02	84.61	69.74	478.49	105.43
(8) Steel	0.00	45.72	11.41	72.49	2.01	1176.31
(9) Rigid aluminum	1.81	0.00	0.18	0.00	0.00	11.95
(10) Total (packaging materials)	180.95	268.54	122.34	370.61	746.92	4301.46
(PCE) Personal consumption expenditures (million 1967 dollars)	860.05	1218.75	625.26	476.45	3160.81	191036.60

	Total (consumer products) 31
(1) Flexible paper and paper closures	3417.51
(2) Flexible plastics and plastic closures	809.26
(3) Metal closures	316.80
(4) Flexible aluminum	118.66
(5) Rigid paper	6172.94
(6) Rigid plastics	610.32
(7) Glass	10202.84
(8) Steel	5671.89
(9) Rigid aluminum	401.62
(10) Total (packaging materials)	27758.11
(PCE) Personal consumption expenditures (million 1967 dollars)	317611.60

Source: Research Triangle Institute.

per unit of expenditure on a particular commodity. A column of coefficients details the material inputs used for packaging a specific product. The set of coefficient columns for all consumer products then provides a comprehensive structural description of consumer products packaging for a particular year. Table 9 presents the coefficients for 1970 measured in kilograms of material used per $100 of expenditure.

The last form used to identify the structure of packaging compares the relative importance of each material in packaging a consumer product. The data in table 10 measure the relative usage of each material in packaging the 30 products in 1970. The observations were derived by dividing the quantity of each material by the total quantity of packaging materials used in a given consumer product.

The three structural matrices described above were measured in physical units (weight). A corresponding set of value matrices was also developed. To make the comparisons of the value structure between years meaningful, it was necessary to deflate the dollars to a common price basis. Separate price indices were used for each of the materials to adjust all dollar measures to 1967 prices. Table 11 presents the absolute dollar value of the packaging inputs in 1970. The set of coefficients measuring the cost of packaging per dollar of expenditure on the consumer good are found in table 12; these coefficients represent packaging's contribution to product price. Expenditure on a given material relative to the total cost of packaging a product is provided in table 13.

The data core for this study was a set of six structural matrices for each year during the 1958-70 period. The following section summarizes some of the broad trends in the structure from a materials orientation. In appendix B, the information is presented from the perspective of the packaged product.

3.3 Trends in the Structure of Packaging

Projections of the 1980 total amount of consumer products packaging and the materials component have been developed to provide an initial estimate of the implications of the continuation of current trends. The approach employed and the projections developed are discussed below.

3.3.1 Methodology

Projecting the quantity of consumer packaging entering the solid waste stream in 1980 involved an analysis of trends in packaging requirements and

Table 9. Packaging consumption per expenditure by consumer product, 1970 (kilograms per $100 of expenditure)

	Baked Goods 1	Dairy Products 2	Frozen Foods 3	Fresh and Cured Meat 4	Fresh and Cured Fish and Seafood 5	Fresh and Cured Poultry 6
(1) Flexible paper and paper closures	2.36	2.65	2.25	2.52	2.30	2.33
(2) Flexible plastics and plastic closures	1.14	0.32	0.70	0.25	0.25	0.23
(3) Metal closures	0.06	0.00	0.06	0.06	0.07	0.06
(4) Flexible aluminum	0.09	0.04	0.07	0.00	0.00	0.00
(5) Rigid paper	4.42	5.64	4.29	3.60	3.69	3.39
(6) Rigid plastics	0.00	0.17	0.00	0.00	0.00	0.00
(7) Glass	0.00	0.12	0.00	0.00	0.00	0.00
(8) Steel	0.03	0.21	0.03	0.00	0.00	0.00
(9) Rigid aluminum	0.30	0.00	0.29	0.00	0.00	0.00
(10) Total (packaging materials)	8.37	9.02	8.24	6.52	6.54	6.01
(PCE) Personal consumption expenditures (million 1967 dollars)	8041.14	12661.57	5520.80	22806.96	575.42	3396.66

	Produce 7	Distilled Spirits 8	Wine 9	Beer 10	Soft Drinks 11	Prepared Beverages 12
(1) Flexible paper and paper closures	2.56	2.12	0.00	0.00	1.13	1.16
(2) Flexible plastics and plastic closures	0.44	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.00	0.00	2.69	1.28	0.07
(4) Flexible aluminum	0.00	0.00	0.00	0.04	0.00	0.06
(5) Rigid paper	3.79	2.12	0.00	2.20	2.17	3.81
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	0.19
(7) Glass	0.00	7.04	22.11	27.36	102.88	30.67
(8) Steel	0.00	0.00	0.00	13.16	22.51	5.36
(9) Rigid aluminum	0.00	0.00	0.00	2.71	3.03	0.00
(10) Total (packaging materials)	7.23	11.28	22.11	48.16	133.00	41.33
(PCE) Personal consumption expenditures (million 1967 dollars)	10267.41	7060.95	1288.77	6279.16	3148.74	2762.72

	Candy and Chewing Gum 13	Canned Foods 14	Cereals, Flour, and Macaroni 15	Pet Foods 16	Tobacco Products 17	Other Foods 18
(1) Flexible paper and paper closures	2.79	0.00	2.09	0.02	1.05	1.52
(2) Flexible plastics and plastic closures	2.25	0.00	0.48	0.00	0.29	0.68
(3) Metal closures	0.00	0.06	0.00	0.01	0.00	0.06
(4) Flexible aluminum	0.23	0.00	0.00	0.15	0.09	0.30
(5) Rigid paper	4.15	1.62	1.99	0.00	1.28	3.81
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	1.94
(7) Glass	0.00	14.85	0.00	0.00	0.00	18.99
(8) Steel	0.00	36.59	0.00	26.92	0.00	1.01
(9) Rigid aluminum	0.00	0.96	0.00	0.01	0.00	0.11
(10) Total (packaging materials)	9.41	54.29	4.56	26.62	2.71	20.42
(PCE) Personal consumption expenditures (million 1967 dollars)	2840.16	6147.80	2217.63	1031.49	9093.96	6789.09

	Soaps and Detergents 19	Other Cleaning Supplies 20	Pesticides 21	Other Household Supplies 22	Packaged Medications 23	Oral Hygiene Products 24
(1) Flexible paper and paper closures	2.14	1.63	0.00	0.65	2.09	2.17
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.44	0.42	0.13	0.01	0.02
(4) Flexible aluminum	0.11	0.00	0.00	0.00	0.03	0.00
(5) Rigid paper	29.03	1.66	0.00	5.42	0.00	0.00
(6) Rigid plastics	3.21	2.60	0.00	0.97	0.38	0.31
(7) Glass	0.00	1.04	3.41	1.04	13.90	16.22
(8) Steel	0.00	2.46	6.64	1.35	0.00	0.09
(9) Rigid aluminum	0.00	0.00	0.00	0.00	0.27	1.31
(10) Total (packaging materials)	34.49	10.16	10.67	9.55	17.09	18.56
(PCE) Personal consumption expenditures (million 1967 dollars)	1654.72	946.21	149.91	2458.32	1603.28	693.86

	Cosmetics and Hand Products 25	Hair Products 26	Shaving Products 27	Other Beauty Aids 28	Other Health Aids 29	Other General Merchandise 30
(1) Flexible paper and paper closures	2.42	2.20	2.07	2.25	2.30	0.54
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.19
(3) Metal closures	0.47	0.42	0.41	0.44	0.44	0.01
(4) Flexible aluminum	0.00	0.00	0.00	0.19	0.06	0.01
(5) Rigid paper	0.00	0.00	0.00	43.87	6.87	0.14
(6) Rigid plastics	2.06	1.88	1.70	1.90	0.33	0.14
(7) Glass	15.22	13.79	13.44	13.60	15.14	0.06
(8) Steel	0.00	3.75	1.66	15.21	0.09	0.62
(9) Rigid aluminum	0.26	0.00	0.03	0.00	0.00	0.01
(10) Total (packaging materials)	20.38	22.03	19.57	77.66	25.21	2.25
(PCE) Personal consumption expenditures (million 1967 dollars)	866.03	2218.75	629.24	476.45	3166.01	191036.60

		Total (consumer products) 31
(1) Flexible paper and paper closures	1	1.07
(2) Flexible plastics and plastic closures	2	.27
(3) Metal closures	3	.10
(4) Flexible aluminum	4	.04
(5) Rigid paper	5	1.94
(6) Rigid plastics	6	.19
(7) Glass	7	3.21
(8) Steel	8	1.79
(9) Rigid aluminum	9	.13
(10) Total (packaging materials)	10	8.74
(PCE) Personal consumption expenditures (million 1967 dollars)	PC	317611.60

Source: Research Triangle Institute.

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Table 10. Relative packaging consumption by consumer product, 1970
(percentage shares)

	Baked Goods 1	Dairy Products 2	Frozen Foods 3	Fresh and Cured Meat 4	Fresh and Cured Fish and Seafood 5	Fresh and Cured Poultry 6
(1) Flexible paper and paper closures	27.91	27.22	27.27	38.71	38.71	38.72
(2) Flexible plastics and plastic closures	13.59	3.57	8.50	3.79	3.42	3.80
(3) Metal closures	0.70	0.67	0.48	0.06	1.05	0.98
(4) Flexible aluminum	1.08	0.48	8.11	0.04	0.05	0.04
(5) Rigid paper	52.81	62.53	51.66	56.49	56.36	56.46
(6) Rigid plastics	0.00	1.93	0.00	0.00	0.00	0.00
(7) Glass	0.00	1.26	0.00	0.00	0.00	0.00
(8) Steel	0.37	2.33	0.34	0.00	0.00	0.00
(9) Rigid aluminum	3.55	0.00	3.49	0.00	0.00	0.00
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	8841.19	12681.57	5524.80	22800.98	525.42	3396.68

	Produce 7	Distilled Spirits 8	Wine 9	Beer 10	Soft Drinks 11	Prepared Beverages 12
(1) Flexible paper and paper closures	34.53	18.81	0.00	0.00	0.85	2.80
(2) Flexible plastics and plastic closures	12.95	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.00	0.00	5.59	0.06	0.16
(4) Flexible aluminum	0.00	0.00	0.00	0.09	0.00	0.15
(5) Rigid paper	52.52	18.79	0.00	4.57	1.43	9.22
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	0.06
(7) Glass	0.00	62.00	100.00	56.81	77.35	74.22
(8) Steel	0.00	0.00	0.00	27.32	16.93	12.98
(9) Rigid aluminum	0.00	0.00	0.00	5.62	2.28	0.01
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	10267.41	7060.95	1286.77	6279.16	3148.74	2762.72

	Candy and Chewing Gum 13	Canned Foods 14	Cereals, Flour, and Macaroni 15	Pet Foods 16	Tobacco Products 17	Other Foods 18
(1) Flexible paper and paper closures	29.63	0.00	45.78	3.07	38.96	5.34
(2) Flexible plastics and plastic closures	23.91	0.00	10.59	0.00	10.45	2.39
(3) Metal closures	0.00	0.11	0.00	1.55	0.00	0.21
(4) Flexible aluminum	2.41	0.00	0.00	1.32	3.21	1.06
(5) Rigid paper	44.05	3.36	43.63	0.00	47.18	13.42
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	4.63
(7) Glass	0.00	27.36	0.00	0.00	0.00	66.82
(8) Steel	0.00	67.40	0.00	93.62	0.00	3.55
(9) Rigid aluminum	0.00	1.77	0.00	0.00	0.00	0.39
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	2840.16	6147.80	2217.63	1631.49	9093.96	6789.09

	Soaps and Detergents 19	Other Cleaning Supplies 20	Pesticides 21	Other Household Supplies 22	Packaged Medications 23	Oral Hygiene Products 24
(1) Flexible paper and paper closures	6.21	14.02	0.00	6.77	12.25	11.70
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	4.33	3.97	1.39	2.38	2.29
(4) Flexible aluminum	0.32	0.00	0.00	0.00	0.20	0.21
(5) Rigid paper	84.16	16.49	0.00	56.71	0.00	0.00
(6) Rigid plastics	9.31	23.98	0.00	10.14	1.75	1.49
(7) Glass	0.00	10.25	31.94	10.90	81.32	76.60
(8) Steel	0.00	28.43	64.09	14.08	0.50	0.49
(9) Rigid aluminum	0.00	0.00	0.00	0.00	1.59	7.05
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	1654.72	944.21	149.91	2454.32	1603.28	693.46

	Cosmetics and Hand Products 25	Hair Products 26	Shaving Products 27	Other Beauty Aids 28	Other Health Aids 29	Other General Merchandise 30
(1) Flexible paper and paper closures	11.88	9.97	10.60	2.69	9.12	24.18
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	6.39
(3) Metal closures	2.31	1.93	2.08	0.56	1.76	0.36
(4) Flexible aluminum	0.00	0.00	0.00	0.25	0.16	0.37
(5) Rigid paper	0.00	0.00	0.00	56.89	27.25	36.27
(6) Rigid plastics	10.13	8.51	9.01	2.05	1.31	4.34
(7) Glass	74.68	62.57	68.67	17.77	60.04	2.46
(8) Steel	0.00	17.03	9.49	19.59	0.35	27.35
(9) Rigid aluminum	1.00	0.00	0.15	0.00	0.00	0.28
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	888.05	1218.75	625.24	476.45	3146.01	191034.60

	Total (consumer products) 31
(1) Flexible paper and paper closures	12.31
(2) Flexible plastics and plastic closures	3.05
(3) Metal closures	1.14
(4) Flexible aluminum	0.41
(5) Rigid paper	22.24
(6) Rigid plastics	2.20
(7) Glass	36.76
(8) Steel	20.44
(9) Rigid aluminum	1.45
(10) Total (packaging materials)	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	317611.60

Source: Research Triangle Institute.

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Table 11. Packaging cost by consumer product, 1970
(million 1967 dollars)

	Baked Goods 1	Dairy Products 2	Frozen Foods 3	Fresh and Cured Meat 4	Fresh and Cured Fish and Seafood 5	Fresh and Cured Poultry 6
(1) Flexible paper and paper closures	40.00	92.07	29.42	136.33	3.16	18.72
(2) Flexible plastics and plastic closures	140.45	50.49	53.70	68.00	1.58	9.35
(3) Metal closures	0.32	6.37	2.58	11.99	0.38	1.67
(4) Flexible aluminum	8.69	5.92	40.18	0.69	0.02	0.09
(5) Rigid paper	201.00	367.70	120.90	631.45	9.99	59.26
(6) Rigid plastics	0.00	35.56	0.00	0.00	0.00	0.00
(7) Glass	0.00	2.69	0.00	0.00	0.00	0.00
(8) Steel	67.54	25.20	33.52	21.85	0.50	2.40
(9) Rigid aluminum	35.24	0.00	21.27	0.00	0.00	0.00
(10) Total (packaging materials)	500.70	586.58	301.57	670.71	15.55	92.07
(PCE) Personal consumption expenditures (million 1967 dollars)	8641.16	12681.57	5524.00	22806.98	525.42	3396.68

	Produce 7	Distilled Spirits 8	Wine 9	Beer 10	Soft Drinks 11	Prepared Beverages 12
(1) Flexible paper and paper closures	60.70	32.04	0.00	0.00	7.63	6.85
(2) Flexible plastics and plastic closures	126.77	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.00	0.00	141.41	33.41	1.52
(4) Flexible aluminum	0.00	0.00	0.00	3.06	0.00	1.88
(5) Rigid paper	200.41	76.44	0.00	71.02	35.18	54.17
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	8.40
(7) Glass	0.00	108.16	62.04	366.33	649.87	166.01
(8) Steel	11.17	0.00	0.00	465.90	390.72	83.55
(9) Rigid aluminum	0.00	0.00	0.00	132.52	74.30	0.05
(10) Total (packaging materials)	399.05	217.16	62.04	1180.24	1200.35	322.43
(PCE) Personal consumption expenditures (million 1967 dollars)	10267.41	7060.95	1280.77	6279.16	3146.74	2742.72

	Candy and Chewing Gum 13	Canned Foods 14	Cereals, Flour, and Macaroni 15	Pet Foods 16	Tobacco Products 17	Other Foods 18
(1) Flexible paper and paper closures	18.78	0.00	11.30	2.04	26.65	23.77
(2) Flexible plastics and plastic closures	98.78	0.00	13.90	0.00	42.98	70.43
(3) Metal closures	9.00	3.11	0.00	3.57	0.00	3.34
(4) Flexible aluminum	7.01	0.00	0.00	3.95	8.59	22.31
(5) Rigid paper	60.57	57.67	22.68	0.00	59.73	133.17
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	83.45
(7) Glass	0.00	178.12	0.00	0.00	0.00	248.04
(8) Steel	130.87	1268.09	0.00	144.94	71.77	65.77
(9) Rigid aluminum	0.00	46.14	0.00	0.08	0.00	10.34
(10) Total (packaging materials)	316.00	1553.54	47.97	154.57	209.71	665.11
(PCE) Personal consumption expenditures (million 1967 dollars)	2800.16	6147.80	2217.63	1031.49	9043.96	6789.09

	Soaps and Detergents 19	Other Cleaning Supplies 20	Pesticides 21	Other Household Supplies 22	Packaged Medications 23	Oral Hygiene Products 24
(1) Flexible paper and paper closures	8.87	3.86	0.00	3.97	8.40	3.77
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	3.49	0.53	2.73	5.46	2.43
(4) Flexible aluminum	1.97	0.00	0.00	0.00	0.59	0.30
(5) Rigid paper	247.07	8.17	0.00	68.41	0.00	0.00
(6) Rigid plastics	85.50	37.17	0.00	38.26	7.74	3.50
(7) Glass	0.00	2.06	1.07	5.33	46.92	20.74
(8) Steel	0.00	0.00	0.00	0.00	0.00	0.00
(9) Rigid aluminum	0.00	0.00	0.00	0.00	17.03	35.47
(10) Total (packaging materials)	343.42	54.74	1.60	118.69	86.13	66.21
(PCE) Personal consumption expenditures (million 1967 dollars)	1654.72	946.21	149.91	2054.32	1603.28	693.46

	Cosmetics and Hand Products 25	Hair Products 26	Shaving Products 27	Other Beauty Aids 28	Other Health Aids 29	Other General Merchandise 30
(1) Flexible paper and paper closures	5.38	6.70	3.25	2.68	18.18	251.46
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	631.57
(3) Metal closures	3.49	4.32	2.12	1.74	11.76	13.12
(4) Flexible aluminum	0.00	0.00	0.00	0.99	1.38	17.38
(5) Rigid paper	0.00	0.00	0.00	107.51	111.71	469.77
(6) Rigid plastics	29.50	36.80	17.74	14.60	16.74	144.68
(7) Glass	28.70	35.60	17.60	13.44	100.86	22.21
(8) Steel	0.00	0.00	0.00	0.00	0.00	662.33
(9) Rigid aluminum	7.09	0.00	0.71	0.00	0.00	19.32
(10) Total (packaging materials)	74.16	83.42	41.42	141.46	260.70	2472.34
(PCE) Personal consumption expenditures (million 1967 dollars)	688.05	1218.75	625.24	676.45	3140.81	191036.60

	Total (consumer products) 31
(1) Flexible paper and paper closures	835.50
(2) Flexible plastics and plastic closures	1313.00
(3) Metal closures	245.00
(4) Flexible aluminum	129.00
(5) Rigid paper	3175.00
(6) Rigid plastics	580.20
(7) Glass	2076.50
(8) Steel	3474.10
(9) Rigid aluminum	399.40
(10) Total (packaging materials)	12245.88
(PCE) Personal consumption expenditures (million 1967 dollars)	317611.60

Source: Research Triangle Institute.

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Table 12. Packaging cost per dollar of expenditure by consumer product, 1970
(cents per dollar)

	Baked Goods 1	Dairy Products 2	Frozen Foods 3	Fresh and Cured Meat 4	Fresh and Cured Fish and Seafood 5	Fresh and Cured Poultry 6
(1) Flexible paper and paper closures	0.55	0.73	0.33	0.60	0.48	0.55
(2) Flexible plastics and plastic closures	1.59	0.40	0.97	0.30	0.30	0.28
(3) Metal closures	0.05	0.05	0.05	0.05	0.06	0.05
(4) Flexible aluminum	0.10	0.05	0.73	0.00	0.00	0.00
(5) Rigid paper	2.27	2.90	2.19	1.69	1.90	1.74
(6) Rigid plastics	0.00	0.28	0.00	0.00	0.00	0.00
(7) Glass	0.00	0.02	0.00	0.00	0.00	0.00
(8) Steel	0.76	0.20	0.01	0.10	0.09	0.09
(9) Rigid aluminum	0.00	0.00	0.38	0.00	0.00	0.00
(10) Total (packaging materials)	5.73	4.63	5.06	2.94	2.96	2.71
(PCE) Personal consumption expenditures (million 1967 dollars)	8841.14	12601.57	5524.80	22806.98	525.42	3396.68

	Produce 7	Distilled Spirits 8	Wine 9	Beer 10	Soft Drinks 11	Prepared Beverages 12
(1) Flexible paper and paper closures	0.59	0.45	0.00	0.00	0.24	0.25
(2) Flexible plastics and plastic closures	1.23	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.00	0.00	2.25	1.07	0.05
(4) Flexible aluminum	0.00	0.00	0.00	0.05	0.00	0.07
(5) Rigid paper	1.95	1.09	0.00	1.13	1.12	1.96
(6) Rigid plastics	0.06	0.00	0.00	0.00	0.00	0.30
(7) Glass	0.00	1.53	4.81	5.83	20.64	6.01
(8) Steel	0.11	0.00	0.00	7.42	12.69	3.02
(9) Rigid aluminum	0.00	0.00	0.00	2.11	2.36	0.00
(10) Total (packaging materials)	3.89	3.08	4.81	18.80	38.12	11.67
(PCE) Personal consumption expenditures (million 1967 dollars)	10267.41	7060.95	1288.77	6279.16	3148.74	2762.72

	Candy and Chewing Gum 13	Canned Foods 14	Cereals, Flour, and Macaroni 15	Pet Foods 16	Tobacco Products 17	Other Foods 18
(1) Flexible paper and paper closures	0.66	0.00	0.51	0.20	0.29	0.35
(2) Flexible plastics and plastic closures	3.48	0.00	0.63	0.00	0.47	1.10
(3) Metal closures	0.00	0.05	0.00	0.35	0.00	0.05
(4) Flexible aluminum	0.25	0.00	0.00	0.36	0.09	0.33
(5) Rigid paper	2.13	0.44	1.02	0.00	0.66	1.96
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	1.24
(7) Glass	0.00	2.90	0.00	0.00	0.00	3.65
(8) Steel	4.61	20.63	0.00	14.05	0.79	0.97
(9) Rigid aluminum	0.00	0.75	0.00	0.01	0.00	0.15
(10) Total (packaging materials)	11.13	25.27	2.16	14.99	2.31	9.80
(PCE) Personal consumption expenditures (million 1967 dollars)	2800.16	6147.80	2217.63	1031.49	9093.96	6789.09

	Soaps and Detergents 19	Other Cleaning Supplies 20	Pesticides 21	Other Household Supplies 22	Packaged Medications 23	Oral Hygiene Products 24
(1) Flexible paper and paper closures	0.54	0.41	0.00	0.16	0.52	0.54
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.37	0.35	0.11	0.34	0.35
(4) Flexible aluminum	0.12	0.00	0.00	0.00	0.04	0.04
(5) Rigid paper	14.93	0.86	0.00	2.79	0.00	0.00
(6) Rigid plastics	5.17	3.93	0.00	1.56	0.48	0.51
(7) Glass	0.00	0.22	0.71	0.22	2.93	2.99
(8) Steel	0.00	0.00	0.00	0.00	0.00	0.00
(9) Rigid aluminum	0.00	0.00	0.00	0.00	1.06	5.12
(10) Total (packaging materials)	20.75	5.79	1.07	4.84	5.37	9.55
(PCE) Personal consumption expenditures (million 1967 dollars)	1454.72	946.21	149.91	2454.32	1603.28	693.46

	Cosmetics and Hand Products 25	Hair Products 26	Shaving Products 27	Other Beauty Aids 28	Other Health Aids 29	Other General Merchandise 30
(1) Flexible paper and paper closures	0.01	0.55	0.52	0.56	0.56	0.13
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.33
(3) Metal closures	0.39	0.35	0.34	0.37	0.37	0.01
(4) Flexible aluminum	0.00	0.00	0.00	0.21	0.04	0.41
(5) Rigid paper	0.00	0.00	0.00	22.56	3.53	0.35
(6) Rigid plastics	3.32	3.02	2.84	3.07	0.53	0.04
(7) Glass	3.23	2.92	2.85	2.93	3.19	0.01
(8) Steel	0.00	0.00	0.00	0.00	0.00	0.36
(9) Rigid aluminum	0.80	0.00	0.11	0.00	0.00	0.01
(10) Total (packaging materials)	8.35	6.80	6.66	29.69	8.25	1.29
(PCE) Personal consumption expenditures (million 1967 dollars)	888.05	1218.75	625.24	476.45	3160.81	191036.60

	Total (consumer products) 31
(1) Flexible paper and paper closures	.26
(2) Flexible plastics and plastic closures	.41
(3) Metal closures	.08
(4) Flexible aluminum	.04
(5) Rigid paper	1.00
(6) Rigid plastics	.18
(7) Glass	.65
(8) Steel	1.09
(9) Rigid aluminum	.13
(10) Total (packaging materials)	3.86
(PCE) Personal consumption expenditures (million 1967 dollars)	317611.60

Source: Research Triangle Institute.

Table 13. Relative packaging cost by consumer product, 1970
(percentage shares)

	Baked Goods 1	Dairy Products 2	Frozen Foods 3	Fresh and Cured Meat 4	Fresh and Cured Fish and Seafood 5	Fresh and Cured Poultry 6
(1) Flexible paper and paper closures	9.66	15.70	9.76	20.33	20.31	20.33
(2) Flexible plastics and plastic closures	27.01	0.69	17.01	10.14	10.14	10.16
(3) Metal closures	0.05	1.09	0.86	1.79	1.95	1.81
(4) Flexible aluminum	1.71	1.01	13.32	0.10	0.13	0.10
(5) Rigid paper	39.68	62.70	40.09	64.39	66.23	64.37
(6) Rigid plastics	0.00	0.06	0.00	0.00	0.00	0.00
(7) Glass	0.00	0.46	0.00	0.00	0.00	0.00
(8) Steel	13.33	4.30	11.12	3.26	3.19	3.28
(9) Rigid aluminum	6.95	0.00	7.05	0.00	0.00	0.00
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	8041.19	12661.57	5524.80	22806.98	525.42	3396.68

	Produce 7	Distilled Spirits 8	Wine 9	Beer 10	Soft Drinks 11	Prepared Beverages 12
(1) Flexible paper and paper closures	15.21	14.76	0.00	0.00	0.44	2.13
(2) Flexible plastics and plastic closures	31.77	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	0.00	0.00	11.98	2.80	0.47
(4) Flexible aluminum	0.00	0.00	0.00	8.76	0.00	0.58
(5) Rigid paper	50.22	35.43	0.00	6.02	2.93	16.80
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	2.60
(7) Glass	0.00	49.81	100.00	31.04	54.14	51.49
(8) Steel	2.80	0.00	0.00	39.47	33.30	25.91
(9) Rigid aluminum	0.00	0.00	0.00	11.23	6.19	0.02
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	10267.41	7040.95	1280.77	6279.16	3148.74	2762.72

	Candy and Chewing Gum 13	Canned Foods 14	Cereals, Flour, and Macaroni 15	Pet Foods 16	Tobacco Products 17	Other Foods 18
(1) Flexible paper and paper closures	5.94	0.00	23.75	1.32	12.71	3.57
(2) Flexible plastics and plastic closures	31.26	0.00	28.98	0.00	20.50	11.19
(3) Metal closures	0.00	0.20	0.00	2.31	0.00	0.50
(4) Flexible aluminum	2.22	0.00	0.00	2.55	4.10	3.35
(5) Rigid paper	19.17	3.71	47.27	0.00	28.48	26.02
(6) Rigid plastics	0.00	0.00	0.00	0.00	0.00	12.62
(7) Glass	0.00	11.47	0.00	0.00	0.00	37.29
(8) Steel	41.41	81.65	0.00	93.77	34.22	9.89
(9) Rigid aluminum	0.00	2.97	0.00	0.05	0.00	1.55
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	2880.16	6197.60	2217.63	1631.09	9093.96	6789.09

	Soaps and Detergents 19	Other Cleaning Supplies 20	Pesticides 21	Other Household Supplies 22	Packaged Medications 23	Oral Hygiene Products 24
(1) Flexible paper and paper closures	2.56	7.05	0.00	3.35	9.75	5.49
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	0.00
(3) Metal closures	0.00	6.38	33.19	2.30	6.34	3.67
(4) Flexible aluminum	0.57	0.00	0.00	0.00	0.69	0.45
(5) Rigid paper	71.94	14.92	0.00	57.63	0.00	0.00
(6) Rigid plastics	24.90	67.90	0.00	32.23	8.99	5.29
(7) Glass	0.00	3.77	66.81	0.49	54.47	31.32
(8) Steel	0.00	0.00	0.00	0.00	0.00	0.00
(9) Rigid aluminum	0.00	0.00	0.00	0.00	19.77	53.58
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	1654.72	946.21	149.91	2454.32	1603.28	693.66

	Cosmetics and Hand Products 25	Hair Products 26	Shaving Products 27	Other Beauty Aids 28	Other Health Aids 29	Other General Merchandise 30
(1) Flexible paper and paper closures	7.25	8.03	7.60	1.89	6.97	18.19
(2) Flexible plastics and plastic closures	0.00	0.00	0.00	0.00	0.00	25.55
(3) Metal closures	4.71	5.18	5.10	1.23	8.51	0.33
(4) Flexible aluminum	0.00	0.00	0.00	0.70	0.53	0.70
(5) Rigid paper	0.00	0.00	0.00	74.06	42.85	27.09
(6) Rigid plastics	39.78	44.11	42.63	10.32	4.48	0.68
(7) Glass	38.70	42.68	42.77	9.85	36.64	0.00
(8) Steel	0.00	0.00	0.00	0.00	0.00	27.60
(9) Rigid aluminum	9.57	0.00	1.70	0.00	0.00	0.78
(10) Total (packaging materials)	100.00	100.00	100.00	100.00	100.00	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	888.05	1218.75	625.24	876.45	3166.81	191036.60

	Total (consumer products) 31
(1) Flexible paper and paper closures	6.82
(2) Flexible plastics and plastic closures	10.72
(3) Metal closures	2.16
(4) Flexible aluminum	1.02
(5) Rigid paper	25.92
(6) Rigid plastics	4.74
(7) Glass	16.96
(8) Steel	28.40
(9) Rigid aluminum	3.26
(10) Total (packaging materials)	100.00
(PCE) Personal consumption expenditures (million 1967 dollars)	317611.60

Source: Research Triangle Institute.

in the intermaterials competition for each of the 30 consumer products identified above. Historical trends in the quantity of packaging consumed per dollar of consumer expenditure were first extrapolated for 30 categories of consumer products. The projected packaging requirements per dollar of consumer expenditure were next multiplied by 1980 forecasts of consumer expenditures for each of the 30 consumer products to obtain quantity projections of the consumption of packaging by each product. Then, the relative usage of the various materials within each consumer product's total packaging requirement was projected on the basis of quantitative analysis and qualitative discussions with consultants in the packaging field and reviews of the literature. Each phase of the procedure is discussed in more detail below.

3.3.1.1 <u>Product Packaging</u>. Packaging provides consumers a variety of services such as saving money, or time; reducing the quantity and price risks associated with the purchase, preparation, and use of packaged products; and increasing the range of product availability. Packaging provides these services primarily by preunitizing products, by protecting product and quality, and by communicating information relevant to package content and product use (ref. 1).

The scheme of 30 consumer product categories was developed to reflect fairly homogeneous packaging requirements and special services. As discussed in sec. 3.2 above, within each of the 30 consumer product categories, detailed data on packaging usage were collected, standardized to a measure of weight (tonnes), and aggregated across packaging materials to obtain a total weight of packaging for each consumer product for the years 1958-70. In order to isolate trends that reflect changes in the packaging of a product from changes in consumption of the product, the data were converted to a measure of packaging weight (kilograms) per $100 of consumer expenditure.

Trends observed in this measure summarize a myriad of technological and economic phenomena. The intermaterials struggle for markets is exemplified most notably in the health and cosmetic product lines where the observed decrease in packaging weight per dollar of expenditure represents a significant shift from glass containers to lighter weight plastics. Competitive pressures have contributed to the application of self-service retailing which not only is made possible by modern packaging systems but also encourages the growth of packaging as an advertising and merchandising tool. This has led to

the use of packaging in new markets--e.g., meat and produce--and increased use of packaging to achieve greater product differentiation in more traditional markets. The increased packaging per dollar of expenditure exhibited in most of the food products also represents the growing consumer preference for convenience in the form of single-portion servings, premeasured and premixed foods, heat-and-serve items, and others.

Assuming that these trends in packaging applications and technological innovations continue, a linear extrapolation to 1980 of the historical data was made for the amount of packaging per dollar of consumer expenditure on each of the 30 product categories.*

3.3.1.2 Consumer Expenditures. A consumer who purchases a pound of meat is, at the same time, purchasing the plastic wrap and the paperboard tray. Therefore, the amount and structure of packaging in 1980 will be determined not only by trends within the packaging industry, but also by other forces that influence consumer buying patterns. The forecast of packaging in 1980 therefore incorporates separate analyses of trends in the packaging of a product and in the consumption of the product.

Expenditure data for the period 1958-70 for the 30 consumer product categories were derived from Supermarketing magazine and the U.S. Department of Commerce Survey of Current Business. All expenditures were converted to constant (1967) dollars by using the consumer price index appropriate for each product.

Projections of personal consumption expenditures for 1980 by the classification used in the national income accounts, provided by the Bureau of Labor Statistics (BLS), were used as benchmark projections of total expenditures on food, tobacco, household supplies, health and beauty aids, and other durables and nondurables. These projections were based on the "Houthakker-Taylor" system (ref. 2). In order to obtain expenditure forecasts for the 30 consumer product categories used in this study that were consistent with the BLS projections, share trends were estimated for subcomponents of food, household supplies, and health and beauty aids. For example, 1958-71 data on personal consumption expenditures for Baked Goods as a proportion of total food expenditures were statistically fit to

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*See appendix B for estimating equations.

a linear time trend. Extrapolation of the trend provided an estimate of Baked Goods' share of the 1980 food budget. Given the BLS projection of total food expenditures in 1980, projections of expenditures for Baked Goods were then derived.*

3.3.1.3 Packaging Materials Consumption. The previously described procedures for projecting packaging requirements per dollar of consumer expenditure and for projecting consumption expenditures provide projections of the amount of packaging consumed in each of 30 product categories in 1980. In order to provide projections on a material basis, the distribution of materials was projected from an evaluation of trends in material substitution within each of the 30 consumer products and a consideration of potential developments within the markets for the five basic packaging materials. Using the estimated 1980 distribution of materials for each of the 30 consumer products and the projection of total packaging, a projection of the consumption of the five packaging materials in 1980 was developed for each of the 30 consumer products.

3.3.2 Trends in Packaging

The amount of all packaging materials used to package consumer products has been closely related to the combined rates of consumer spending on all durable and nondurable items (fig. 3). In 1970, the estimated total of paper, plastics, glass, steel, and aluminum used to package consumer products was 27,758 thousand tonnes. This value was 67 percent above the estimate for 1958.

The trend towards a service economy has tended to inhibit the growth of packaging for consumer products. Because the trend is projected to continue to 1980 (ref. 3), consumer goods packaging, in total, is expected to continue to grow at a rate somewhat less than that projected for all personal consumption expenditures.

By 1980, personal consumption expenditures on durables and nondurables are projected to total $467.2 billion (in 1967 dollars) or $1,988 per capita (fig. 4). Based on projections of expenditures for each of the 30 consumer products identified for this study and projections of the amount of packaging per dollar of expenditure on each consumer product, consumer products packaging in 1980 is projected to total 44 million tonnes (fig. 5). This

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*See appendix B for share equations and total expenditure projections.
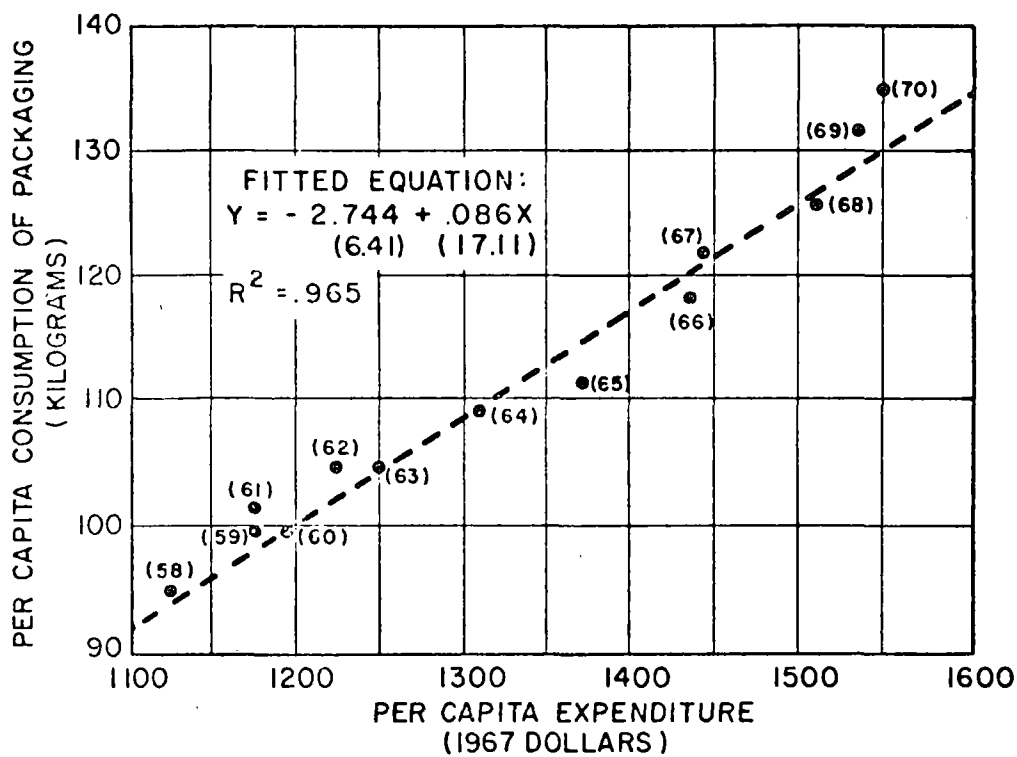
Figure 3. Relationship between consumer expenditures on durable
and nondurable products and consumer product packaging.
Numbers in parentheses are year of observation.
(Source: Research Triangle Institute.)
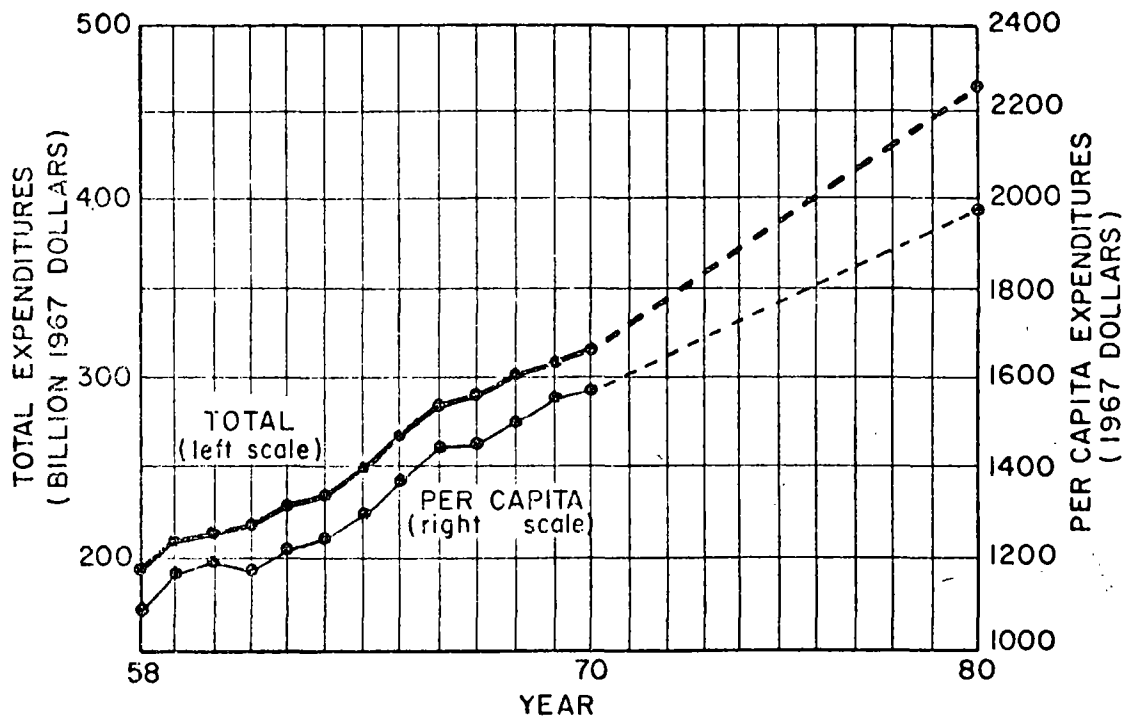
Figure 4. Trends in consumer expenditures on durable and nondurable
products. (Source: Historical data, Department of Commerce;
projection, unpublished Department of Labor data.)
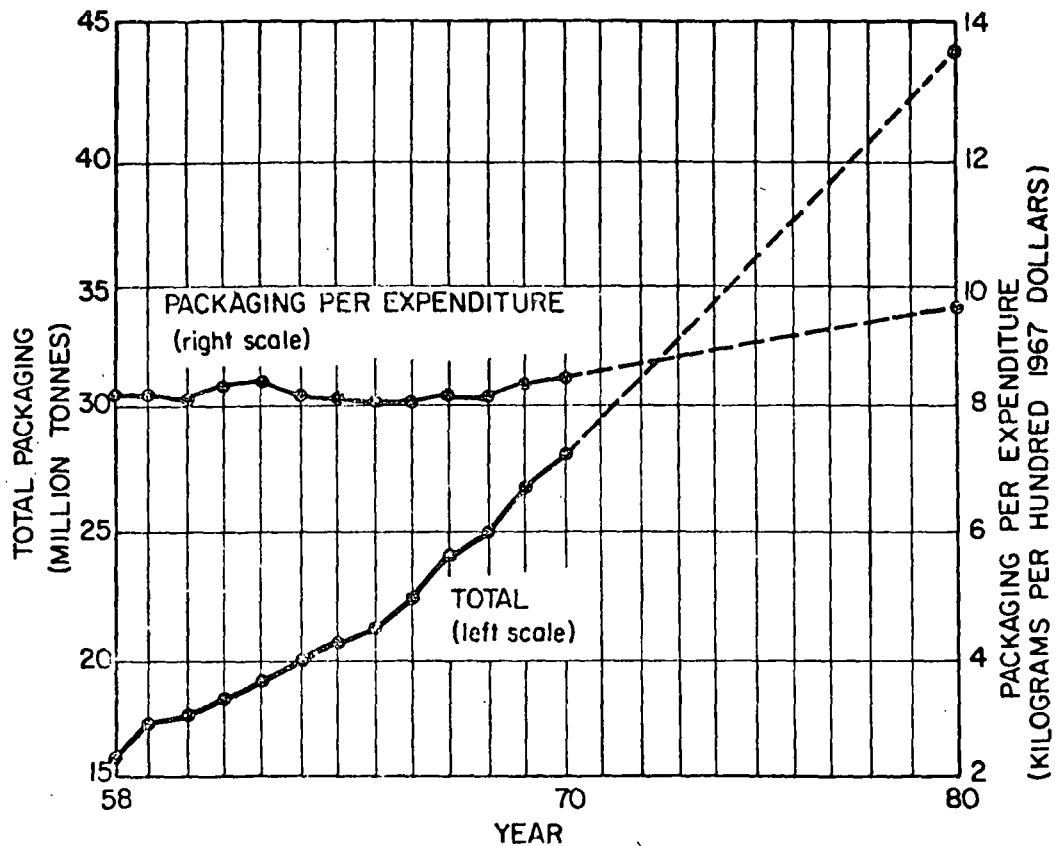
Figure 5.   Trends in consumer products packaging.
(Source: Research Triangle Institute.)

projection is consistent (within 12 percent) with that which can be obtained
by substituting the projected rate of per capita expenditures on durables and
nondurables into the equation shown in figure 3 and multiplying that result
by the projected 1980 population of 235 million (ref. 4).

The methodology employed and the projections developed above do not
specifically relate to the packaging climate; that is, the variety of social,
economic, political, and technical factors that intertwine to influence
product packaging. Yet, these factors lie behind any set of projections.

The factors can be grouped into those that relate to the climate within which packaging exists and the intermaterials competition within that climate. Three important developments relating to the concentration of manufacturing and distribution, the demand for convenience, and the possibility of restrictive legislation that will influence the packaging climate are discussed below.

3.3.2.1 <u>Concentration of Production and Distribution</u>. The trend towards greater concentration of economic activity in the American economy means that the traditional pattern of relatively small firms serving local markets has been supplanted, in most industries, by a few large firms serving national markets. The general rationale for the concentration of industry is the economies of scale conferred upon large producers. These economies include advantages in diverse areas such as production costs, advertising costs, brand acceptance, input prices, and access to capital. The ability of large firms to employ greater division of labor and specialization within a particular plant or production process results in a general pattern of the larger corporations paying higher wages and salaries, employing more capital intensive technologies, and realizing higher profit margins than their smaller competitors (ref. 5).

New packaging developments both encourage this trend and are induced by it. Perhaps the best example is the brewing industry. As shown in figure 6, the number of breweries has declined substantially since 1940 when there were over 12 breweries on the average for each State until today when the average is about three per State. Over the same period, the average output per brewery has increased. The desire to achieve economies of scale is frequently cited as a major reason for the reduction in the number of breweries. However, the introduction first of nonrefillable bottles--and subsequently cans--as economical, one-way containers for Beer that do not incur the transportation costs that refillable bottles must, has provided brewers with the opportunity to ship Beer longer distances at less cost than would otherwise be possible.

A reduction in the number of firms has been observed for most of the industries producing the 30 consumer products identified in this study (table 14). There appears to be no reason for this trend to halt, much less reverse itself. The implication of the trend is the development of packaging that can be shipped longer distances, provide greater protection against damage in shipment, and weigh less than current packaging.
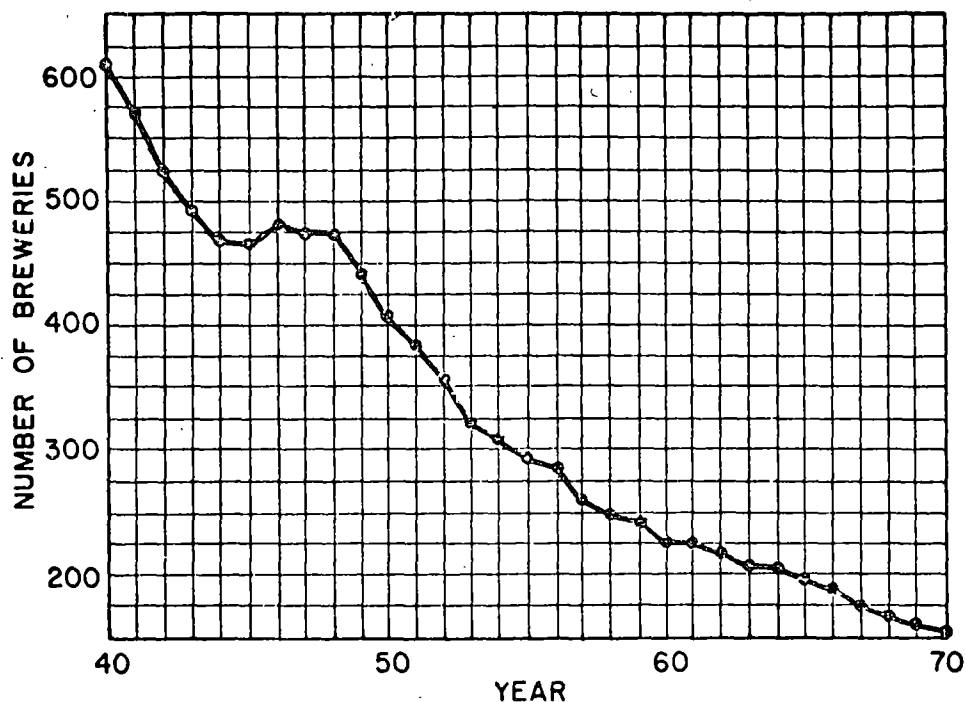
Figure 6.   Number of breweries operated, 1940-70.
(Source: Brewers Almanac, 1971, United States
Brewers Association, Inc., Washington, D.C., 1971.)

The trend in concentration observed for manufacturing also exists in the distribution sector of the economy and will continue to have an influence on packaging.   Packaging has been cited as a major factor in the growth of super-markets and the demise of the general store because improvements in product packaging made mass distribution and self-service store merchandising possible (ref. 6).   During the depression of the 1930's, self-service stores were widely introduced in an effort to reduce costs by achieving economies of scale (ref. 7).   With the elimination of the sales clerk, the package became "the maker's sole representative at the sales decision point.   Advertising messages dimly recalled, competitive product claims loudly heard: all of these interfere in strident cacophony with the message he wants to communicate: Look.   This product is different.   This product is unique.   This product will satisfy, benefit, totally respond to your need.   It will really do what it says it will do.   You won't like it only now.   You'll like in in your home.   Even weeks from now" (ref. 8).

As shown in table 15, the trend in retail food stores in general, and grocery stores in particular, toward fewer but larger stores is expected to

Table 14. Trend in the number of establishments producing packaged products

Consumer product* (consumer category numbers)	Industry numbers (SIC)	Industry name	Number of establishments for the year		
			1958	1963	1967
Baked Goods	2051	Bread, cake, & related products	6,026	5,010	4,042
(1)	2052	Cookies and crackers	339	356	348
		Total	6,365	5,366	4,390
Dairy Products	2021	Creamery butter	1,058	766	540
(2)	2022	Cheese, natural, & processed	1,310	1,138	1,026
`	2026	Fluid milk	5,828	4,619	3,481
		Total	8,196	6,523	5,047
Frozen Foods	2024	Ice cream & frozen desserts	1,390	1,081	850
(3)	2036	Fresh & frozen packaged fish	2,352	2,814	3,607
	2037	Frozen fruits and vegetables	3,208	3,911	4,576
		Total	6,950	7,806	9,033
Fresh and Cured Meat	2011	Meatpacking plants	2,810	2,992	2,707
Fresh and Cured Fish & Seafood	2013	Sausages & other prepared meats	1,494	1,341	1,375
Fresh and Cured Poultry	2015	Poultry dressing plants	1,233	967	839
(4-6)		Total	5,537	5,300	4,921
	2095	Roasted coffee	380	324	268
	2082	Malt liquors	262	222	185
Beverages	2084	Wines, brandy, & brandy spirits	239	222	205
(8-12)	2085	Distilled liquor, except brandy	122	107	112
	2086	Bottled & canned soft drinks	4,394	3,905	3,400
	2087	Flavoring, extract, sirups, N.E.C.	534	520	431
		Total	5,931	5,300	4,601
Candy & Chewing Gum	2071	Confectionery products	3,563	4,237	4,989
(13)	2072	Chocolate & cocoa products	4,646	5,639	6,450
	2073	Chewing gum	4,532	5,577	6,095
		Total	12,741	15,453	17,534
	2023	Condensed & evaporated milk	313	281	291
Canned Foods	2031	Canned & cured seafood	411	405	320
(14)	2032	Canned specialties	107	173	175
	2033	Canned fruits & vegetables	1,630	1,430	1,223
		Total	2,461	2,289	2,009
	2041	Flour & other grain mill products	814	618	541
Cereals, Flour,	2043	Cereal preparations	43	48	45
and Macaroni	2044	Rice milling	72	74	68
(15)	2045	Blended & prepared flour	117	165	145
	2098	Macaroni & spaghetti	214	221	205
		Total	1,260	1,126	1,004
Pet Foods	2042	Prepared feeds for animals & fools	2,379	2,590	2,355
(16)					

Consumer product* (consumer category numbers)	Industry numbers (SIC)	Industry name	Number of establishments for the year		
			1958	1963	1967
Tobacco Products	2111	Cigarettes	19	14	16
(17)	2121	Cigars	283	193	148
	2131	Chewing & smoking tobacco	58	51	46
		Total	360	258	210
Other Foods	2034	Dried & dehydrated fruits & veg.	161	176	178
(18)	2035	Pickled fruits & vegetables, vegetables sauces & seasonings; salad dressings	619	588	527
	2046	Wet corn milling	59	60	45
	206	Sugar	170	164	182
	209	Miscellaneous food preparations and kindred products	1,099	1,067	996
	2099	Food preparations, N.E.C.	2,307	2,190	2,082
		Total	4,415	4,245	4,010
	2819	Household bleaches, dry, liq.	580	674	718
	2899	Chemical preparations N.E.C.	1,294	1,387	1,373
	2841	Soap & other detergents	608	704	668
	2842	Polishes & sanitation goods	1,156	1,101	1,004
	2843	Surface active agents	142	148	164
Household	2641	Paper coating & glazing	340	387	397
supplies	2642	Envelopes	205	230	228
(19-22)	2643	Bag, except textile	461	586	557
	2644	Wall paper	73	79	77
	2645	Diecut paper & board	372	425	440
	2646	Pressed & molded pulp goods	55	59	58
	2649	Converted paper products, N.E.C.	--	610	610
	3999	Manufacturers, N.E.C.	1,898	2,108	2,211
	3069	Fabricated rubber products, N.E.C.	1,074	1,173	1,189
	3461	Metal stampings	2,454	2,574	2,710
	3221	Glass containers	100	113	120
	3641	Electric lamps	66	81	106
		Total	10,878	12,439	12,630
	2844	Toilet preparations	748	707	672
Health and	2647	Sanitary paper products	NA	119	125
beauty aids	3842	Surgical appliances & supplies	590	704	811
(23-29)	2834	Pharmaceutical preparations	1,114	1,011	875
	3964	Needles, pins, fasteners	367	343	289
		Total	2,819	2,884	2,772

* Does not include Consumer product (7) Produce nor (30) Other General Merchandise.

Table 15. Retail food stores trends

	Year						
	1954	1958	1963	1967	1970	1971	1980
Number of stores							
Food stores	384,616	356,754	319,433	294,243	NA	NA	NA
Grocery stores	287,572	259,796	244,839	218,130	208,000	205,000	182,000
Meat markets	22,896	23,844	16,457 ⎫	⎰ 17,943	NA	NA	NA
Fish markets	4,458	4,339	3,630 ⎭		NA	NA	NA
Bakeries	19,034	19,235	18,631	19,598	NA	NA	NA
Other	50,656	49,540	35,876	38,572	NA	NA	NA
Percentage distribution of sales							
Grocery store sales							
Over $1,000,000	31.2	42.9	50.2	59.1	64.9	66.0	69.2
$500,000-$1,000,000	15.4	14.7	15.3	13.2	12.0	11.2	10.0
Less than $500,000	53.4	42.4	34.5	27.7	23.1	22.8	20.8
	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Historical data for the number of stores: Department of Commerce, Bureau of the Census, U.S. Census of Business, 1958, 1963, 1967; projections and estimated distribution of sales: Supermarketing magazine, September 1972, p. 12.

continue into the future. This will continue to emphasize the role of packaging as a merchandising tool.

The package can be a persuasive force in the purchase decision, for it can create product differentiation where little may otherwise exist. The importance of product differentiation is seen in the degree of competition among products for the consumer's dollar. A typical supermarket offers about 8,000 items for sale. Assuming that the average consumer spends an average of one-half hour per shopping trip, the average item is exposed to each potential customer less than one-fourth of a second. The successful package must first attract the potential customer's attention by being visually attractive. Next, it must convince the potential customer that the product will meet his needs by communicating pertinent information relative to the package contents and product use. Then, it must trigger the sale by overcoming any last resistance of the buyer (ref. 9).

Once purchased, the product must perform as expected by the consumer, or it may not be purchased again, thus enjoying the repeat sales that most products require in order to survive. In many cases, the performance of the product is intimately related to the performance of the package, most notably in connection with the fast growing sales volume of convenience products.

3.3.2.2 <u>Convenience</u>. Convenience foods may save customers money and/or time. Centralized processing, where water is removed and the inedible portions of products are discarded, reduces bulk, weight, perishability, and, hence, marketing costs (ref. 10). Frozen concentrate orange juice, in a composite can, frozen or canned peas and lima beans, and instant coffee in a jar, for example, cost consumers about one-half the cost of their fresh counterparts (e.g., fresh orange juice, peas and lima beans, roasted ground coffee), as well as saving preparation time (table 16). Most convenience foods, however, sell at a price premium over their home-prepared counterparts, but save consumers time in preparation. About 100 such foods are shown in table 17.

In many cases the convenience incorporated into foods is a function of packaging. Some typical examples include (ref. 11):

(1) Opening and closing features--e.g., one-hand dispensing devices for lotions, tear-tape opening strips, and zip-tops;

(2) Direct-use packages--e.g., shoe polish container with zip-top lid, applicator, and polishing cloth;

(3) Preunitized packages--e.g., breakfast cereals in single-service boxes;

(4) Aerosols--e.g., rug shampoo aerosol with integral brush.

Increases in consumer demand for convenience incorporated into packaging are expected for the future, due both to an increasing share of women in the work force and to increases in affluence. The number of women in the work force has been increasing and is expected to continue to increase through 1980 (table 18). This should increase the demand for packaging which will save housewives time, especially time spent in food preparation and cleanup.

Consumers do regard some current packaging characteristics with disfavor, a factor that can discourage the growth in some packaging. A number of surveys indicate that consumers are concerned about the impacts of packaging on the

Table 16. Cost savings of convenience foods

Consumer product (Consumer product category)	Percent cost savings using convenience foods over fresh or home-prepared forms
Dairy Products (2)	
cheese, sliced	3.5
Frozen Foods (3)	
orange concentrate	50.9
peas	53.9
lima beans	41.0
cut corn	20.2
spinach	33.3
shrimp	7.1
Produce (7)	
orange juice, store squeezed	6.8
Prepared Beverages (12)	
instant coffee	48.9
Canned Foods (14)	
cherries	60.0
orange juice	45.9
peas	61.5
cut corn	16.3
spinach	42.0
lima beans	35.6
asparagus	13.1
beets	5.4
spaghetti	18.6
chicken	11.7
beef stew	9.1
Cereals, Flour, and Macaroni (15)	
devil's food cake, incomplete mix	30.0
chocolate frosting, complete mix	16.7
yellow cake, incomplete mix	17.2
waffles, complete mix	9.1
pudding, chocolate	14.3

Source: U.S. Department of Agriculture, Economic Research Service, Comparative Costs to Consumers of Convenience Foods and Home-Prepared Foods, Marketing Research Report, No. 609, Washington, D.C., June 1963, pp. 8-9.

Table 17. Cost of worktime saved by using prepared foods

Consumer product (consumer product category)	Cost premium (cents)	Time saved (minutes)	Cost per hour of time saved (dollars)
Baked Goods (1)			
sugar cookies	0.3	0.6	$0.30
yellow cake	1.6	2.0	0.48
cherry pie	6.9	8.2	0.50
coconut pie	5.8	6.8	0.51
apple pie	7.4	7.8	0.57
devil's food cake	2.6	2.5	0.62
pound cake	1.3	1.2	0.65
yeast rolls	3.4	2.2	0.92
brownies	1.2	0.6	1.20
angelfood cake	3.7	1.7	1.31
Frozen Foods (3)			
french fries	0.3	5.3	0.04
puffs	1.3	7.1	0.11
patties	2.8	7.6	0.22
asparagus	0.2	0.7	0.17
broccoli	2.9	3.0	0.58
brussels sprouts	0.7	0.7	0.60
green beans	1.4	1.2	0.70
corn on cob	2.1	1.3	0.97
coconut	0.9	1.8	0.30
pineapple	3.1	1.5	1.24
peaches	6.1	2.0	1.83
strawberries	2.5	1.8	0.83
red raspberries	4.6	1.3	2.12
fried rice	3.9	3.7	0.63
frozen pizza	22.0	11.3	1.17
biscuits, refrigerated	0.3	2.0	0.09
biscuits, frozen	3.7	2.2	1.01
cherry pie	3.4	7.7	0.26
apple pie	4.4	7.2	0.37
coconut pie	7.7	6.4	0.72
brownies	1.0	0.6	1.00
yeast rolls	0.6	2.0	0.18
pancakes	7.2	2.7	1.60
devil's food cake	4.6	1.7	1.62
waffles	7.5	1.5	3.00
pound cake	4.6	0.9	3.07
orange sherbert complete mix	0.9	0.6	0.90
orange sherbert	2.9	1.9	0.92
haddock fish sticks	0.9	2.7	0.20
codfish sticks	2.4	3.1	0.46
haddock dinner	36.2	7.8	2.78
prefried shrimp	11.8	6.9	1.03
shrimp creole	15.6	8.1	1.15
cooked, peeled deveined shrimp	14.1	5.9	1.43
fried, peeled deveined shrimp	10.2	2.5	2.45

Table 17 (con.). Cost of worktime saved by using prepared foods

Consumer product (consumer product category)	Cost premium (cents)	Time saved (minutes)	Cost per hour time saved (dollars)
Canned Foods (14)			
boiled whole potatoes	2.3	1.2	$1.15
green beans	1.1	2.7	0.25
carrots, diced	1.3	2.6	0.30
carrots, sliced	2.2	2.8	0.47
brussels sprouts	3.4	1.9	1.07
coconut	0.1	1.8	0.04
pineapple	0.3	1.5	0.12
peaches	2.0	2.1	0.57
cranberries, whole	1.9	0.7	0.77
red raspberries	2.4	1.6	0.90
strawberries	5.1	1.8	1.70
spanish rice	2.1	3.5	0.36
canned codfish flakes	0.3	0.6	0.30
cooked crab meat	4.9	4.0	0.73
cooked shrimp	5.4	3.1	1.04
Cereals, Flour, and Macaroni (15)			
waffle mix, incomplete	0.1	1.3	0.05
pound cake mix, incomplete	0.1	0.8	0.07
pancake mix, incomplete	0.3	1.6	0.11
coconut pie mix, incomplete	0.6	2.2	0.16
corn muffin mix, incomplete	0.4	0.1	2.40
cherry pie mix, complete	0.6	4.9	0.07
apple pie mix, complete	1.8	4.2	0.26
yeast rolls mix, complete	0.5	0.9	0.34
pancake mix, complete	1.3	1.7	0.46
white frosting mix, complete	0.8	0.8	0.60
angelfood cake mix, complete	0.5	0.3	1.00
chocolate fudge mix, complete	0.6	1.0	0.36
Other Foods			
chocolate fudge	1.0	1.4	0.43
packaged complete pizza	4.6	5.9	0.47
chilled pizza	8.7	11.3	1.17

Table 18. Labor force participation of women, 1940 to 1980*

| Year | Female labor force (thousands) | | | Percent distribution of female labor force | | Female labor force participation rate (percent) |
	Total	Married	Not married	Married	Not married	Total
1940	13,840	5,040	8,800	36.4	63.6	27.4
1950	17,795	9,273	8,522	52.1	47.9	31.4
1960	22,516	13,485	8,671	59.9	40.1	34.8
1965	25,952	16,154	9,798	62.2	37.8	36.7
1970	31,233	19,799	11,434	63.4	36.6	41.6
1980	37,115	NA	NA	NA	NA	43.0

*Persons 14 years and older through 1965; thereafter, 16 years and older.

Source: For 1940, 1950: U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-50; for other years: U.S. Department of Labor, Bureau of Labor Statistics, Special Labor Force Reports.

environment. If these concerns become reflected in consumer purchase decisions, then the growth trends for some packaged products may be affected. Also, failures of packaging to perform desired functions may also affect growth. A recent survey identified several consumer complaints. Most often mentioned were dysfunctional aerosol cans, leaky cartons, finger-cutting tear tabs, tear strips or tabs that do not tear, and economy-sized packages that do not really save consumers money (ref. 12).

The trend, however, for most consumer products is for packaging to represent a larger portion of product costs today than 10 years ago (fig. 7). These trends may already be reflective of the greater use of packaging and the incorporation of package design features that offer consumers convenience.

3.3.2.3 Government. The role that government may play in displacing the trends in packaging is difficult to project. It appears obvious that many legislators are responding to the concerns of their constituents about packaging and its influence on the quality of life by introducing legislation aimed at influencing packaging decisions. Most Federal legislation has been directed toward labeling, or toward providing consumers (especially children)

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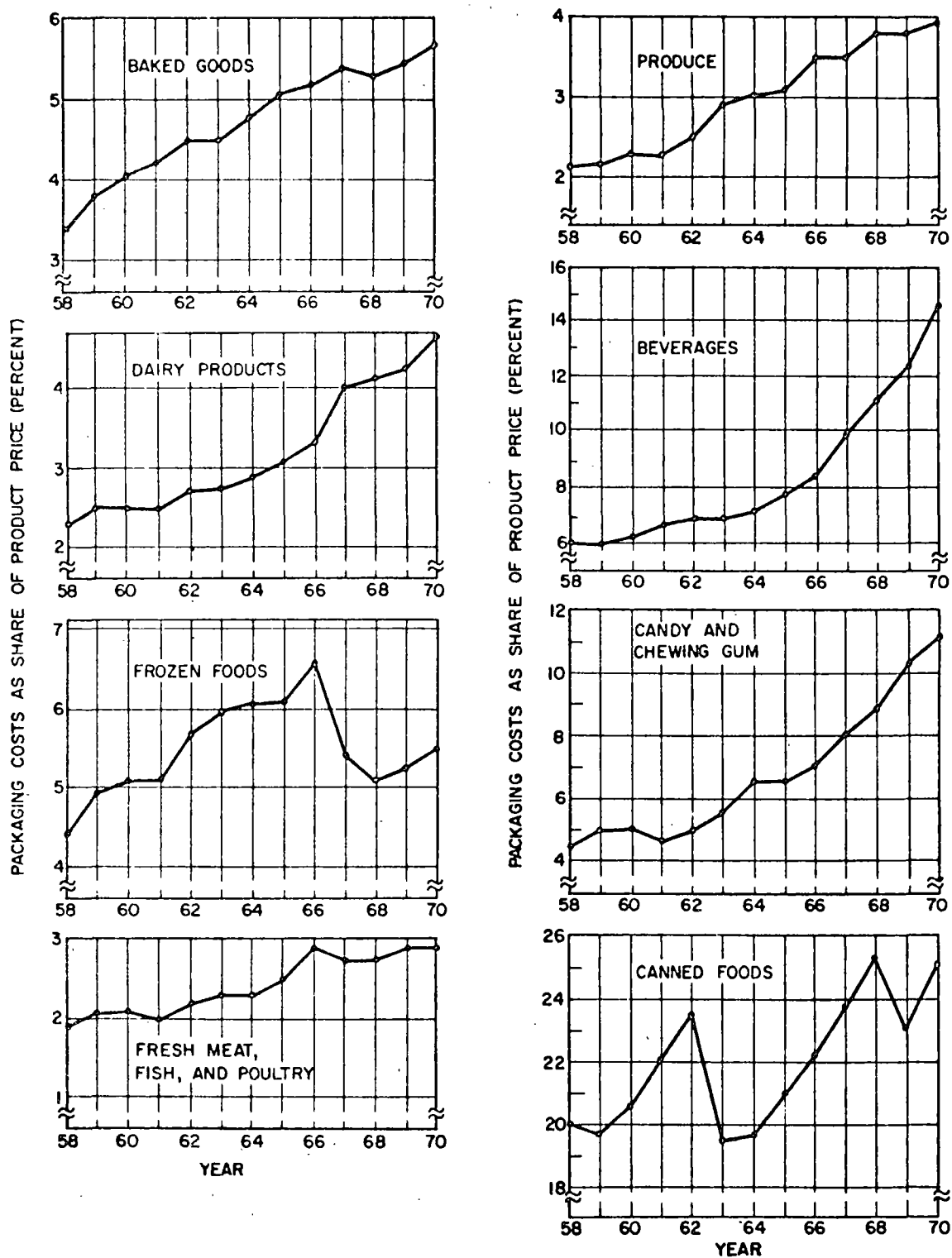
Figure 7. Share of consumer product costs represented by packaging.
(Source: Research Triangle Institute.)
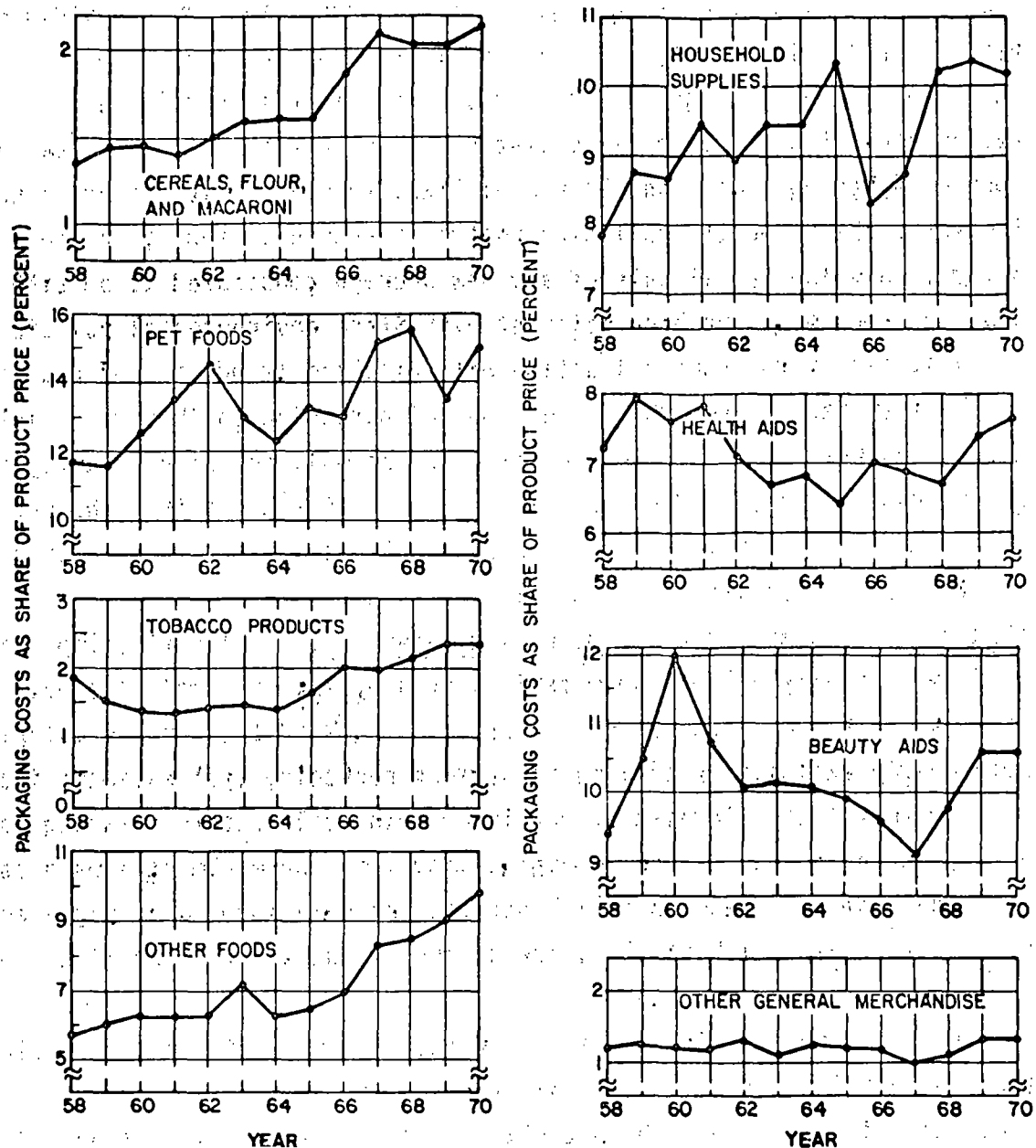
Figure 7 (con.) Share of consumer product costs represented by packaging. (Source: Research Triangle Institute.)

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protection from packaged products that are hazardous (ref. 13). On the State and local level, however, there appears to be a greater willingness to experiment with legislation designed to alter or reverse packaging trends seen as inimical to the environment. Three examples of such approaches are noteworthy. In New York City, a tax on nonfood plastic containers was instituted for the purpose of reducing the cost of solid waste disposal and encouraging recycling of plastic containers. However, the law was declared unconstitutional. In Oregon, all beer and soft drink containers to be sold in the State are required to have refund values. If this requirement is adopted by other States, it could dramatically reverse the trend in Beer and Soft Drink packaging toward an all-nonrefillable-container system of packaging. In Minnesota, the Minnesota Pollution Control Agency has been given the authority to ban the retail sale of any new package considered to be either a solid waste problem or one "inconsistent with State environmental policies."

To what extent governmental action will displace trends is, of course, not easily answerable. For the projections of packaging in 1980, the implicit assumption has been made that governmental action will not significantly modify current packaging trends. However, it should be pointed out that the purpose of this study is to identify how government could alter the use of packaging through the use of regulation and/or fiscal incentives.

3.3.2.4 Competition Among Packaging Materials. Qualitative improvements observed in virtually all of the materials used by society (ref. 14) have also affected the packaging industries. Prior to World Ward II, certain materials had held nearly exclusive positions in various packaging applications; i.e., choice of material was dictated primarily by technical factors relating to the product being packaged. For example, many foods were almost always packaged in cans made from tin-plated steel; beverages and some foods were packaged in glass bottles or jars with steel closures; and products requiring flexible packaging were packaged in paper.

Since that time, qualitative improvements in other materials, especially plastics and aluminum, have increased the range of alternatives in package material selection and hence the potential scope of price competition. As the plastics and aluminum producing industries developed, production technology improved and economies of scale emerged. These economies of scale encouraged producers to develop qualitative improvements in their products to promote their

use in new applications. The result has been an increase in the range of materials available for packaging. For example, the beverage producer may now choose from various types of bottles, steel cans, or aluminum cans as packaging materials. The food packager has the same choice plus the possibility of flexible or rigid plastic containers. In applications where flexible packages are required or desirable, aluminum foil, paper, plastic film, or combinations of these may be used.

Recent trends in applications and usage of the five basic packaging materials are discussed below.

a. Paper

Paper and paperboard are a major factor in the packaging of consumer products. In 1970, an estimated 9.6 million tonnes of paper and paperboard were used to package consumer goods, representing approximately 35 percent of the total consumption of packaging materials. Paperboard--or rigid paper (setup boxes, folding boxes, sanitary foodboard, and composite cans)--accounts for the major share of paper packaging. Flexible papers (converting papers; bag paper; and glassine, greaseproof, and vegetable papers) and paper closures represent approximately one-third of paper packaging.

The low cost and versatility of paper have accounted for its dominance in packaging. However, technological advances that improved the quality and cost competitiveness of plastics have created a threat to traditional paper markets. Therefore, paper has become a slow growth material in the packaging industry, averaging a 3.1 percent annual rate of growth from 1958 to 1970 as compared to 4.4 percent for all packaging materials. This rate of growth in the use of paper for packaging consumer products did not keep pace with the increase in consumption of goods over the 13 years. The amount of paper packaging per dollar of expenditure on durable and nondurable goods was 15 percent lower in 1970 than in 1958, an average annual decrease of 1.39 percent.

The most significant gains during the 1958 to 1970 period for both flexible and rigid paper were in the packaging of perishable food items. In this category of consumer goods, paper packaging increased absolutely and relative to consumer expenditures. Three factors were responsible: the shift from the glass milk bottle to paperboard containers (and plastic bottles); increased packaging of meat and produce; and the dramatic increase in the demand for frozen convenience foods that have large paper-packaging requirements. The paper industry is attempting to maintain its share of this potential market

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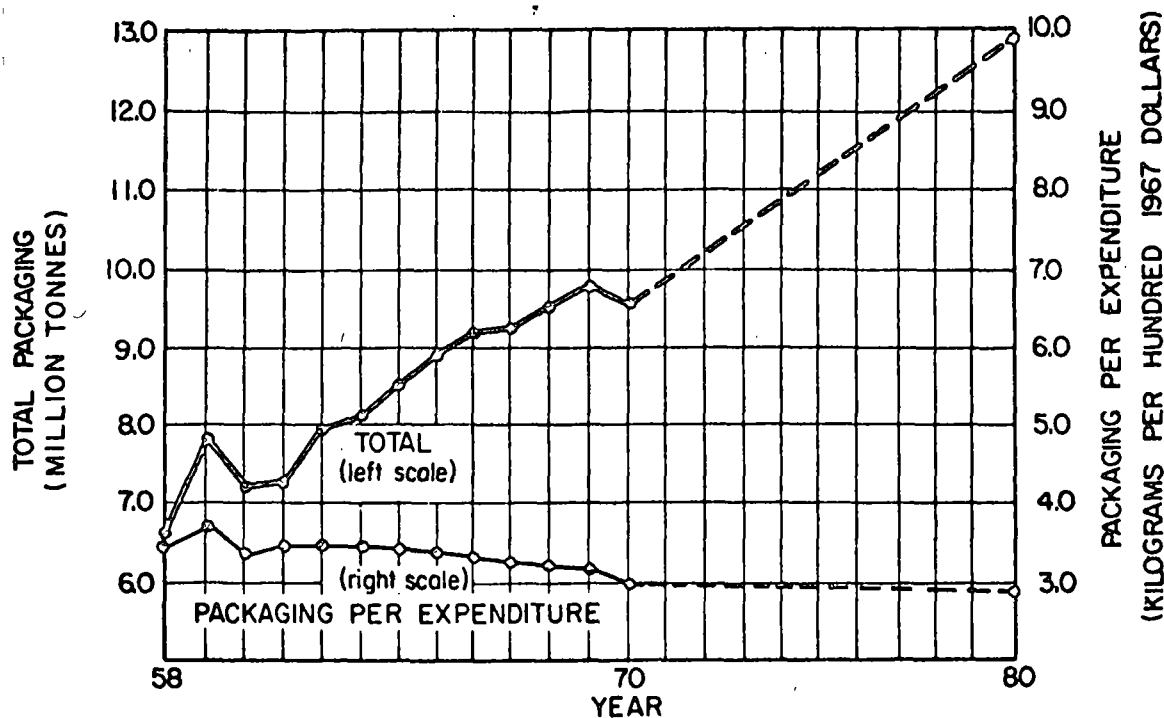
Figure 8. Trends in paper packaging.
(Source: Research Triangle Institute.)

in the face of the popularity of plastics by using combinations of paper and the competing materials in new and more versatile packages. It is noteworthy that almost two-thirds of the dollar value of plastics used in packaging in 1969 was consumed by the paper industry (ref. 15).

In the packaging of nonperishable foods, paper usage per dollar of consumer expenditure remained fairly stable from 1958 to 1970. However, the total amount of paper consumed in nonfood packaging grew at an average annual rate of only 1.1 percent per year, much below the growth rate of expenditures.

If the trends in the utilization of paper packaging and the distribution of consumer expenditures continue, the amount of paper used in packaging consumer goods is projected to be 12.8 million tonnes in 1980, or an average of 2.7 kilograms per dollar of expenditure on durable and nondurable goods (fig. 8).

b. Plastics

During the past decade, plastics have emerged as a major container material and a contender for markets previously dominated by glass, steel, and paper.

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In 1970, 798 thousand tonnes of flexible plastics, 610 thousand tonnes of rigid plastic containers, and 55 thousand tonnes of plastic closures were used in packaging consumer goods. Although this represented only 5 percent (by weight) of all packaging materials consumed in 1970, in 1958 only 2 percent of materials used were plastics.

The relative significance of flexible versus rigid container applications of plastics has undergone a rapid transformation. In 1958, 12 percent of all plastic packaging consumption, as measured by weight, was in the form of rigid containers; in 1970, 42 percent of the consumption was in the form of rigid containers. The average annual rate of growth in rigid containers was 26 percent.

Glass has been particularly vulnerable to the rapid growth in plastic containers due to glass breakage. Plastics have almost displaced glass for packaging household cleaning supplies; the usage of plastics has increased significantly for packaging medicinal and cosmetic products. Rigid plastic containers have not been utilized significantly in food and beverage products. However, they have been used in the packaging of milk and have met customer acceptance; also, success in the test-marketing of Soft Drinks in plastic
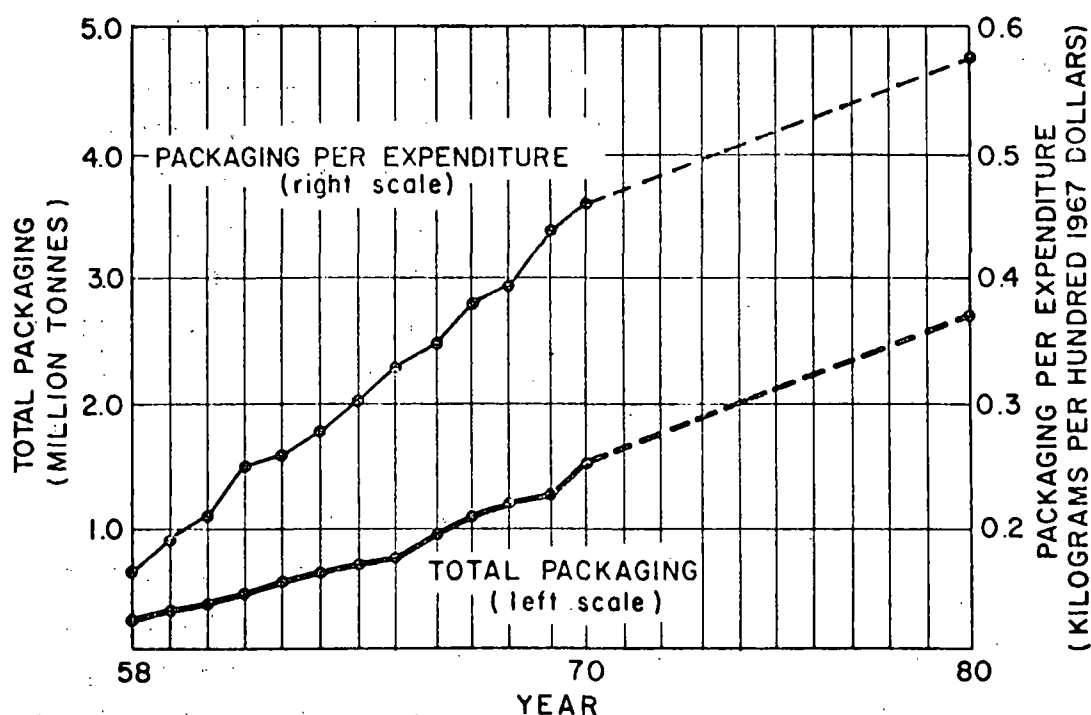
Figure 9. Trends in plastics packaging.
(Source: Research Triangle Institute.)

bottles (ref. 16) portends future applications in food and beverage markets.

The growth in using flexible plastics (including cellophane, according to convention) for packaging, although not as spectacular as that of rigid containers, has been almost twice the rate of the increase in consumer expenditures. Much of this is due to increased packaging applications of polyethylene bags. Bread is predominantly packaged in this manner and a growing proportion of produce is prepackaged in polyethylene bags. Flexible plastics have received consumer acceptance particularly due to their transparent quality, and considerable potential for expansion still exists.

The usage of plastic closures quadrupled from 1958 to 1970. Given new legislation requiring child-resistant closures, it is likely that plastics will replace metal as a closure material.

Extrapolating the trends in the usage of plastics in consumer packaging and the trends in consumption expenditures, the amount of plastics to be used in packaging is projected to be 2.6 million tonnes in 1980 (fig. 9).

c. Glass

In 1970, 10 million tonnes of glass were used in packaging consumer products. This figure represents an average annual rate of increase over 1958 of 6.2 percent. Thus, despite the strides made by competing materials in capturing packaging markets, glass activity has been significant.

The growth in glass usage for packaging consumer products can be almost wholly attributed to the radical shift to nonrefillable beverage bottles. Consumer preference for convenience, retailer reluctance to handle refillables, and the encouragement of glass manufacturers eager to expand their sales have all contributed to the trend toward nonrefillables. Between 1958 and 1970, nonrefillables increased at an average annual rate of 30 percent in the packaging of Soft Drinks and 15 percent in packaging Beer. The rates of increase in consumer expenditures on these items were 2 percent and 1 percent, respectively.

Vigorous competition from other materials, particularly plastics, has displaced glass in many markets. Glass is heavy; thus the material's cost advantage is lost in greater transportation charges. Glass is fragile, and consumer demand for safety has encouraged the shift to alternative packages. For example, plastic bottles have now secured the market for packaging liquid

household products; paper cartons and plastic bottles have replaced glass milk containers.

Glass retains technical advantages as a package in some product lines. Glass is chemically inert, transparent, and compatible with convenient closures for making glass packages easily resealable. These properties are particularly attractive to the consumer in packaging food items such as mayonnaise, relishes, jams, and baby foods. In these markets, glass has kept pace with the growth of consumer expenditures.

Glass jars have decreased in importance as a package for health and beauty aids; however, at present, technical factors apparently limit the extent to which glass can be replaced in this market. For example, plastics have become an important material in packaging medicinal products, but because many drug preparations are chemically incompatible with plastics, glass jars must be used. Similarly, in fragrant toiletries such as perfumes and after shave lotions, the oil will permeate plastic containers in a relatively short time.
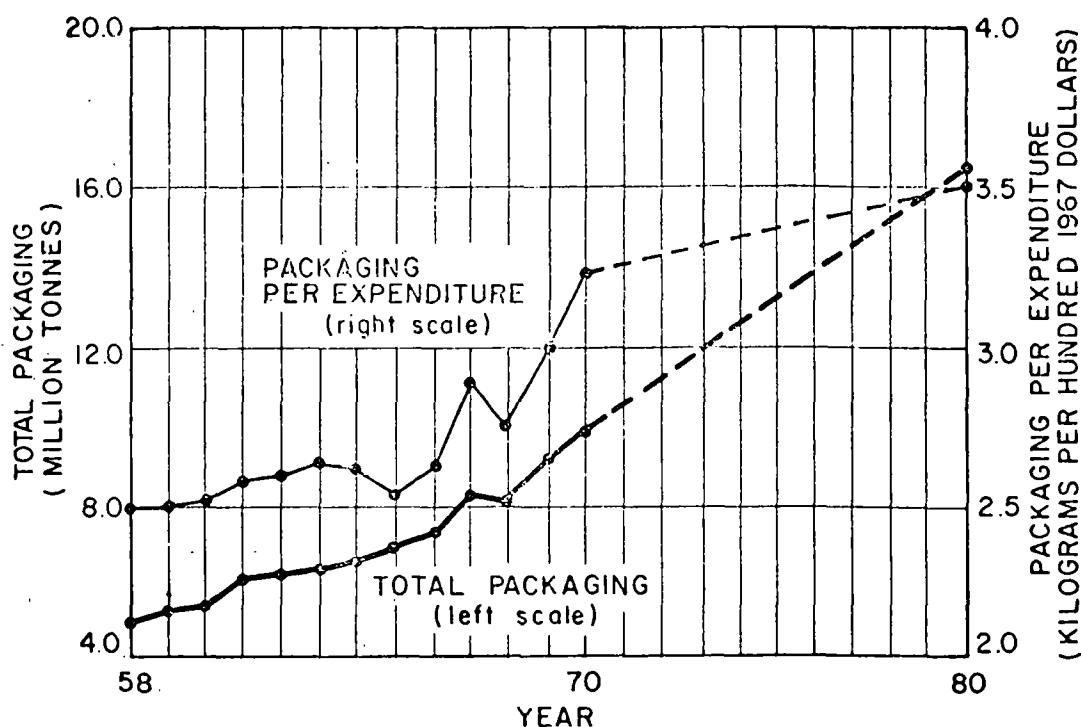
Figure 10. Trends in glass packaging.
(Source: Research Triangle Institute.)

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Research by the glass industry has been directed at lighter weight, unbreakable glass containers. If unbreakable glass is developed, trends occurring over the past 13 years may be reversed. However, proceeding with the assumption that packaging trends will continue, 16.3 million tonnes of glass are projected to be used for packaging in 1980 (fig. 10).

d. Steel

Consumer products packaging consumed 6 million tonnes of steel in 1970. About 95 percent of the total was fabricated into cans; the remainder was used for closures.

Between 1958 and 1970, the quantity of steel converted into cans increased at a modest annual rate of 2.8 percent. During this same period, thinner can-sheet gages gained wider application; as a result, the number of cans used in the packaging of consumer products increased annually by about 3.1 percent. This rate, however, is still below the 3.8 percent growth rate of consumer expenditures on goods.

Food containers are the major outlet for steel cans; 76 percent of steel cans consumed in 1970 were used in packaging food items. The advantages of steel containers for packaging food relate to strength (important in hot or vacuum filling), total impermeability, and resistance to temperature extremes.

Two recent trends in steel cans deserve particular attention: the greater application of cans in beverage packaging (particularly Soft Drinks), and aerosol packaging.

By 1958, cans had captured a large share of Beer containerization but were not yet used extensively in packaging Soft Drinks. Supermarket chains first introduced the Soft Drink can and one-way bottle to market their house brands. The success of these convenience containers encouraged bottlers of the national brands to offer their products in cans and nonrefillable bottles. During the 13 years of 1958 through 1970, the amount of steel used to package Soft Drinks increased over twentyfold. Beer and Soft Drink containers accounted for 25 percent of steel can consumption in 1970.

The growth in aerosol cans is representative of the trend toward convenience packaging. The increase in labor force participation by women has created a demand for time-saving packages, and greater affluence has led to a willingness to pay a premium for convenience. Thus, although aerosol cans are more expensive than traditional containers, the aerosol can has had a successful history. In 1958, 56 thousand tonnes of metal were converted into aerosol containers; in 1970,
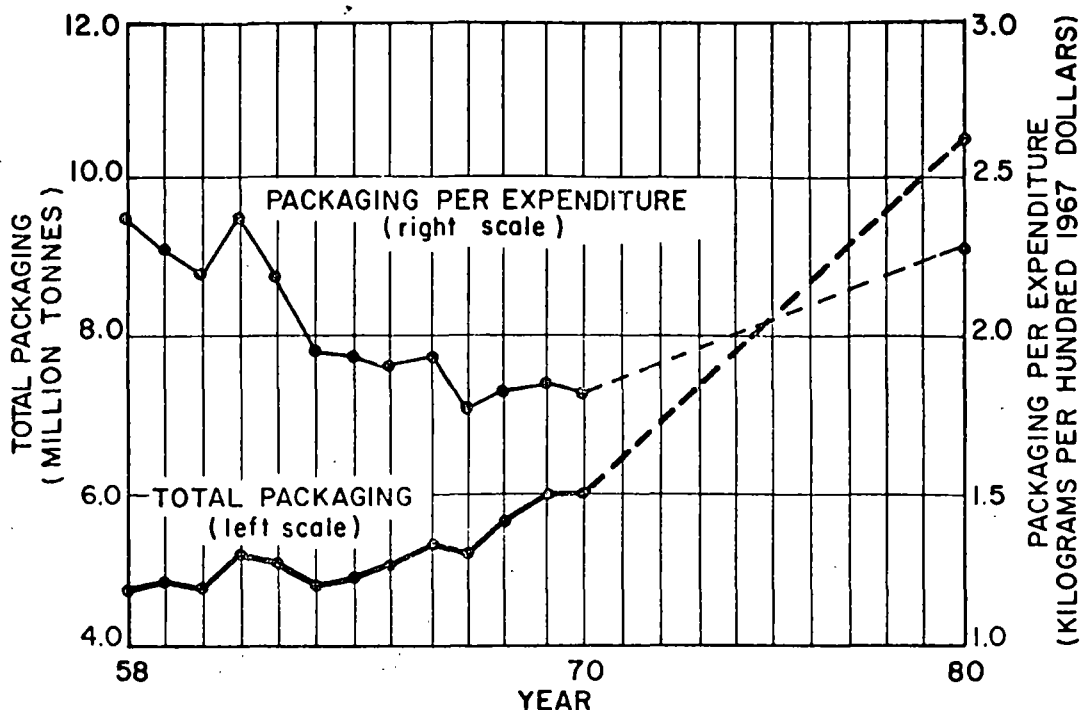
Figure 11. Trends in steel packaging.
(Source: Research Triangle Institute.)

256 thousand tonnes of metal were used. The major applications to date of
the aerosol container have been in household products and beauty aids.
Aerosol cans have not been extensively used for packaging food products due
to chemical incompatibilities between product and package and problems in
the design of aerosol valves for food products. Expansion of aerosol cans
in food packaging can be expected as refined packages and new consumer
products are developed. In fact, the aerosol can is a prime example of the
way in which developments in packaging create opportunities in product
markets; the introduction of the aerosol can led to the development of a new
product, hair spray.

If trends observed during the past 13 years continue, steel usage for
the packaging of consumer products is projected to be 10.5 million tonnes
in 1980 (fig. 11).

e.   Aluminum

Containers and packaging is the third largest market for aluminum
(ref. 17). Aggressive promotional activity by the Aluminum Association has
led to wide acceptance of aluminum as a packaging material. Substantial

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growth has occurred in the usage of aluminum in packaging during the past
decade and it is likely that significant new packaging applications will
be developed in the future.

Aluminum can fabrication accounts for 80 percent of aluminum used in
packaging, and it is the container most responsible for the substantial
increase in consumption of aluminum packaging. In 1967, the first year
for which detailed data on aluminum cans were available, 177 thousand
tonnes of aluminum were converted into cans; by 1970, the amount of aluminum
in can fabrication had increased 87 percent to 331 thousand tonnes.

Aluminum cans, though more expensive than other metal cans, are light-
weight and thereby gain a cost advantage in transportation charges. Aluminum
tears more easily than steel, thus making it safe and easy to open when used
as one of the zip-top devices. For this reason aluminum has made inroads
into the beverage market. Beer and Soft Drink containers account for most
of the aluminum cans used in packaging; in 1970, these two outlets consumed
80 percent of all aluminum cans produced.

Aluminum cans are also beginning to move into other food packaging
markets such as for canned meats, Pet Foods, and Frozen Foods. However,
aluminum, unlike steel, would buckle and collapse under air pressure in the
vacuum filling method; therefore, it is not a currently suitable package for
many food processors.

Aluminum foil, in both flexible and semirigid forms, is being used
increasingly in packaging, primarily for food products. Aluminum foil is
tasteless and odorless, and performs well in freezing, heating, and drying
processes, which make it applicable to a variety of food types. Aluminum
is also an excellent conductor of heat, which provides it with excellent
growth opportunities in the face of increasing demand for heat-and-serve
foods. Semirigid foil has been used most extensively in packaging Baked
Goods and Frozen Foods. Flexible foil is utilized for its barrier properties
in numerous food products, and it has been particularly successful in packaging
unit-of-use items such as mustard and catsup. Consumption of aluminum foil
increased at an average annual rate of 8 percent during the 1958-70 period.

Collapsible metal tubes are the slowest area of growth for aluminum.
(Although not all collapsible tubes are made of aluminum, it is the most
commonly used material. The available information does not distinguish this
package by metal type; therefore, all collapsible tubes have been included
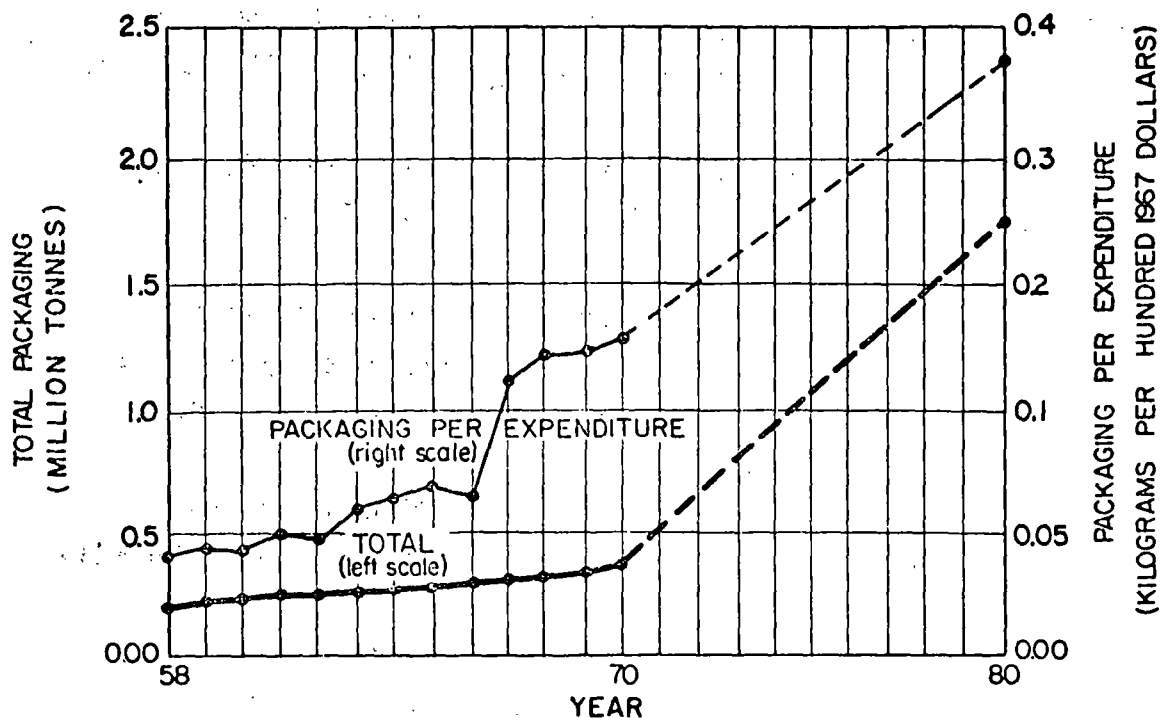
Figure 12. Trends in aluminum packaging.
(Source: Research Triangle Institute.)

in the aluminum category). Collapsible tubes are used for semiliquid
materials. They have had success in cosmetics and pharmaceuticals, but
consumers have not accepted tubes as a food package. The slow growth
in the metal tube can be attributed primarily to the development of plastic
tubes. The greater popularity of plastics should continue to inhibit metal
tube growth.

If the trends in aluminum packaging continue to 1980, consumption of
aluminum is projected to be 1.7 million tonnes, an average growth rate of
13 percent (fig. 12).

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CHAPTER 4: SELECTION OF POLICY INSTRUMENTS AND DEVELOPMENT OF A METHODOLOGY FOR THEIR EVALUATION

4.1 Introduction

Many courses of governmental action on the subject of packaging and its relationship to environmental quality have been proposed both from within and outside the government. Four possible governmental policy instruments are identified in this chapter and analyzed in the succeeding one.

Criteria for evaluating the effectiveness and costs of alternative policy instruments are also presented in this chapter. The measurement of costs is based on the concept of consumer surplus as a measure of consumer welfare. The latter measure enjoys fairly widespread acceptance by applied economists.

The major theoretical limitation of the consumer surplus measure of welfare is that it assumes that the marginal utility of income is constant across individuals; i.e., that a dollar provides the same real income to all recipients.* In applied work another limitation is that the estimation of forfeited consumer surplus requires empirical estimates of product demand elasticities.† Nonetheless, it is a useful tool for developing reasonable estimates.

Ultimate criteria for developing monetary values of the benefits to society of reductions in packaging or alterations in the mix of packaging materials or of the inputs to packaging are not readily available. It is possible that in some cases informed judgment may provide a more reliable measure of the benefits of a policy instrument than the measures of "effectiveness" employed in this study. Yet those measures often suffer from the subtle interjection of normative criteria.

The final section of this chapter discusses the design of the programmed model used to provide quantitative estimates of the costs and effective-

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*The use of consumer surplus as a measure of welfare implicity assumes that a consumer's allocation of his limited income among alternative goods and services is optimal to him. This is far from being a universally accepted maxim in an age in which "rational behavior" is not always observed and many industries spend large sums on advertising designed to alter consumer tastes and preferences.

†Demand elasticity estimation generally requires extensive data analysis which often fails to clarify the extent to which the elasticity parameter estimate varies over certain ranges of prices and quantities.

ness of each policy instrument.

Like any model, this one has limitations. Specification problems related to the parameters of the supply functions imposed the assumption of unconstrained supply in both the packaging materials and consumer product markets. That is, any producing industry may purchase, at a given price, as much or as little of a given packaging material as desired. Similarly, consumers may purchase any amount of a commodity at the current product price.

A second limitation is due to the incomplete specification of the production function. Substitution between packaging and nonpackaging materials in response to changes in the price of packaging may affect product prices, consumer demand, and the composition and quantity of nonpackaging solid waste. While we would have preferred to incorporate these relationships into the packaging model, the problems of defining the appropriate nonpackaging resources and the lack of quantitative data on many of the factors precluded such an effort within this study. However, knowledge of the nonpackaging factors may modify the results and conclusions of this analysis.

Thirdly, the response to a change in the price of a consumer product is conceptually treated in the model as a movement along the demand curve for that commodity. A demand curve is defined as a schedule that holds the prices of all other goods constant. A packaging strategy, however, simultaneously affects many consumer product prices and will therefore cause a shift in the demand curve for a given commodity. Estimating the degree of the shift (cross-price elasticity) is difficult with times series data due to the strong correlation of price data; hence, it was not pursued in this study. The calculated change in consumption of a good will be an overestimate or underestimate since the good is, in the aggregate, a substitute or complement for other goods whose price has increased.

Despite the limitations, we believe that this study provides a useful basis for informed decisionmaking on the problem of packaging and also provides insight into the use of regulatory and fiscal measures to reduce environmental problems associated with solid waste generation. While the estimates of the absolute change in packaging wastes are sensitive to the restrictive assumptions of the model and should be cautiously interpreted, the results provide useful conclusions regarding the relative effectiveness of the alternative policy instruments.

4.2 Selection of Policy Instruments

The selection for subsequent analysis of alternative regulatory and fiscal (or price) policy instruments which may reduce some of the undesirable environmental aspects of product packaging requires the use of judgment. Since the perspective of this study is the entire range of packaging, the instruments selected for analysis were those that have potentially broad applications to the entire range of packaging. The policy instruments selected can be divided into two broad classes, regulatory and fiscal, depending on whether they tend to dictate desired behavior through the law (regulatory) or induce it through the market (fiscal).

4.2.1 Regulations

Regulations have been the most common response of government to problems in environmental quality. Explicit regulations, supported by effective enforcement, can induce the desired behavior by industry or consumers. Because of the high level of predictability associated with properly described and enforced regulations, they may be especially applicable to solid waste problems when quick results are necessary.

There are, however, several drawbacks to regulations.

(a) They are difficult to write in unambiguous language, and may therefore be avoided or at least delayed through the legal channels.

(b) Since obeying regulations is usually expensive, there is pressure to avoid regulations. As a result, the costs of effective administration and enforcement may be high compared to fiscal incentives.

(c) Regulations are frequently enforced in an erratic or even lax manner.

(d) Assuming they are effective in dictating behavior, regulations do not promise to provide results at a minimum cost (excluding administrative and enforcement) to society.

One regulation that would have broad application to packaging has been selected for analysis. It is conceivable, however, that for a narrower definition of packaging, other regulations may be more appropriate.

4.2.1.1 Regulation Requiring the Use of Postconsumer Waste in Product Packaging.

The conservation of natural resources would be promoted and the need for disposal sites reduced if there were greater recycling of postconsumer waste. One way to promote recycling is to require it.

Such an approach has been frequently proposed with respect to government purchases, and could be extended to other sectors of the economy if merited.

For example, government could require that all packaging incorporate at least (x) percent recycled materials. The percentage could be uniform across all packaging materials or reflect some assessment of the costs of recycling.

Many industries already do recycle in that they recycle the in-plant waste from cuttings, trimming, etc. back into the production process. If these materials were included in the definition of "waste," it is likely that the effect of the regulation would be simply to induce greater production of in-plant waste to meet the requirement. For this reason "postconsumer" or municipal waste is the only waste product considered in the analysis. Several uniform requirements are analyzed in chapter 5.

4.2.2 Fiscal Incentives

Among the several types of fiscal incentives proposed for application to problems in environmental quality, taxes are most often mentioned. Taxes could be used to promote source reduction of packaging and/or resource recovery in packaging, thereby reducing the environmental problems associated with the generation, collection, and disposal of packaging solid waste.

Beginning with Pigou (ref. 1), economists have argued for the imposition of a tax on the activities that create external diseconomies (e.g., pollution). This tax should be equal to the social costs imposed on society by the activity. One problem frequently posed regarding the use of such taxes is the lack of data needed to estimate the magnitude of the social costs. However, Baumol has recently argued for the establishment of standards regarding the desired levels of environmental quality and the imposition of taxes on the offending activities sufficient to reach the standard. He cites the case for the use of a corrective tax over regulation, as a means of meeting the standard, thus: "...it promises to be operational because it requires far less information for its implementation. It utilizes global measures and avoids direct controls with all of their heavy administrative costs and their distortions of consumer choice and inefficiencies. It does not use the police and the courts as the prime instrument to achieve the desired modification of the outputs of the

economy. Its effects are long lasting, not depending on the vigor of an enforcement agency, which all too often proves to be highly transitory. ...it need not add to the mounting financial burdens of the state and local governments. Finally, it can be shown that, unlike any system of direct controls, it promises, at least in principle, to achieve decreases in pollution or other types of damage to the environment at minimum cost to society (ref. 2)."

The tax base selected should be the offensive characteristic of the product. For example, the production of electricity from fossil fuels results in the generation of sulfur emissions. If the purpose of a tax is to reduce sulfur emissions, the tax should probably be placed on sulfur, emissions not on electricity. Similarly, with respect to packaging, it is first necessary to identify the offending characteristic of packaging in order to select the proper base. Many alternative tax bases have been suggested in the popular literature including: disposability, degradability, energy content, natural resource content or mix, potential for recycling, volume, and weight. For some of these bases, the data do not exist. Other potential bases are difficult to define meaningfully and/or suffer from a lack of agreement as to desirability or undersirability. For example, the idea of taxing "disposability" has been suggested by several observers. However, disposability is not easily measurable, being dependent on the material and the method of disposal. Plastics might be considered disposable with incineration, yet in a landfill they may remain unaltered. But, even assuming that disposability could be measured, is it desirable? Is it important that solid waste degrade in a landfill? And if so, how important, i.e., how much should society be willing to pay? Some maintain that it may be more desirable if solid waste did not degrade so that landfills would form a more stable base for building upon, or so that resources discarded today could be "mined" at some future date. Lacking data or a persuasive case for their selection, many possible tax bases can be dismissed for this study. Package weight and the units of packaging are two of the more frequently used potential bases because data are available for these parameters and, also, the social costs imposed on society by packaging are probably correlated with weight or units.

If taxes are used, they should be imposed at the point in the

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production process where the decisions are made that determine the
use of packaging. These are the package user industries. The
taxing authority could ascertain the materials the user industries
purchase by requiring that the manufacturer of the packaging material
adequately describe the material for tax payments purposes on the
shipping order or bill of lading.

The disbursement of tax revenues is a problem only if the revenues
are earmarked for distribution to other levels of government or to
particular functions within the Federal Government. If the revenues
are not earmarked, they simply are put into the general fund and
treated like any other tax revenue. If they are earmarked, then the
problem is to develop a formula for distributing these revenues. The
formula might deal with the level of government that would receive the
distributed revenues, the population of the area, the average per capita
income and existing expenditures for solid waste disposal and collection.
Another problem in the distribution of the tax revenues is to insure
that these distributed revenues are used for the earmarked purposes.
If the earmarking requires that they be used for solid waste collection
and disposal, then there probably is no way to insure that they are
actually used for this purpose so long as the receiving governments
spend at least as much on solid waste operations. If the requirement
is that these distributed revenues be a supplement to actual local
expenditures, then some enforcement mechanism is necessary to see that
these funds actually increase expenditures on solid waste rather than
simply supplanting local funds.

One of the drawbacks to the use of taxes is the problem of pre-
dicting the outcome. While analysis prior to the institution of a
tax can provide an important starting point, the need for adjustment
in the tax rate should be anticipated.

Three possible tax bases are discussed below and analyzed in
chapter 5.

4.2.2.1 Two Taxes on Packaging Weight. A tax per pound or tonne
on all products, packaging included, has been proposed in several quarters
as a means of providing an incentive to producers to reduce the quantities
of packaging "which must ultimately be disposed of..." (ref. 3) and to raise
revenues to finance a more advanced solid waste management system.

The tax could be imposed on all packaging regardless of the materials used, imposed at different rates on different materials if the social costs of materials are found to vary among materials, or only on the portion of the packaging that represents virgin materials inputs, in order to encourage recycling.

A per tonne tax on packaging and a per tonne tax on the packaging that excludes the portion consisting of materials recycled from post-consumer waste are both analyzed in chapter 5. Several tax rates are used to observe the sensitivity of the impacts of the tax to alternative tax rates.

4.2.2.2 <u>A Tax on Containers</u>. A tax on the unit of rigid packaging (container) has been suggested by some observers as a means of reducing overpackaging and encouraging a shift to fewer, larger containers which have more volume per unit of container weight than small containers. Products such as toothpaste which are frequently packaged in a tube in a box (for ease of stacking and protection of the tube from unsightly dents or punctures) would be taxed as two containers. The tax would be neutral as to material types, whereas a tax on weight favors the materials that have the highest cost per tonne.

Several tax rates using containers as a base have been selected for analysis in order to provide a range of data on the responses projected.

4.3 <u>Methodology for Evaluating Policy Instruments</u>

The approach used to evaluate the alternative packaging policy instruments is cost-effectiveness analysis. This approach implies the acceptance of the objectives of a program for controlling product packaging and confines the analysis to determining the costs and degree of effectiveness of the policy instrument in promoting the objective.

The measures for evaluating the effectiveness of an instrument were developed from the major Federal solid waste legislation (refs. 4,5). The measures for evaluating costs were based on economic theory. The evaluations are approached from the perspective of society as a whole.

4.3.1 <u>Measures for Evaluating Effectiveness</u>

Two criteria are used to evaluate the effectiveness of the alternative instruments: the projected impacts of the instruments on (a) the generation of packaging wastes and on (b) the utilization of virgin materials by the packaging industries.

4.3.1.1 <u>Solid Waste Generation</u>. The Solid Waste Disposal Act expresses, among other things, the intent of Congress to promote the conservation of natural resources by reducing the generation of solid wastes. The Resource Recovery Act of 1970 specifically identifies packaging as a component of solid waste where reductions are sought.

Packaging waste generation is measured as a flow per unit of time (e.g., tonnes per year). Column 2 of table 19 summarizes the estimated 1970 rates of packaging wastes generation from residential sources. Reductions in these rates would, all other things being equal, promote the objectives of the legislation cited above.

4.3.1.2 <u>Natural Resource Utilization</u>. The conservation of natural resources by reducing the generation of waste and by promoting the recovery and utilization of potential resources in waste is also a purpose of the acts cited above.

Resource utilization is measured as a flow per unit of time. Column 3 of table 19 presents estimates of the 1970 rates of natural resource utilization for production of the materials used to package consumer products. Currently there is no significant recovery and reuse of waste consumer product packaging materials. Promotion of the recovery and reuse of the resources in solid waste for packaging consumer products and reductions in the utilization of natural resources for packaging applications would, all other things being equal, promote the objectives of the Solid Waste Disposal Act and Resource Recovery Act of 1970.

4.3.2 <u>Measures for Evaluating Costs</u>

Costs are the losses to society attendant to the imposition of a policy instrument. The major costs are the permanent losses due to higher product prices. However, because employment impacts are always of interest, this criterion is also included.

4.3.2.1 <u>Product Prices and Consumer Surplus</u>. From a perspective of the welfare of society, prices have at least two important dimensions. First, they affect the standard of living. Higher prices, all other things being equal, mean reductions in the amount of goods and services that consumers can purchase with a fixed income. Since the distribution of consumption expenditures varies by income group, it can be anticipated that the incidence of a packaging strategy that raises prices will vary across income groups. As shown in table 20, lower income groups spend proportionately more of their budget on food and tobacco than

Table 19. Rates of solid waste generation and natural resource
utilization for consumer products packaging, 1970

| Packaging material | Solid waste generation (thousand tonnes) | Natural resource utilization | |
		Raw materials (thousand tonnes)	Energy* (equivalent million kilowatt-hours)
Paper	9,590	7,223[†]	23,497
Plastics	1,460	2,952	1,942
Glass	10,203	12,025	26,334
Steel	5,989	9,760	19,374
Aluminum	516	2,962	8,859
Total	27,758	34,922	80,005

*For material manufacture.
†Does not include waste paper.

Source: Solid waste data from Research Triangle Institute; natural resource utilization data extracted from Table 2-3.

Table 20. Distribution of family expenditures by income class, 1960-61

| | Percent of families | 1 Lowest | 2 | 3 | 4 | 5 | 6 Highest |
		24.0	25.1	27.8	13.4	6.8	2.0
Expenditure category							
I. Food and tobacco		25.6	23.5	22.0	21.2	19.3	15.9
II. Clothing, accessories, and jewelry		5.9	7.4	8.0	8.8	9.2	8.9
III. Personal care		2.4	2.4	2.3	2.2	2.1	1.7
IV. Housing		26.9	23.5	22.7	21.8	21.2	21.9
V. Household operation		14.0	12.6	12.5	12.0	12.0	12.4
VI. Medical care expenses		7.1	5.5	5.2	4.9	4.9	4.5
VII. Personal business		2.3	3.8	4.7	5.3	5.6	6.0
VIII. Transportation		7.3	12.3	12.5	12.9	12.7	10.4
IX. Recreation		2.6	3.5	3.8	4.1	4.5	4.0
X. Private education and research		.4	.5	.7	.8	1.5	2.0
XI. Religious and welfare activities		3.5	3.6	4.1	4.3	5.0	8.8
XII. Foreign travel and other, net		2.0	1.4	1.5	1.7	2.0	3.5
		100.0	100.0	100.0	100.0	100.0	100.0

Source: Developed by the Research Triangle Institute from data presented in Bureau of Labor Statistics, Survey of Consumer Expenditures, 1960-61.

do the higher income groups. Lower, income groups also allocate larger shares of their incomes to consumption expenditures rather than savings compared to higher income groups. Since the majority of packaging is used to package food items, any strategy that raises the cost of packaging in general is therefore likely to weigh most heavily on the lower income groups.

Secondly, prices provide information about the value or worth of products to consumers. For example, if a consumer is willing to pay 30 cents for a loaf of bread, then the bread must be worth at least 30 cents to him. If, however, the bread actually sells for 25 cents per loaf, this consumer would be enjoying a "surplus" of 5 cents per loaf.

The concept that shows the relationship between product prices and a consumer's willingness to purchase a product is a demand curve. Assume, for example, that we ask a consumer how many loaves of bread he will purchase at prices of 60 cents, 50 cents, 40 cents, 30 cents, 20 cents, and 10 cents per loaf and that we array this information graph- ically--assume perfect divisibility of prices and product. A demand curve for bread for this individual can thus be constructed (see figure 13). A market demand curve can be developed by horizontally summing all individual demand curves. The area under this demand curve is a measure of society's maximum value for the quantity in question. In figure 14, that value is the sum of areas A, B, and C for quantity Q_1. Now assume a market price P_0; the quantity purchased per unit is Q_0 and the total expenditures are area A. The total amount that consumers would be willing to pay (A + B) minus what they do pay (A) is a measure of the "consumer surplus" (B) they enjoy. Higher prices imply a reduction in consumer surplus. For example, suppose the effect of a packaging strategy is an increase in price of a product from P_0 to P_1 (fig. 15). The quantity purchased would decrease from Q_0 to Q_1. Consumer surplus would decrease from A + B + C to C, or simply by A + B. Part of the decrease (A) is due to the increase in expenditures and is equal to the change in price times the amount still purchased. The other part (B) of the decrease is that lost on the quantities no longer purchased at the higher prices $(Q_0 - Q_1)$.

Price (cents per loaf)	Quantity demanded
60	0
50	1
40	2
30	3
20	4
10	5
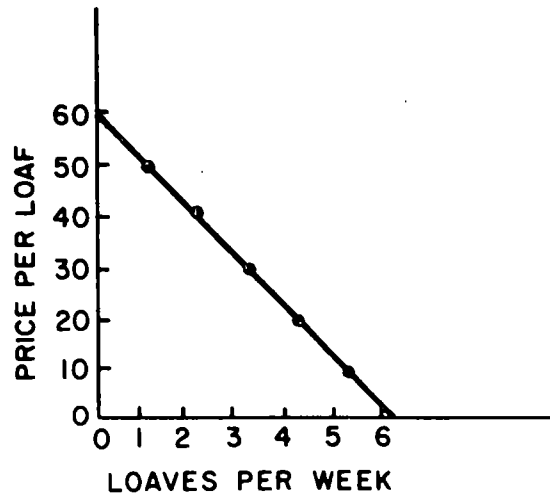
Figure 13. Demand curve.
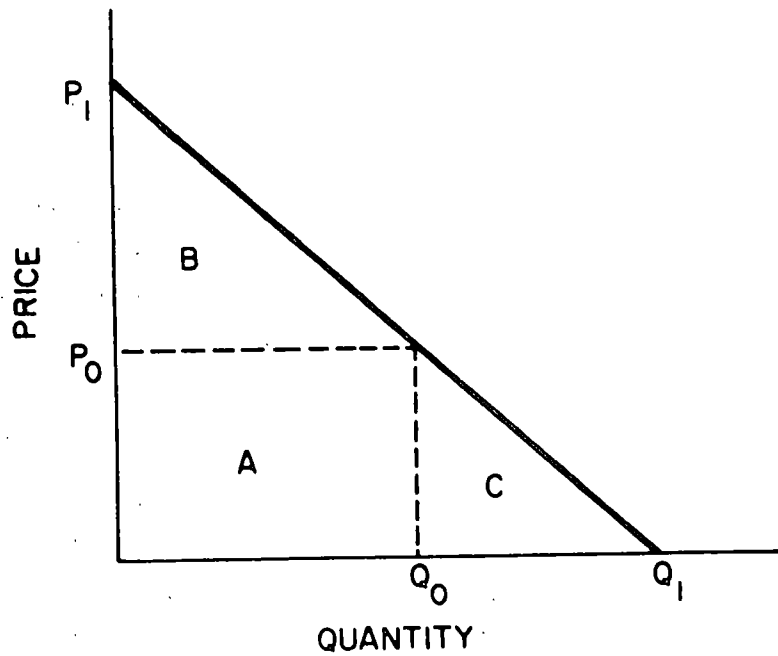
Figure 14. Consumer surplus.
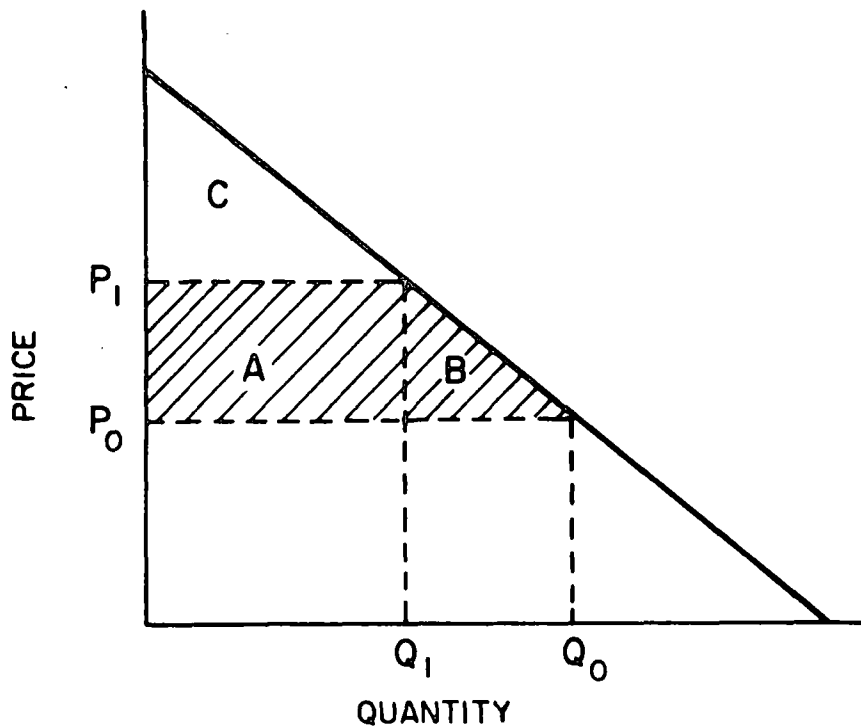
Figure 15. Losses in consumer surplus
from own-price increase.

The entire area (A + B) can be interpreted as the amount of money
that society would have been willing to pay to avoid the price increase
from P_0 to P_1.

If the basis for the price increase was the imposition of a specific
tax, then the area of the rectangle A is a transfer of income from consumers
to government, and the triangle B is the only loss to society.
The implicit assumption is that the costs imposed on society by the
quantity Q_0 - Q_1 are at least equal to the area of triangle B. In
the case of a regulation that increases product prices from P_0 to P_1, the
entire area A + B (the total loss in consumer surplus) must be compared
with the benefits of reducing consumption from Q_0 to Q_1.

4.3.2.2 Employment. In an economy committed to achieving full
employment, reductions in the employment in some industries are expected
to be offset by increases in the employment in other industries as a
result of the application of the fiscal and monetary policy by the
Federal Government. Nevertheless, even transitory reductions in employ-
ment can create temporary hardships on those affected.

4.3.3 Cost-Effectiveness Comparisons

The independently projected values for the costs and effectiveness of a policy instrument must be related in order to provide an estimate of the net changes in the welfare of society. Theoretically, such an estimate can be made by subtracting any costs created by the instrument from the benefits that it generates.

The implication of the solid waste legislation is that the price of collection and disposal of solid waste and the prices of natural resources do not reflect all the costs to society attendant to solid waste generation or natural resource utilization. If these services and products were fully costed, there would be less waste generated and resources extracted. However, the available data do not provide any satisfactory measure of these social costs; hence, there is no completely satisfactory way of valuing the measures of the effectiveness in dollar terms.

By dividing the cost of a policy instrument, measured in this study as the losses in consumer surplus, by each value for each measure of effectiveness, it is possible, however, to provide a relative comparison of the cost-effectiveness across policy instruments. Although it is not possible to say whether society would be better off with or without a policy instrument for controlling packaging, if the effectiveness of two policy instruments are being compared, it is possible to identify the policy instrument that provides benefits at the least cost per unit of effectiveness. Since cost is successively divided by several values for effectiveness, the resulting values are not additive.

4.4 Packaging Model

A model of consumer products packaging has been developed to provide quantitative estimates of some of the more significant impacts of various regulatory and fiscal instruments. The model is a comparative statics one, designed to compare "with and without" the policy instrument using 1970 values as a benchmark.

In its simplest form, the model consists of a set of inputs, outputs, and a structure for generating the output estimates.

Although the model is constructed to provide product-by-product analyses for the 30 consumer products used in this study, its primary purpose is to provide aggregate estimates of the impacts of specific instruments. Any implications for a particular product should be cautiously interpreted.

4.4.1 Model Input

The model is designed to accept as input one or more of the following policy instruments applied to each of nine package material types:

(a) A tax per tonne on packaging;

(b) A tax per unit on rigid packaging;

(c) A tax per tonne on packaging exempting recycled materials;

(d) A regulation requiring the use of a minimum amount of recycled materials in product packaging, by share of package weight.

4.4.2 Model Output

The output of the model consists of estimates of the values for the following packaging system parameters before and after the imposition of a policy instrument:

(a) Weight of solid waste packaging by material;

(b) Weight of major virgin materials used in the manufacture of each packaging material;

(c) Weight of additional recycled materials used by material;

(d) Equivalent kilowatt-hours of energy used to produce each material;

(e) Employment in the packaging industries;

(f) Dollar value of tax revenues;

(g) Consumer expenditures for each consumer product;

(h) Price increases in each consumer product;

(i) Losses in consumer surplus.

4.4.3 Model Structure

The packaging model consists of several interrelated elements that transfer a policy instrument to estimates of the values for the output parameters. A flow diagram is presented and the major elements of the model are discussed in appendix C.

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2. S. J. Baumol. "On Taxation and the Control of Externalities." American Economic Review LXII (June 1972):219.

3. S.3058, Solid Waste Management Act of 1972.

4. Solid Waste Disposal Act of 1965.

5. Resource Recovery Act of 1970.

Chapter 5: ANALYSIS OF REGULATORY AND FISCAL POLICY INSTRUMENTS

5.1 Introduction

An analysis of the effectiveness and costs of one regulation and three fiscal policy instruments that have potential application to packaging is presented in this chapter. The methodology and packaging model presented in chapter 4 and appendix C provides the basic framework for the analysis. It should be reiterated here, however, that the measures of cost and effectiveness used in this analysis are not all inclusive. Nor are the projected impacts precise estimates; they are rather tendencies to move in various directions toward the values estimated.

5.2 Regulation Requiring the Use of Postconsumer Waste in Product Packaging

Recycling of postconsumer waste would tend to promote the conservation of natural resources and lessen the need for solid waste disposal sites. One way to promote recycling of solid waste by the packaging industries is to require that all packaging be composed of a minimum amount (by weight) of materials recycled from postconsumer waste. The regulation could be specific by material and consumer product or could be applied broadly across all packaging materials and consumer products. For this study, three uniform regulations have been examined: 10 percent, 20 percent, and 30 percent.

A regulation to use postconsumer wastes in lieu of virgin materials for the manufacture of packaging materials would raise the average cost of raw materials inputs. The increase in cost would depend on the differences in costs of recycled and virgin materials and the level of the regulation. Because there are no markets in which postconsumer wastes are sold currently, tentative supply functions were developed as described in chapter 4. The projected impacts of these regulations should be cautiously interpreted.

The analysis indicates that each of the three regulations examined would cause only minimal reductions in the use of packaging. The highest regulation examined, 30 percent, would reduce the total amount of packaging only slightly more than 1 percent (see tables 21 and 22) because the regulation, while it would raise the average cost of inputs to packaging materials manufacture as higher cost recycled materials are substituted for virgin materials, would have only a small effect on finished package costs. This is because raw material inputs to packaging material manufacture account

Table 21.. Consumption of packaging by consumer product, 1970:
Regulation requiring the use of recycled materials
(thousand tonnes)

Consumer product	Recycling regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Baked Goods (1)	734	729	723
Dairy Products (2)	1,138	1,132	1,127
Frozen Foods (3)	456	456	456
Fresh and Cured Meat (4)	1,484	1,483	1,481
Fresh and Cured Fish and Seafood (5)	34	34	34
Fresh and Cured Poultry (6)	204	203	203
Produce (7)	736	731	725
Distilled Spirits (8)	796	796	796
Wine (9)	285	285	285
Beer (10)	3,022	3,021	3,019
Soft Drinks (11)	4,184	4,180	4,176
Prepared Beverages (12)	1,140	1,137	1,135
Candy and Chewing Gum (13)	266	264	263
Canned Foods (14)	3,302	3,265	3,229
Cereals, Flours, and Macaroni (15)	101	101	101
Pet Foods (16)	273	271	269
Tobacco Products (17)	246	246	246
Other Foods (18)	1,919	1,909	1,899
Soaps and Detergents (19)	571	571	571
Other Cleaning Supplies (20)	96	96	96
Pesticides (21)	16	16	16
Other Household Supplies (22)	234	233	232
Packaged Medications (23)	274	273	273
Oral Hygiene Products (24)	129	129	129
Cosmetics and Hand Products (25)	180	180	179
Hair Products (26)	269	269	269
Shaving Products (27)	122	122	121
Other Beauty Aids (28)	364	357	351
Other Health Aids (29)	797	797	797
Other General Merchandise (30)	4,301	4,301	4,300
Total	27,672	27,585	27,499

Source: Research Triangle Institute

Table 22. Reductions in the consumption of packaging by consumer product, 1970: Regulation requiring the use of recycled materials (percentage decrease in the weight of packaging)

Consumer product	Recycling regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Baked Goods (1)	0.8	1.6	2.4
Dairy Products (2)	0.5	1.0	1.5
Frozen Foods (3)	0.0	0.0	0.0
Fresh and Cured Meat (4)	0.1	0.3	0.4
Fresh and Cured Fish and Seafood (5)	0.2	0.4	0.6
Fresh and Cured Poultry (6)	0.2	0.4	0.6
Produce (7)	0.8	1.5	2.2
Distilled Spirits (8)	0.0	0.0	0.0
Wine (9)	0.0	0.0	0.0
Beer (10)	0.1	0.1	0.2
Soft Drinks (11)	0.1	0.2	0.3
Prepared Beverages (12)	0.2	0.4	0.6
Candy and Chewing Gum (13)	0.5	1.1	1.6
Canned Foods (14)	1.1	2.2	3.3
Cereals, Flour, and Macaroni (15)	0.1	0.3	0.4
Pet Foods (16)	0.7	1.4	2.0
Tobacco Products (17)	0.0	0.1	0.1
Other Foods (18)	0.5	1.1	1.6
Soaps and Detergents (19)	0.0	0.0	0.0
Other Cleaning Supplies (20)	0.3	0.5	0.8
Pesticides (21)	0.4	0.8	1.2
Other Household Supplies (22)	0.3	0.7	1.0
Packaged Medications (23)	0.1	0.2	0.3
Oral Hygiene Products (24)	0.0	0.0	0.0
Cosmetic and Hand Products (25)	0.3	0.7	1.0
Hair Products (26)	0.0	0.0	0.0
Shaving Products (27)	0.2	0.5	0.7
Other Beauty Aids (28)	1.7	3.4	5.1
Other Health Aids (29)	0.0	0.0	0.0
Other General Merchandise (30)	0.0	0.0	0.0
Total	0.3	0.6	0.9

Source: Research Triangle Institute

for only a small share of total costs; except for plastics, the share is less than 10 percent; the remainder of cost is due to processing and fabrication.

Based on the supply functions for recycled materials in the packaging model, the raw material costs of steel and paper would be most sensitive to a regulation to use postconsumer waste in product packaging. A regulation of 30 percent for example, would increase the raw material costs of steel by 172 percent and those of paper 135 percent (table 23). The raw material cost of aluminum, on the other hand, shows the smallest increase, 11 percent for a 30 percent regulation; plastics and glass raw material costs are increased 57 and 90 percent, respectively. However, taking into account both the increase in the raw material costs and the share that these costs represent of finished packaging costs, plastics costs are most affected, aluminum and paper the least. The effect of the regulation, then, should be a better competitive position of aluminum and paper against the other three materials; steel and glass would maintain their same position relative to each other, while the position of plastics would fall relative to all materials.

The distribution of the reductions in the use of packaging due to the increase in raw materials costs is shown in table 24. The reductions consist of those caused by decreases in the utilization of packaging for a consumer product (substitution effect) and those caused by decreases in the quantity demanded of a product by consumers as a result of the increase in product prices (consumption effect). The substitution effect is most responsible for reductions in the use of packaging for Other Beauty Aids, Baked Goods, Produce, and Pesticides as producers reduce packaging and/or substitute lighter for heavier packaging. The consumption effect is most responsible for the reductions in consumer purchses of Canned Foods, Pet Foods, Candy and Chewing Gum, Other Household Supplies, and Cosmetics and Hand Products.

5.2.1 Effectiveness

The quantities of reductions of wastes and resource utilization are summarized in table 25.

5.2.1.1 Solid Waste Generation. The regulation is expected to cause only minimal reductions in the generation of packaging wastes because of the small impacts on packaging costs. For the highest regulation evaluated, 30 percent, the annual reduction is projected at 259,000 tonnes (table 26), or

Table 23. Projected increases in the cost of raw material inputs, 1970: requirement to use recycled materials

Packaging material	Average cost per tonne of finished packaging, dollars	Average cost per tonne of raw material inputs, dollars	Recycling regulation (percentage recycled materials as a share of packaging weight)		
			10	20	30
Paper	418	6	44.9	89.6	134.5
Plastics	1,297	344	19.1	38.2	57.2
Glass	204	16	5.6	16.8	89.6
Steel	625	25	57.4	114.8	171.9
Aluminum	1,015	81	3.5	7.0	10.5

Source: Research Triangle Institute.

Table 24. Distribution of the reductions in packaging between the consumption and substitution effects: Requirement to use recycled materials (percentage share)

Consumer product	Recycling regulation (percentage recycled materials as a share of packaging weight)					
	10		20		30	
	Consumption effect	Substitution effect	Consumption effect	Substitution effect	Consumption effect	Substitution effect
Baked Goods (1)	11.4	88.6	11.5	88.5	11.5	88.5
Dairy Products (2)	32.0	68.0	31.3	68.9	31.1	68.9
Frozen Foods (3)	0.0	0.0	0.0	0.0	0.0	0.0
Fresh and Cured Meat (4)	30.8	69.2	34.6	65.4	33.3	66.7
Fresh and Cured Fish and Seafood (5)	42.9	57.1	43.9	56.1	43.3	56.7
Fresh and Cured Poultry (6)	15.0	85.0	17.9	82.1	16.9	83.1
Produce (7)	14.7	85.3	14.1	85.9	13.9	86.1
Distilled Spirits (8)	100.0	0.0	100.0	0.0	100.0	0.0
Wine (9)	0.0	0.0	0.0	0.0	0.0	0.0
Beer (10)	100.0	0.0	100.0	0.0	100.0	0.0
Soft Drinks (11)	100.0	0.0	100.0	0.0	100.0	0.0
Prepared Beverages (12)	100.0	0.0	100.0	0.0	100.0	0.0
Candy and Chewing Gum (13)	68.5	31.5	68.5	31.5	67.9	32.1
Canned Foods (14)	100.0	0.0	100.0	0.0	100.0	0.0
Cereals, Flour, and Macaroni (15)	33.3	66.7	32.0	68.0	29.7	70.3
Pet Foods (16)	100.0	0.0	100.0	0.0	100.0	0.0
Tobacco Products (17)	100.0	0.0	100.0	0.0	100.0	0.0
Other Foods (18)	48.1	51.9	47.7	52.3	48.1	51.9
Soaps and Detergents (19)	0.0	0.0	0.0	0.0	0.0	0.0
Other Cleaning Supplies (20)	0.0	100.0	0.0	100.0	0.0	100.0
Pesticides (21)	7.3	92.7	7.4	92.6	7.4	92.6
Other Household Supplies (22)	100.0	0.0	100.0	0.0	100.0	0.0
Packaged Medications (23)	54.5	45.5	54.5	45.5	54.5	45.5
Oral Hygiene Products (24)	0.0	0.0	0.0	0.0	0.0	0.0
Cosmetics and Hand Products (25)	100.0	0.0	100.0	0.0	99.0	1.0
Hair Products (26)	0.0	0.0	0.0	0.0	0.0	0.0
Shaving Products (27)	100.0	0.0	100.0	0.0	100.0	0.0
Other Beauty Aids (28)	54.7	45.3	54.4	45.6	54.0	46.0
Other Health Aids (29)	0.0	0.0	0.0	0.0	0.0	0.0
Other General Merchandise (30)	0.0	100.0	0.0	100.0	0.0	100.0

Source: Research Triangle Institute.

Table 25. Summary of effectiveness, 1970:
Regulation requiring the use of recycled materials

Measures of effectiveness	Recycling regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Reductions in solid waste generation (thousand tonnes)	87	173	259
Increases in the consumption of post-consumer waste materials (thousand tonnes)	2,774	5,529	8,272
Reductions in raw materials consumption (thousand tonnes)	(4,191)	(8,352)	(12,486)
Paper packaging	1,015	2,033	3,025
Plastics packaging	305	606	907
Glass packaging	1,232	2,459	3,681
Steel packaging	1,338	2,663	3,973
Aluminum packaging	301	601	900
Reduction in energy utilization (equivalent million kWh)	(247)	(494)	(740)
Paper packaging	68	135	202
Plastics packaging	7	14	20
Glass packaging	60	121	181
Steel packaging	95	190	285
Aluminum packaging	17	35	52

Source: Research Triangle Institute.

Table 26. Reductions in solid waste generation, 1970:
Regulation requiring the use of recycled materials
(thousand tonnes)

Packaging material	Recycling regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Paper	28	55	82
Plastics	5	10	15
Glass	23	47	70
Steel	29	59	88
Aluminum	1	2	3
Total	87	173	259

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

1 percent of the total generation of packaging wastes prior to a regulation. The largest reductions are projected in the amounts of glass, steel, and paper packaging, which combined account for 95 percent of the total reductions. The usage of plastics and aluminum for packaging is only slightly affected by the higher raw material costs.

Substantial increases are projected, however, in the use of postconsumer waste materials. For example, with a regulation of 30 percent, the packaging industries are projected to consume 8,272,000 tonnes of materials, at 1970 rates, from postconsumer waste (table 27). This amount is equal to 30 percent of the total amount of discarded packaging. The greatest increases would be in the use of cullet, waste paper, and scrap steel since these materials are the major packaging materials.

5.2.1.2 Natural Resource Utilization. The utilization of natural resources for packaging materials manufacture would decline in almost direct proportion to the level of the regulation. Largest reductions in natural resource utilization would be for glass sand, wood pulp, and iron ore and agglomerates (table 28). The largest energy savings are reported for paper and glass manufacture. However, all estimates of energy savings are over-stated since the use of energy for recycling solid waste is not included in the estimates.

Table 27. Increases in the consumption of postconsumer waste materials for product packaging, 1970: Regulation requiring the use of recycled materials (thousand tonnes)

Packaging material	Recycled regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Waste paper	956	1,907	2,852
Waste plastics	145	290	433
Cullet	1,018	2,031	3,040
Steel scrap	596	1,186	1,770
Aluminum scrap	59	118	177
Total	2,774	5,529	8,272

Source: Research Triangle Institute.

Table 28. Reductions in natural resource consumption, 1970: Regulation requiring the use of recycled materials (thousand tonnes)

Packaging material	Natural resource inputs	Recycling regulation (percentage recycled materials as a share of packaging weight)		
		10	20	30
Paper	Raw materials			
	Wood pulp	657	1,311	1,960
	Waste paper	274	545	816
	Chlorine	13	26	38
	Caustic	15	29	44
	Soda ash	8	16	23
	Sodium sulfate	32	65	97
	Lime	16	31	47
	Energy (equivalent million kWh)	68	135	202
Plastics	Raw materials			
	NLG feed stocks	182	363	543
	Field condensates	11	21	32
	Refinery feed stocks	112	222	332
	Energy (equivalent million kWh)	7	14	20
Glass	Raw materials			
	Glass sand	694	1,385	2,073
	Limestone	227	453	678
	Soda ash	226	451	675
	Feldspar	79	158	236
	Prepared saltcake	1	2	3
	Water for dust control	5	10	16
	Energy (equivalent million kWh)	60	121	181
Steel	Raw materials			
	Iron ore and agglomerates	617	1,228	1,832
	Scrap	313	624	931
	Coke	248	493	736
	Fluxes	142	283	422
	Mill cinder and scale	18	35	52
	Energy (equivalent million kWh)	95	190	285
Aluminum	Raw materials			
	Bauxite	231	460	689
	Lime makeup	6	12	19
	Soda ash makeup	25	51	76
	Petroleum coke	27	54	80
	Pitch	9	17	26
	Cryolite	2	4	6
	Aluminum trifluoride	1	3	4
	Energy (equivalent million kWh)	17	35	52
Summary totals				
	Weight of raw materials (thousand tonnes)	4,191	8,352	12,486
	Amount of energy (equivalent million kWh)	247	494	740

Source: Research Triangle Institute.

Note: Due to rounding, sums of columns may not equal totals shown.

5.2.2 Costs

The prices of all consumer prices are expected to increase only moderately, usually less than 1 percent even at the highest regulation (30 percent). The average increase, as shown in table 29, using 1970 current consumption expenditure distribution of weighting is only 0.2 percent for the 30 percent regulation. The products whose prices would be most sensitive are Canned Foods, Soft Drinks, and Pet Foods because of the large share of steel can cost in their total packaging costs.

The losses in consumer surplus due to higher prices average about $1, $2, and $3 per capita at 1970 rates for the three regulations (10, 20, 30 percent), respectively (table 30). The largest losses in consumer surplus are projected for consumers of Other General Merchandise and Canned Foods. Employment losses are estimated at 4,000 for the 30 percent regulation. However, increases in employment in the recycling industries are not included.

5.2.3 Cost-Effectiveness Comparison

The cost of the regulation is the estimated loss in consumer surplus (table 31). The physical measures of effectiveness have each been divided into costs in order to provide a relative measure of the cost of providing the various benefits. Since no attempt has been made to allocate the costs across the measures of effectiveness, the cost per unit of effectiveness values are not additive. For all three recycling regulations the cost per unit of effectiveness is fairly constant.

5.3 Two Taxes on Packaging Weight (Fiscal Incentive)

A tax on the weight of packaging would tend to reduce the quantitites of packaging utilized for packaging consumer products, thereby conserving natural resources and reducing the solid waste management costs. It would also raise revenue. If the portion of packaging representing recycled materials were not taxed, then for any tax rate, less reductions in solid waste and greater reductions in natural resource utilization would be expected in comparison to a tax without the exemption. Both possible tax bases are analyzed here.

The unit of weight on which the tax is assumed to be imposed is the

Table 29. Increases in the consumer product prices, 1970:
Regulation requiring the use of recycled materials
(percentage increases)

Consumer product	Recycling regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Baked Goods (1)	0.10	0.19	0.29
Dairy Products (2)	0.06	0.12	0.18
Frozen Foods (3)	0.07	0.14	0.20
Fresh and Cured Meat (4)	0.03	0.07	0.10
Fresh and Cured Fish and Seafood (5)	0.03	0.07	0.10
Fresh and Cured Poultry (6)	0.03	0.06	0.09
Produce (7)	0.08	0.15	0.22
Distilled Spirits (8)	0.02	0.04	0.05
Wine (9)	0.02	0.04	0.06
Beer (10)	0.27	0.54	0.81
Soft Drinks (11)	0.46	0.91	1.37
Prepared Beverages (12)	0.13	0.27	0.40
Candy and Chewing Gum (13)	0.17	0.34	0.50
Canned Foods (14)	0.55	1.11	1.66
Cereals, Flour, and Macaroni (15)	0.04	0.09	0.13
Pet Foods (16)	0.37	0.74	1.11
Tobacco Products (17)	0.03	0.05	0.08
Other Foods (18)	0.22	0.44	0.66
Soaps and Detergents (19)	0.30	0.59	0.89
Other Cleaning Supplies (20)	0.18	0.35	0.53
Pesticides (21)	0.01	0.02	0.03
Other Household Supplies (22)	0.08	0.17	0.25
Packaged Medications (23)	0.05	0.09	0.13
Oral Hygiene Products (24)	0.05	0.10	0.15
Cosmetics and Hand Products (25)	0.16	0.33	0.49
Hair Products (26)	0.15	0.30	0.44
Shaving Products (27)	0.14	0.28	0.42
Other Beauty Aids (28)	0.27	0.54	0.80
Other Health Aids (29)	0.07	0.13	0.20
Other General Merchandise (30)	0.03	0.07	0.10
Weighted average	0.07	0.14	0.20

Source: Research Triangle Institute

Table 30. Consumer surplus losses and employment reductions, 1970: Regulation requiring the use of recycled materials

	Recycling regulation (percentage recycled materials as a share of packaging weight)		
	10	20	30
Consumer surplus losses (million dollars)			
Baked Goods (1)	$ 8	$ 17	$ 25
Dairy Products (2)	7	15	22
Frozen Foods (3)	4	8	11
Fresh and Cured Meat (4)	8	15	23
Fresh and Cured Fish and Seafood (5)	0	0	0
Fresh and Cured Poultry (6)	1	2	3
Produce (7)	8	16	23
Distilled Spirits (8)	1	3	4
Wine (9)	0	1	1
Beer (10)	17	34	51
Soft Drinks (11)	14	29	43
Prepared Beverages (12)	4	7	11
Candy and Chewing Gum (13)	5	9	14
Canned Foods (14)	34	67	100
Cereals, Flour, and Macaroni (15)	1	2	3
Pet Foods (16)	4	8	11
Tobacco Products (17)	2	5	7
Other Foods (18)	15	30	45
Soaps and Detergents (19)	5	10	15
Other Cleaning Supplies (20)	2	3	5
Pesticides (21)	0	0	0
Other Household Supplies (22)	2	4	6
Packaged Medications (23)	1	1	2
Oral Hygiene Products (24)	0	1	1
Cosmetics and Hand Products (25)	1	3	4
Hair Products (26)	2	4	5
Shaving Products (27)	1	2	3
Other Beauty Aids (28)	1	3	4
Other Health Aids (29)	2	4	6
Other General Merchandise (30)	65	131	196
Total	$216	$431	$645
Employment reductions (thousands)			
Paper	0	0	0
Plastics	0	0	0
Glass	1	1	2
Steel	0	1	1
Aluminum	0	0	0
Total	1	3	4

Source: Research Triangle Institute.

Note: Due to rounding, sums of columns may not equal totals shown.

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tonne. The four tax rates used and conversions to English units are shown below:

$10/tonne (≃ 0.5 cents/pound)
$22/tonne (≃ 1.0 cents/pound)
$50/tonne (≃ 2.3 cents/pound)
$100/tonne (≃ 4.5 cents/pound)

Table 31. Cost-effectiveness comparison, 1970:
Regulation requiring the use of recycled materials

	Recycling regulation (percentage recycled materials as a share of packaging weight).		
	10	20	30
Cost			
Loss in consumer surplus (million dollars)	$216	$431	$645
Cost/Effectiveness			
Reductions in solid waste generation (dollars per tonne)	2,482	2,491	2,490
Increases in the consumption of postconsumer waste materials (dollars per tonne)	78	78	78
Reductions in raw materials consumption (dollars per tonne)	(52)	(52)	(52)
Paper packaging	212	212	213
Plastics packaging	708	711	711
Glass packaging	175	175	175
Steel packaging	161	162	162
Aluminum packaging	718	717	717
Reduction in energy utilization (dollars per thousand kWh)	874	872	872

Source: Research Triangle Institute

A tax on packaging with the exemption for recycled materials would shift the demand for recycled materials, possibly causing the substitution of recycled for virgin materials. Because of the tentative nature of the demand and supply functions for recycled materials developed in appendix C, these results should be interpreted as the type of incentive effects such a tax could have.

At tax rates up to $22, the reductions in the use of packaging would be small, less than 2 percent. For all tax rates, the tax without the exemption causes more reductions in the use of packaging than the tax with the exemption. In the aggregate, however, the differences are not very significant. The consumer products whose packaging would be most sensitive to a tax on weight are Fresh and Cured Fish and Seafood, Pesticides, Other Beauty Aids, and Baked Goods (tables 32 through 35).

As shown in table 36, as the tax rate is increased, first glass then the other materials except plastics would be recycled into packaging. Plastics are not recycled due to the high supply price used in the model.

Most of the reductions in packaging are due to shifts in packaging and not to reductions in consumer spending on packaged products (tables 37 and 38).

5.3.1 Effectiveness

The quantities of reductions of wastes and resource utilization are summarized in tables 39 and 40.

5.3.1.1 <u>Solid Waste Generation</u>. A tax on packaging of $22 per tonne is projected to reduce packaging waste generation 395,000 to 441,000 tonnes annually, depending on whether recycled materials are exempted or not (tables 41 and 42). Most of the reduction would be for paper, glass, and steel.

If recycled materials are exempted, the increase in the consumption of postconsumer waste materials would be 14 times greater than the reductions in solid waste generation for a $22 per tonne tax. Glass would be recycled in the greatest quantitites (table 43).

5.3.1.2 <u>Natural Resource Utilization</u>. With a tax on packaging, the only source of reductions in natural resource utilization is due to the reductions in the use of packaging. If recycled materials are exempted, then an additional source of reductions in natural resource utilization is possible--the substitution of recycled for virgin material inputs to packaging manufacture. As shown in tables 44 and 45, the tax with the

Table 32. Consumption of packaging by consumer product, 1970:
Tax on packaging
(thousand tonnes)

Consumer product	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Baked Goods (1)	721	698	645	550
Dairy Products (2)	1,127	1,107	1,061	982
Frozen Foods (3)	456	456	456	456
Fresh and Cured Meat (4)	1,480	1,473	1,457	1,428
Fresh and Cured Fish and Seafood (5)	33	31	27	21
Fresh and Cured Poultry (6)	203	201	197	195
Produce (7)	724	703	653	565
Distilled Spirits (8)	796	795	794	791
Wine (9)	285	285	285	285
Beer (10)	3,021	3,018	3,010	2,995
Soft Drinks (11)	4,177	4,163	4,132	4,077
Prepared Beverages (12)	1,135	1,127	1,107	1,073
Candy and Chewing Gum (13)	265	262	256	246
Canned Foods (14)	3,302	3,259	3,159	2,981
Cereals, Flour, and Macaroni (15)	101	100	99	98
Pet Foods (16)	273	272	268	261
Tobacco Products (17)	246	246	246	245
Other Foods (18)	1,875	1,811	1,663	1,410
Soaps and Detergents (19)	571	571	571	571
Other Cleaning Supplies (20)	95	94	92	87
Pesticides (21)	15	14	13	11
Other Household Supplies (22)	234	233	231	227
Packaged Medications (23)	273	271	268	263
Oral Hygiene Products (24)	129	129	129	129
Cosmetics and Hand Products (25)	180	179	177	173
Hair Products (26)	269	269	269	269
Shaving Products (27)	122	122	121	119
Other Beauty Aids (28)	352	331	289	227
Other Health Aids (29)	797	797	797	797
Other General Merchandise (30)	4,301	4,301	4,300	4,299
Total	27,557	27,318	26,770	25,828

Source: Research Triangle Institute.

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Table 33. Consumption of packaging by consumer product, 1970:
Tax on packaging with exemption for recycled materials
(thousand tonnes)

Consumer product	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Baked Goods (1)	721	698	657	591
Dairy Products (2)	1,127	1,107	1,072	1,016
Frozen Foods (3)	456	456	456	456
Fresh and Cured Meat (4)	1,480	1 474	1,461	1,440
Fresh and Cured Fish and Seafood (5)	33	31	28	24
Fresh and Cured Poultry (6)	203	201	198	195
Produce (7)	724	703	665	603
Distilled Spirits (8)	796	795	795	793
Wine (9)	285	285	285	285
Beer (10)	3,021	3,019	3,013	3,005
Soft Drinks (11)	4,177	4,169	4,151	4,120
Prepared Beverages (12)	1,135	1,130	1,119	1,099
Candy and Chewing Gum (13)	265	263	258	250
Canned Foods (14)	3,303	3,266	3,185	3,061
Cereals, Flour, and Macaroni (15)	101	100	100	98
Pet Foods (16)	273	272	268	263
Tobacco Products (17)	246	246	246	245
Other Foods (18)	1,877	1,835	1,748	1,601
Soaps and Detergents (19)	571	571	571	571
Other Cleaning Supplies (20)	95	94	92	89
Pesticides (21)	15	15	14	12
Other Household Supplies (22)	234	233	231	228
Packaged Medications (23)	273	272	270	266
Oral Hygiene Products (24)	129	129	129	129
Cosmetics and Hand Products (25)	180	180	178	176
Hair Products (26)	269	269	269	269
Shaving Products (27)	122	122	121	120
Other Beauty Aids (28)	352	333	301	255
Other Health Aids (29)	797	797	797	797
Other General Merchandise (30)	4,301	4,301	4,300	4,299
Total	27,561	27,363	26,975	26,357

Source: Research Triangle Institute.

Table 34. Reductions in the comsumption of packaging by consumer product, 1970:
Tax on packaging
(percent)

Consumer product	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Baked Goods (1)	2.6	5.7	12.9	25.7
Dairy Products (2)	1.5	3.2	7.2	14.2
Frozen Foods (3)	0	0	0	0
Fresh and Cured Meat (4)	0.4	0.9	2.0	3.9
Fresh and Cured Fish and Seafood (5)	4.3	9.5	21.0	37.7
Fresh and Cured Poultry (6)	0.7	1.4	3.3	4.4
Produce (7)	2.4	5.3	12.0	23.8
Distilled Spirits (8)	0.1	0.1	0.3	0.6
Wine (9)	0	0	0	0
Beer (10)	0.1	0.2	0.5	1.0
Soft Drinks (11)	0.3	0.6	1.3	2.7
Prepared Beverages (12)	0.6	1.3	3.0	6.0
Candy and Chewing Gum (13)	0.8	1.8	4.1	8.0
Canned Foods (14)	1.1	2.4	5.4	10.7
Cereals, Flour, and Macaroni (15)	0.4	0.8	1.8	3.5
Pet Foods (16)	0.5	1.1	2.4	4.9
Tobacco Products (17)	0	0.1	0.2	0.5
Other Foods (18)	2.8	6.2	13.8	27.0
Soaps and Detergents (19)	0	0	0	0
Other Cleaning Supplies (20)	1	2.1	4.9	9.7
Pesticides (21)	4.3	9.4	21.0	32.0
Other Household Supplies (22)	0.3	0.7	1.7	3.3
Packaged Medications (23)	0.4	0.9	2.1	4.1
Oral Hygiene Products (24)	0	0	0	0
Cosmetics and Hand Products (25)	0.4	1.0	2.2	4.3
Hair Products (26)	0	0	0	0
Shaving Products (27)	0.3	0.7	1.5	2.9
Other Beauty Aids (28)	4.9	10.4	21.9	38.5
Other Health Aids (29)	0	0	0	0
Other General Merchandise (30)	0	0	0	0.1
Total	0.7	.16	3.7	7.5

Source: Research Triangle Institute.

Table 35. Reductions in the consumption of packaging by consumer product, 1970:
Tax on packaging with exemption for recycled materials
(percent)

Consumer product	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Baked Goods (1)	2.6	5.7	11.0	20.2
Dairy Products (2)	1.5	3.2	6.0	11.2
Frozen Foods (3)	0	0	0	0
Fresh and Cured Meat (4)	0.4	0.9	1.7	3.1
Fresh and Cured Fish and Seafood (5)	4.3	9.0	18.4	30.1
Fresh and Cured Poultry (6)	0.7	1.4	2.8	4.3
Produce (7)	2.4	5.3	10.4	18.7
Distilled Spirits (8)	0.1	0.1	0.2	0.4
Wine (9)	0	0	0	0
Beer (10)	0.1	0.2	0.4	0.7
Soft Drinks (11)	0.3	0.5	0.9	1.6
Prepared Beverages (12)	0.6	1.0	2.0	3.7
Candy and Chewing Gum (13)	0.8	1.8	3.6	6.4
Canned Foods (14)	1.1	2.2	4.6	8.3
Cereals, Flour, and Macaroni (15)	0.4	0.8	1.5	2.8
Pet Foods (16)	0.5	1.1	2.3	4.2
Tobacco Products (17)	0	0.1	.2	0.4
Other Foods (18)	2.7	4.9	9.4	17.0
Soaps and Detergents (19)	0	0	0	0
Other Cleaning Supplies (20)	1	2.1	4.2	7.6
Pesticides (21)	4	6.7	12.6	23.1
Other Household Supplies (22)	0.3	0.7	1.4	2.6
Packaged Medications (23)	0.4	0.8	1.5	2.8
Oral Hygiene Products (24)	0	0	0	0
Cosmetics and Hand Products (25)	0.4	0.7	1.5	2.7
Hair Products (26)	0	0	0	0
Shaving Products (27)	0.3	0.5	1	1.8
Other Beauty Aids (28)	4.9	10.0	18.8	31.1
Other Health Aids (29)	0	0	0	0
Other General Merchandise (30)	0	0	0	0.1
Total	0.7	1.4	2.9	5.3

Source: Research Triangle Institute.

Table 36. Share of recycled materials inputs to packaging, 1970: Tax on packaging with exemption for recycled materials (percent)

Packaging material	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Paper	0	8.0	30.0	30.0
Plastics	0	0	0	0
Glass	38.0	50.0	50.0	50.0
Steel	0	1.0	12.0	32.0
Aluminum	0	8.0	45.0	45.0

Source: Research Triangle Institute.

Table 37. Distribution of the reductions in packaging between the consumption and substitution effects: Tax on packaging (percentage share)

Consumer product	Tax rate (dollars per tonne of packaging)							
	$10		$22		$50		$100	
	C*	S*	C*	S*	C*	S*	C*	S*
Baked Goods (1)	3.1	96.9	2.8	97.2	2.4	97.6	1.8	98.2
Dairy Products (2)	15.6	84.4	15.6	84.4	14.6	85.4	13.0	87.0
Frozen Foods (3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fresh and Cured Meat (4)	20.0	80.0	21.8	78.2	20.7	79.3	20.4	79.6
Fresh and Cured Fish and Seafood (5)	3.9	96.1	3.5	96.5	2.8	97.2	1.9	98.1
Fresh and Cured Poultry (6)	9.1	90.9	9.7	90.3	9.5	90.5	13.8	86.2
Produce (7)	4.1	95.9	3.8	96.2	3.3	96.7	2.6	97.4
Distilled Spirits (8)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Wine (9)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beer (10)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Soft Drinks (11)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Prepared Beverages (12)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Candy and Chewing Gum (13)	25.3	74.7	24.9	75.1	24.0	76.0	22.8	77.2
Canned Foods (14)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Cereals, Flour, and Macaroni (15)	11.4	88.6	11.7	88.3	10.9	89.1	10.6	89.4
Pet Foods (16)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Tobacco Products (17)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Other Foods (18)	11.3	88.7	10.5	89.5	9.2	90.8	6.9	93.1
Soaps and Detergents (19)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cleaning Supplies (20)	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
Pesticides (21)	2.6	97.4	2.0	98.0	1.0	99.0	0.3	99.7
Other Household Supplies (22)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Packaged Medications (23)	53.7	46.3	53.8	46.2	53.2	46.8	52.6	47.4
Oral Hygiene Products (24)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cosmetics and Hand Products (25)	97.7	2.3	97.9	2.1	98.1	1.9	98.1	1.9
Hair Products (26)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shaving Products (27)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Other Beauty Aids (28)	42.3	57.7	40.3	59.7	35.6	64.4	26.6	73.4
Other Health Aids (29)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other General Merchandise (30)	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0

*C = Consumption; S = Substitution.
Source: Research Triangle Institute.

Table 38. Distribution of the reductions in packaging between the
consumption and substitution effects: Tax on packaging
with exemption for recycled materials
(percentage share)

| | Tax rate (dollars per tonne of packaging) | | | | | | | |
| | $10 | | $22 | | $50 | | $100 | |
	C*	S*	C*	S*	C*	S*	C*	S*
Baked Goods (1)	3.1	96.9	2.8	97.2	2.5	97.5	2.1	97.9
Dairy Products (2)	15.6	84.4	15.4	84.6	14.8	85.2	13.9	86.1
Frozen Foods (3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fresh and Cured Meat (4)	20.0	80.0	20.7	79.3	20.9	79.1	20.7	79.3
Fresh and Cured Fish and Seafood (5)	3.9	96.1	3.5	96.5	2.9	97.1	2.4	97.6
Fresh and Cured Poultry (6)	9.1	90.9	9.8	90.2	9.5	90.5	11.0	89.0
Produce (7)	4.1	95.9	3.8	96.2	3.6	96.4	2.9	97.1
Distilled Spirits (8)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Wine (9)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beer (10)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Soft Drinks (11)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Prepared Beverages (12)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Candy and Chewing Gum (13)	25.3	74.7	24.6	75.4	24.6	75.4	24.5	75.5
Canned Foods (14)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Cereals, Flour, and Macaroni (15)	11.4	88.6	10.4	89.6	11.2	88.8	10.9	89.1
Pet Foods (16)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Tobacco Products (17)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Other Foods (18)	11.1	88.9	10.8	89.2	10.3	89.7	9.0	91.0
Soaps and Detergents (19)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cleaning Supplies (20)	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
Pesticides (21)	2.5	97.5	2.4	97.6	1.9	98.1	1.0	99.0
Other Household Supplies (22)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Packaged Medications (23)	52.5	47.5	46.8	53.2	45.5	54.5	45.7	54.3
Oral Hygiene Products (24)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cosmetics and Hand Products (25)	97.6	2.4	97.3	2.7	97.9	2.1	98.1	1.9
Hair Products (26)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shaving Products (27)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Other Beauty Aids (28)	41.9	58.1	38.6	61.4	34.9	65.1	28.8	71.2
Other Health Aids (29)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other General Merchandise (30)	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0

*C = Consumption; S = Substitution.
Source: Research Triangle Institute.

Table 39. Summary of effectiveness, 1970: Tax on packaging

Measures of effectiveness	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Reductions in solid waste generation (thousand tonnes)	201	441	988	1,930
Reductions in raw materials consumption (thousand tonnes)	(273)	(597)	(1,348)	(2,627)
Paper packaging	89	196	437	849
Plastics packaging	31	68	153	291
Glass packaging	77	173	386	759
Steel packaging	68	148	336	663
Aluminum packaging	8	12	36	65
Reduction in energy utilization (equivalent million kWh)	(529)	(1,157)	(2,596)	(5,078)
Paper packaging	213	464	1,036	2,016
Plastics packaging	20	45	101	192
Glass packaging	171	375	843	1,652
Steel packaging	102	224	507	1,003
Aluminum packaging	22	48	109	214

Source: Research Triangle Institute.

Table 40. Summary of effectiveness, 1970: Tax on packaging with exemption for recycled materials

Measures of effectiveness	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Reductions in solid waste generation (thousand tonnes)	198	395	783	1,402
Increases in the consumption of postconsumer waste materials (thousand tonnes)	3,894	5,911	8,742	9,703
Reductions in raw materials consumption (thousand tonnes)	(4,880)	(7,660)	(12,688)	(15,744)
Paper packaging	89	954	3,229	3,433
Plastics packaging	31	66	132	231
Glass packaging	4,685	6,104	6,168	6,272
Steel packaging	67.	276	1,810	4,447
Aluminum packaging	8	260	1,349	1,361
Reduction in energy utilization (equivalent million kWh)	(518)	(1,031)	(2,050)	(3,675)
Paper packaging	212	454	892	1,585
Plastics packaging	20	44	87	153
Glass packaging	164	287	561	1,019
Steel packaging	100	203	424	764
Aluminum packaging	21	42	86	155

Source: Research Triangle Institute.

Table 41. Reductions in solid waste generation, 1970:
Tax on packaging
(thousand tonnes)

Packaging material	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Paper	87	189	423	823
Plastics	15	34	76	144
Glass	66	145	327	640
Steel	32	69	157	310
Aluminum	1	3	6	12
Total	201	441	988	1,930

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

Table 42. Reductions in solid waste generation, 1970:
Tax on packaging with exemption for recycled materials
(thousand tonnes)

Packaging material	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Paper	87	185	364	647
Plastics	15	33	65	115
Glass	63	111	217	395
Steel	31	63	131	236
Aluminum	1	2	5	9
Total	198	395	783	1,402

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

Table 43. Increases in the consumption of postconsumer waste materials
for product packaging, 1970: Tax on packaging with exemption
for recycled materials
(thousand tonnes)

Packaging material	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	100
Waste paper	0	740	2,768	2,683
Waste plastics	0	0	0	0
Cullet	3,894	5,055	4,993	4,913
Steel scrap	0	66	716	1,844
Aluminum scrap	0	50	265	263
Total	3,894	5,911	8,742	9,703

Source: Research Triangle Institute.

Table 44. Reductions in natural resource consumption, 1970: Tax on packaging (thousand tonnes)

Packaging material	Natural resource inputs	Tax rate (dollars per tonne of packaging)			
		$10	$22	$50	$100
Paper	Raw materials				
	Wood pulp	58	127	283	550
	Waste paper	24	53	118	229
	Chlorine	1	2	6	11
	Caustic	1	3	6	12
	Soda ash	1	2	3	7
	Sodium sulfate	3	6	14	27
	Lime	1	3	7	13
	Energy (equivalent million kWh)	213	464	1,036	2,016
Plastics	Raw materials				
	NLG feed stocks	19	41	92	174
	Field condensates	1	2	5	10
	Refinery feed stocks.	11	25	56	107
	Energy (equivalent million kWh)	20	45	101	192
Glass	Raw materials				
	Glass sand	44	97	218	427
	Limestone	14	32	71	140
	Soda ash	14	32	71	139
	Feldspar	5	11	25	49
	Prepared saltcake	0	0	0	1
	Water for dust control	0	1	1	3
	Energy (equivalent million kWh)	171	375	843	1,652
Steel	Raw materials				
	Iron ore and agglomerates	31	68	155	306
	Scrap	16	35	79	155
	Coke	13	27	62	123
	Fluxes	7	16	36	70
	Mill cinder and scale	1	2	4	9
	Energy (equivalent million kWh)	102	224	507	1,003
Aluminum	Raw materials				
	Bauxite	6	12	28	55
	Lime makeup	0	0	1	1
	Soda ash makeup	1	1	3	6
	Petroleum coke	1	1	3	6
	Pitch	0	0	1	2
	Cryolite	0	0	0	1
	Aluminum trifluoride	0	0	0	0
	Energy (equivalent million kWh)	22	48	109	214
Summary totals					
Weight of raw materials (thousand tonnes)		274	599	1,348	2,633
Amount of energy (equivalent million kWh)		529	1,157	2,596	5,078

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

Table 45. Reductions in natural resource consumption, 1970: Tax on packaging with exemption for recycled materials (thousand tonnes)

Packaging material	Natural resource inputs	Tax rate (dollars per tonne of packaging)			
		$10	$22	$50	$100
Paper	Raw materials				
	Wood pulp	58	618	2,092	2,224
	Waste paper	24	257	871	926
	Chlorine	1	12	41	43
	Caustic	1	14	47	50
	Soda ash	1	7	25	27
	Sodium sulfate	3	31	103	110
	Lime	1	15	50	53
	Energy (equivalent million kWh)	212	454	892	1,585
Plastics	Raw materials				
	NLG feed stocks	19	40	79	139
	Field condensates	1	2	5	8
	Refinery feed stocks	11	24	48	84
	Energy (equivalent million kWh)	20	44	87	153
Glass	Raw materials				
	Glass sand	2,638	3,438	3,474	3,533
	Limestone	863	1,124	1,136	1,155
	Soda ash	859	1,119	1,131	1,150
	Feldspar	301	392	396	403
	Prepared saltcake	4	5	5	5
	Water for dust control	20	26	26	26
	Energy (equivalent million kWh)	164	287	561	1,019
Steel	Raw materials				
	Iron ore and agglomerates	31	127	835	2,051
	Scrap	16	65	424	1,042
	Coke	12	51	335	824
	Fluxes	7	29	192	472
	Mill cinder and scale	1	4	24	58
	Energy (equivalent million kWh)	100	203	424	764
Aluminum	Raw materials				
	Bauxite	6	200	1,032	1,042
	Lime makeup	0	5	28	28
	Soda ash makeup	1	22	114	115
	Petroleum coke	1	23	120	121
	Pitch	0	7	39	39
	Cryolite	0	2	10	10
	Aluminum trifluoride	0	1	6	6
	Energy (equivalent million kWh)	21	42	86	155
Summary totals					
	Weight of raw materials (thousand tonnes)	4,880	7,660	12,688	15,744
	Amount of energy (equivalent million kWh)	518	1,031	2,050	3,675

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

exemption usually induces reductions in natural resource utilization substantially greater than the tax without the exemption. Glass sand, limestone, soda ash, and woodpulp utilization would be most affected.

5.3.2 Costs

The prices of most consumer products would not be significantly affected by either tax, although the tax with the exemption causes smaller price increases. Soft Drinks and Canned Foods with their high share of costs due to packaging would be most affected (tables 46 and 47).

The costs, measured by the loss in consumer surplus, are less for the tax with the exemption than without it since the consumer product price increases are smaller for the former tax. For a tax of $22 per tonne, the loss in consumer surplus would be $531 million annually for the tax with the exemption and $598 million without the exemption (tables 48 and 49).

5.3.3 Cost-Effectiveness Comparison

Cost per unit of effectiveness for both taxes is shown in tables 50 and 51. The tax on packaging with an exemption for recycled materials has equal or lower costs per unit of effectiveness than the tax on packaging. This is because it induces recycling, thus resulting in reduced raw materials consumption and increases in the consumption of postconsumer waste materials. However, it should be noted that the costs also include the tax payments which do not represent reductions in welfare from the perspective of society since they are redistributions of resources from consumers to government. Therefore, the costs per unit of effectiveness are overstated.

5.4 Tax on Containers (Fiscal Incentive)

A per unit tax on containers would tend to reduce the quantities of rigid packaging materials utilized for packaging consumer products, thereby conserving materials resources and reducing solid waste management costs. It would also raise revenue. Four tax rates have been analyzed, each rate uniformly applied to all containers. The rates are 0.5, 1.0, 1.5, and 2.0 cents per container.

In estimating the impacts, the tax per container was converted to a tax per tonne on the basis of the average number of units per tonne for each of 12 containers. The equivalent tax per tonne of a 1-cent tax on containers for each of the five rigid materials is as follows:

Table 46. Increases in consumer product prices, 1970: Tax on packaging
(percent)

Consumer product	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Baked Goods (1)	0.1	0.2	0.4	0.6
Dairy Products (2)	0.1	0.2	0.4	0.8
Frozen Foods (3)	0.1	0.2	0.4	0.8
Fresh and Cured Meat (4)	0.1	0.1	0.3	0.6
Fresh and Cured Fish and Seafood (5)	0.1	0.1	0.3	0.4
Fresh and Cured Poultry (6)	0.1	0.1	0.3	0.6
Produce (7)	0.1	0.2	0.3	0.6
Distilled Spirits (8)	0.1	0.2	0.6	1.1
Wine (9)	0.2	0.5	1.1	2.2
Beer (10)	0.5	1.1	2.4	4.8
Soft Drinks (11)	1.3	2.9	6.7	13.3
Prepared Beverages (12)	0.4	0.9	2.1	4.1
Candy and Chewing Gum (13)	0.1	0.2	0.5	0.9
Canned Foods (14)	0.5	1.2	2.7	5.4
Cereals, Flour, and Macaroni (15)	0.0	0.1	0.2	0.4
Pet Foods (16)	0.3	0.6	1.3	2.7
Tobacco Products (17)	0	0.1	0.1	0.3
Other Foods (18)	0.3	0.6	1.2	2.1
Soaps and Detergents (19)	0.3	0.8	1.7	3.4
Other Cleaning Supplies (20)	0.1	0.2	0.3	0.6
Pesticides (21)	0	0.1	0.1	0
Other Household Supplies (22)	0.1	0.2	0.4	0.8
Packaged Medications (23)	0.2	0.4	0.8	1.7
Oral Hygiene Products (24)	0.2	0.4	0.9	1.8
Cosmetics and Hand Products (25)	0.2	0.4	1.0	2.0
Hair Products (26)	0.2	0.4	0.9	1.8
Shaving Products (27)	0.2	0.4	0.9	1.8
Other Beauty Aids (28)	0.6	1.3	2.6	4.0
Other Health Aids (29)	0.3	0.6	1.3	2.5
Other General Merchandise (30)	0	0.1	0.1	0.2
Weighted average	0.1	0.2	0.4	0.8

Source: Research Triangle Institute.

Table 47. Increases in consumer product prices, 1970: Tax on packaging with exemption for recycled materials (percent)

Consumer product	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Baked Goods (1)	0.1	0.2	0.3	0.5
Dairy Products (2)	0.1	0.2	0.4	0.6
Frozen Foods (3)	0.1	0.2	0.4	0.7
Fresh and Cured Meat (4)	0.1	0.1	0.3	0.5
Fresh and Cured Fish and Seafood (5)	0.1	0	0.2	0.4
Fresh and Cured Poultry (6)	0.1	0	0.3	0.5
Produce (7)	0.1	0	0.3	0.5
Distilled Spirits (8)	0.1	0.2	0.4	0.7
Wine (9)	0.2	0.3	0.7	1.2
Beer (10)	0.5	0.9	1.8	3.2
Soft Drinks (11)	1.3	2.3	4.4	8.1
Prepared Beverages (12)	0.4	0.7	1.4	2.6
Candy and Chewing Gum (13)	0.1	0.2	0.4	0.7
Canned Foods (14)	0.5	1.1	2.3	4.2
Cereals, Flour, and Macaroni (15)	0	0.1	0.2	0.4
Pet Foods (16)	0.3	0.6	1.3	2.3
Tobacco Products (17)	0	0.1	0.1	0.2
Other Foods (18)	0.3	0.5	0.9	1.6
Soaps and Detergents (19)	0.3	0.8	1.5	2.8
Other Cleaning Supplies (20)	0.1	0.1	0.3	0.5
Pesticides (21)	0	0	0.1	0.1
Other Household Supplies (22)	0.1	0.2	0.3	0.6
Packaged Medications (23)	0.2	0.3	0.5	1.0
Oral Hygiene Products (24)	0.2	0.3	0.6	1.1
Cosmetics and Hand Products (25)	0.2	0.3	0.9	1.3
Hair Products (26)	0.2	0.3	0.6	1.1
Shaving Products (27)	0.2	0.3	0.6	1.1
Other Beauty Aids (28)	0.6	1.2	2.1	3.3
Other Health Aids (29)	0.2	0.5	0.9	1.6
Other General Merchandise (30)	0	0	0.1	0.2
Weighted average	0.1	0.2	0.3	0.6

Source: Research Triangle Institute.

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Table 48. Consumer surplus losses and employment reductions, 1970: Tax on packaging

	Tax rate (dollars per tonne of packaging)			
	$10	$22	$50	$100
Consumer surplus losses (million dollars)				
Baked Goods (1)	$ 7	$ 15	$ 32	$ 55
Dairy Products (2)	11	24	53	99
Frozen Foods (3)	5	10	23	46
Fresh and Cured Meat (4)	15	32	73	143
Fresh and Cured Fish and Seafood (5)	0	1	1	2
Fresh and Cured Poultry (6)	2	4	10	20
Produce (7)	7	15	33	57
Distilled Spirits (8)	8	18	40	79
Wine (9)	3	6	14	28
Beer (10)	30	66	151	301
Soft Drinks (11)	42	92	208	413
Prepared Beverages (12)	11	25	56	111
Candy and Chewing Gum (13)	3	6	13	25
Canned Foods (14)	33	73	162	316
Cereals, Flour, and Macaroni (15)	1	2	5	10
Pet Foods (16)	3	6	14	27
Tobacco Products (17)	2	5	12	25
Other Foods (18)	19	40	84	143
Soaps and Detergents (19)	6	13	29	57
Other Cleaning Supplies (20)	1	1	3	6
Pesticides (21)	0	0	0	0
Other Household Supplies (22)	2	4	10	20
Packaged Medications (23)	3	6	13	26
Oral Hygiene Products (24)	1	3	6	13
Cosmetics and Hand Products (25)	2	4	9	18
Hair Products (26)	2	5	11	22
Shaving Products (27)	1	2	5	11
Other Beauty Aids (28)	3	6	12	18
Other Health Aids (29)	8	17	40	79
Other General Merchandise (30)	43	95	215	430
Total	$274	$598	$1,338	$2,593
Employment reductions (thousands)				
Paper	0	1	2	3
Plastics	0	1	2	3
Glass	2	4	9	19
Steel	0	1	2	4
Aluminum	0	0	0	0
Total	3	7	15	30

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

Table 49. Consumer surplus losses and employment reductions, 1970: Tax on packaging with exemption for recycled materials

| | Tax rate (dollars per tonne of packaging) | | | |
	$10	$22	$50	$100
Consumer surplus losses (million dollars)				
Baked Goods (1)	$ 7	$ 15	$ 29	$ 48
Dairy Products (2)	11	24	47	81
Frozen Foods (3)	5	10	20	36
Fresh and Cured Meat (4)	15	32	64	114
Fresh and Cured Fish and Seafood (5)	0	1	1	2
Fresh and Cured Poultry (6)	2	4	9	15
Produce (7)	7	15	29	48
Distilled Spirits (8)	8	14	28	50
Wine (9)	3	4	8	16
Beer (10)	29	55	111	202
Soft Drinks (11)	40	71	139	254
Prepared Beverages (12)	11	19	38	69
Candy and Chewing Gum (13)	3	6	12	21
Canned Foods (14)	33	67	139	248
Cereals, Flour, and Macaroni (15)	1	2	4	8
Pet Foods (16)	3	6	13	23
Tobacco Products (17)	2	5	11	20
Other Foods (18)	18	32	61	105
Soaps and Detergents (19)	6	12	25	46
Other Cleaning Supplies (20)	1	1	3	5
Pesticides (21)	0	0	0	0
Other Household Supplies (22)	2	4	8	16
Packaged Medications (23)	3	5	9	16
Oral Hygiene Products (24)	1	2	4	8
Cosmetics and Hand Products (25)	2	3	6	11
Hair Products (26)	2	4	8	14
Shaving Products (27)	1	2	4	7
Other Beauty Aids (28)	3	5	10	15
Other Health Aids (29)	8	14	28	51
Other General Merchandise (30)	43	93	195	358
Total	$268	$531	$1,062	$1,906
Employment reductions (thousands)				
Paper	1	1	1	2
Plastics	0	1	2	3
Glass	2	3	6	12
Steel	0	1	2	3
Aluminum	0	0	0	0
Total	3	6	11	20

Note: Due to rounding, sums of columns may not equal totals shown.

Source: Research Triangle Institute.

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Table 50. Cost-effectiveness comparison, 1970: Tax on packaging

	Tax rate (dollars on tonne of packaging)			
	$10	$22·	$50	$100
Cost				
Loss in consumer surplus (million dollars)	$ 274	$ 598	$ 1,338	$ 2,599
Cost/Effectiveness				
Reductions in solid waste generation (dollars per tonne)	1,363	1,356	1,354	1,347
Reductions in raw materials consumption (dollars per tonne)	(1,003)	(1,002)	(993)	(989)
Paper packaging	3,079	3,051	3,062	3,061
Plastics packaging	8,839	8,794	8,745	8,931
Glass packaging	3,558	3,457	3,466	3,424
Steel packaging	4,029	4,041	3,982	3,920
Aluminum packaging	34,250	49,833	37,167	39,985
Reduction in energy utilization (dollars per thousand kWh)	518	517	515	512
Tax payments (million dollars)	276	601	1,337	2,582

Source: Research Triangle Institute.

Table 51. Cost-effectiveness comparison, 1970: Tax on packaging with exemption for recycled materials

	Tax rate (dollars on tonne of packaging)			
	$10	$22	$50	$100
Cost				
Loss in consumer surplus (million dollars)	$ 268	$ 531	$ 1,062	$ 1,906
Cost/Effectiveness				
Reductions in solid waste generation (dollars per tonne)	1,354	1,344	1,356	1,359
Increases in the consumption of postconsumer waste materials (thousand tonnes)	69	90	121	196
Reductions in raw materials consumption (dollars per tonne)	(55)	(70)	(84)	(121)
Paper packaging	3,011	557	329	555
Plastics packaging	8,645	8,045	8,045	8,251
Glass packaging	57	87	172	304
Steel packaging	4,000	1,924	587	429
Aluminum packaging	33,500	2,042	787	1,400
Reduction in energy utilization (dollars per thousand kWh)	517	515	518	519
Tax payments (million dollars)	237	472	913	1,670

Source: Research Triangle Institute.

Equivalent Tax Per Tonne of a 1-Cent Tax Per Container

Rigid paper	$398.12
Rigid plastics	206.51
Glass	36.73
Steel	90.17
Rigid aluminum	133.45

The impacts of a tax on containers are quite difficult to project since the tax may induce significant shifts to larger container sizes. Ideally, each consumer product would also be disaggregated by container size; e.g., Beer in 12-ounce steel cans, and own price and cross price elasticities estimated for each. However, such an undertaking is beyond the scope of this study and probably beyond the availabilities of existing data. Because of the aggregated nature of the materials and products in the packaging model, the results should be interpreted as only a first approximation of some of the major impacts.

A 1-cent tax on all containers used to package consumer products would induce reductions in packaging of about 2.3 million tonnes (table 52) annually at 1970 rates, or about 9 percent. The tax would fall mostly on paper containers due to their low cost per container. The largest reductions would be for Fresh and Cured Fish and Seafood, Produce, Other Beauty Aids, and Cereals, Flour, and Macaroni (table 53).

As can be seen in table 54, most of the reductions in packaging are due to shifts in packaging, not reductions in quantity demanded by packaged products.

5.4.1 Effectiveness

The quantities of reductions of wastes and resource utilization are summarized in table 55.

5.4.1.1 <u>Solid Waste Generation</u>. A 1-cent tax on containers would reduce packaging solid waste generation about 2.3 million tonnes annually (table 56). Paper would be most affected, accounting for about two-thirds of the total.

5.4.1.2 <u>Natural Resource Utilization</u>. Natural resource consumption would be reduced only due to the reductions in packaging consumption. Wood-pulp, the primary input to paper, would be reduced most (table 57).

Table 52. Consumption of packaging by consumer product, 1970: Tax on containers (thousand tonnes)

Consumer product	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Baked Goods (1)	399	349	348	348
Dairy Products (2)	1,119	1,095	1,071	1,046
Frozen Foods (3)	456	456	456	456
Fresh and Cured Meat (4)	1,416	1,402	1,387	1,373
Fresh and Cured Fish and Seafood (5)	8	0	0	0
Fresh and Cured Poultry (6)	195	193	192	190
Produce (7)	509	286	256	256
Distilled Spirits (8)	793	791	788	785
Wine (9)	285	285	285	285
Beer (10)	3,011	2,998	2,985	2,972
Soft Drinks (11)	4,157	4,126	4,095	4,064
Prepared Beverages (12)	1,113	1,085	1,057	1,029
Candy and Chewing Gum (13)	262	257	253	248
Canned Foods (14)	3,146	2,954	2,761	2,569
Cereals, Flour, and Macaroni (15)	76	57	57	57
Pet Foods (16)	268	260	253	246
Tobacco Products (17)	245	244	242	241
Other Foods (18)	1,639	1,515	1,440	1,366
Soaps and Detergents (19)	571	571	571	571
Other Cleaning Supplies (20)	80	80	80	80
Pesticides (21)	15	13	12	11
Other Household Supplies (22)	220	206	192	178
Packaged Medications (23)	272	271	270	268
Oral Hygiene Products (24)	129	129	129	129
Cosmetics and Hand Products (25)	178	176	173	172
Hair Products (26)	269	269	269	269
Shaving Products (27)	121	120	120	119
Other Beauty Aids (28)	158	156	153	150
Other Health Aids (29)	797	797	797	797
Other General Merchandise (30)	4,301	4,301	4,301	4,301
Total	26,209	25,441	24,992	24,575

Source: Research Triangle Institute.

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Table 53. Reductions in the consumption of packaging by consumer product, 1970: Tax on containers (percent)

Consumer product	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Baked Goods (1)	46.2	52.9	53.0	53.0
Dairy Products (2)	2.1	4.3	6.4	8.5
Frozen Foods (3)	0	0	0	0
Fresh and Cured Meat (4)	4.8	5.7	6.7	7.6
Fresh and Cured Fish and Seafood (5)	75.8	98.9	98.9	98.9
Fresh and Cured Poultry (6)	4.5	5.3	6.0	6.7
Produce (7)	31.5	61.4	65.5	65.5
Distilled Spirits (8)	0.4	0.7	1.0	1.4
Wine (9)	0	0	0	0
Beer (10)	0.4	0.9	1.3	1.7
Soft Drinks (11)	0.7	1.5	2.2	3
Prepared Beverages (12)	2.5	5	7.4	10
Candy and Chewing Gum (13)	1.8	3.7	5.5	7.3
Canned Foods (14)	5.8	11.5	17.3	23.0
Cereals, Flour, and Macaroni (15)	24.5	43.6	43.6	43.6
Pet Foods (16)	2.6	5.2	7.7	10.3
Tobacco Products (17)	0.5	1.1	1.6	2.1
Other Foods (18)	15.1	21.5	25.4	29.2
Soaps and Detergents (19)	0	0	0	0
Other Cleaning Supplies (20)	16.5	16.5	16.5	16.5
Pesticides (21)	8.4	16.8	25.0	31.9
Other Household Supplies (22)	6.0	12.0	18	24.1
Packaged Medications (23)	0.5	1.1	1.6	2.2
Oral Hygiene Products (24)	0	0	0	0
Cosmetics and Hand Products (25)	1.5	2.9	4.1	5.2
Hair Products (26)	0	0	0	0
Shaving Products (27)	0.8	1.5	2.3	3
Other Beauty Aids (28)	57.2	57.9	58.7	59.4
Other Health Aids (29)	0	0	0	0
Other General Merchandise (30)	0	0	0	0
Total	5.9	9.1	11.1	13.0

Source: Research Triangle Institute.

Table 54. Distribution of the reductions in packaging between the consumption and substitution effects: Tax on containers (percentage share)

| Consumer product | Tax rate (cents per container) | | | | | | | |
| | 0.5 | | 1.0 | | 1.5 | | 2.0 | |
	C*	S*	C*	S*	C*	S*	C*	S*
Baked Goods (1)	0.2	99.8	0.2	99.8	0.3	99.7	0.4	99.6
Dairy Products (2)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Frozen Foods (3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fresh and Cured Meat (4)	20.2	79.8	33.6	66.4	43.0	57.0	50.3	49.7
Fresh and Cured Fish and Seafood (5)	0.1	99.9	0.0	100.0	0.0	100.0	0.0	100.0
Fresh and Cured Poultry (6)	16.1	83.9	27.9	72.1	36.7	63.3	43.6	56.4
Produce (7)	1.3	98.7	0.1	99.9	0.0	100.0	0.0	100.0
Distilled Spirits (8)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Wine (9)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beer (10)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Soft Drinks (11)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Prepared Beverages (12)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Candy and Chewing Gum (13)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Canned Foods (14)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Cereals, Flour, and Macaroni (15)	0.6	99.4	0.0	100.0	0.0	100.0	0.0	100.0
Pet Foods (16)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Tobacco Products (17)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Other Foods (18)	5.6	94.4	5.9	94.1	6.9	93.1	7.5	92.5
Soaps and Detergents (19)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cleaning Supplies (20)	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
Pesticides (21)	1.8	98.2	1.1	98.9	0.4	99.6	0.0	100.0
Other Household Supplies (22)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Packaged Medications (23)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Oral Hygiene Products (24)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cosmetics and Hand Products (25)	78.0	22.0	77.4	22.6	76.6	23.4	80.6	19.4
Hair Products (26)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shaving Products (27)	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Other Beauty Aids (28)	1.3	98.7	2.5	97.5	3.7	96.3	4.9	95.1
Other Health Aids (29)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other General Merchandise (30)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*C = Consumption; S = Substitution.
Source: Research Triangle Institute.

Table 55. Summary of effectiveness, 1970: Tax on containers

Measures of effectiveness	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Reductions in solid waste generation (thousand tonnes)	1,549	2,317	2,766	3,183
Reductions in raw materials consumption (thousand tonnes)	(1,950)	(3,019)	(3,719)	(4,413)
Paper packaging	1,105	1,488	1,585	1,652
Plastics packaging	249	351	364	389
Glass packaging	228	447	670	889
Steel packaging	332	663	995	1,327
Aluminum packaging	36	70	105	156
Reduction in energy utilization (equivalent million kWh)	(3,897)	(5,956)	(7,287)	(8,530)
Paper packaging	2,627	3,532	3,766	3,925
Plastics packaging	164	232	240	248
Glass packaging	496	976	1,458	1,936
Steel packaging	502	1,004	1,506	2,007
Aluminum packaging	108	212	318	414

Source: Research Triangle Institute.

Table 56. Reductions in solid waste generation, 1970: Tax on containers (thousand tonnes)

Packaging material	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Paper	1,072	1,442	1,537	1,602
Plastics	123	174	180	186
Glass	192	378	565	750
Steel	155	310	465	620
Aluminum	6	12	19	24
Total	1,549	2,317	2,766	3,183

Source: Research Triangle Institute.

Table 57. Reductions in natural resource consumption, 1970: Tax on containers (thousand tonnes)

Packaging material	Natural resource inputs	Tax rate (cents per container)			
		0.5	1.0	1.5	2.0
Paper	Raw materials				
	Wood pulp	716	963	1,027	1,070
	Waste paper	298	401	427	445
	Chlorine	14	19	20	21
	Caustic	16	22	23	24
	Soda ash	9	12	12	13
	Sodium sulfate	35	48	51	53
	Lime	17	23	25	26
	Energy (equivalent million kWh)	2,627	3,532	3,766	3,925
Plastics	Raw materials				
	NLG feed stocks	149	210	218	225
	Field condensates	9	12	13	13
	Refinery feed stocks	91	129	133	151
	Energy (equivalent million kWh)	164	232	240	248
Glass	Raw materials				
	Glass sand	128	252	377	500
	Limestone	42	82	123	164
	Soda ash	42	82	123	163
	Feldspar	15	29	43	57
	Prepared saltcake	0	0	1	1
	Water for dust control	1	2	3	4
	Energy (equivalent million kWh)	496	976	1,458	1,936
Steel	Raw materials				
	Iron ore and agglomerates	153	306	459	612
	Scrap	78	155	233	311
	Coke	62	123	184	246
	Fluxes	35	70	106	141
	Mill cinder and scale	4	9	13	17
	Energy (equivalent million kWh)	502	1,004	1,506	2,007
Aluminum	Raw materials				
	Bauxite	28	54	81	123
	Lime makeup	1	1	2	3
	Soda ash makeup	3	6	9	12
	Petroleum coke	3	6	9	12
	Pitch	1	2	3	4
	Cryolite	0	1	1	1
	Aluminum trifluoride	0	0	0	1
	Energy (equivalent million kWh)	108	212	318	414
Summary totals					
Weight of raw materials (thousand tonnes)		1,950	3,019	3,719	4,413
Amount of energy (equivalent million kWh)		3,897	5,956	7,287	8,530

Source: Research Triangle Institute.

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Table 58. Increases in consumer prices, 1970: Tax on containers (percent)

Consumer Product	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Baked Goods (1)	0.2	0.2	0.3	0.5
Dairy Products (2)	0.8	1.6	2.4	3.2
Frozen Foods (3)	0.9	1.8	2.7	3.5
Fresh and Cured Meat (4)	0.8	1.5	2.3	3.0
Fresh and Cured Fish and Seafood (5)	0.1	0	0	0
Fresh and Cured Poultry (6)	0.7	1.4	2.1	2.8
Produce (7)	0.4	0.1	0	0
Distilled Spirits (8)	0.7	1.3	2.0	2.7
Wine (9)	0.4	0.9	1.3	1.7
Beer (10)	2.2	4.3	6.5	8.7
Soft Drinks (11)	3.7	7.4	11.1	14.8
Prepared Beverages (12)	1.7	3.4	5.1	6.8
Candy and Chewing Gum (13)	0.8	1.7	2.5	3.3
Canned Foods (14)	2.9	5.8	8.8	11.7
Cereals, Flour, and Macaroni (15)	0.2	0.0	0	0.0
Pet Foods (16)	1.4	2.8	4.3	5.7
Tobacco Products (17)	0.3	0.6	1.0	1.3
Other Foods (18)	0.8	1.4	2.0	2.6
Soaps and Detergents (19)	7.6	15.2	22.8	30.4
Other Cleaning Supplies (20)	0.3	0.5	0.8	1.1
Pesticides (21)	0.1	0.1	0	0
Other Household Supplies (22)	1.5	3	4.4	5.9
Packaged Medications (23)	0.4	0.8	1.2	1.7
Oral Hygiene Products (24)	0.8	1.7	2.5	3.3
Cosmetics and Hand Products (25)	0.6	1.1	1.5	2.1
Hair Products (26)	0.5	0.9	1.4	1.9
Shaving Products (27)	0.5	0.9	1.4	1.8
Other Beauty Aids (28)	0.5	0.9	1.4	1.9
Other Health Aids (29)	1.9	3.8	5.7	7.6
Other General Merchandise (30)	0.2	0.4	0.5	0.7
Weighted average	0.5	1.0	1.5	2.0

Source: Research Triangle Institute.

Table 59. Consumer surplus losses and employment reductions, 1970: Tax on containers

	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Consumer surplus losses (million dollars)				
Baked Goods (1)	$ 19	$ 21	$ 31	$ 41
Dairy Products (2)	101	199	295	389
Frozen Foods (3)	49	98	147	196
Fresh and Cured Meat (4)	172	343	512	680
Fresh and Cured Fish and Seafood (5)	1	0	0	0
Fresh and Cured Poultry (6)	24	47	71	94
Produce (7)	42	12	0	0
Distilled Spirits (8)	47	94	141	188
Wine (9)	6	11	17	22
Beer (10)	136	271	406	540
Soft Drinks (11)	116	232	346	460
Prepared Beverages (12)	46	91	135	178
Candy and Chewing Gum (13)	23	46	69	91
Canned Foods (14)	175	339	492	636
Cereals, Flour, and Macaroni (15)	5	0	0	0
Pet Foods (16)	14	28	42	55
Tobacco Products (17)	29	58	87	115
Other Foods (18)	57	91	132	171
Soaps and Detergents (19)	126	252	377	503
Other Cleaning Supplies (20)	3	5	8	10
Pesticides (21)	0	0	0	0
Other Household Supplies (22)	35	68	99	128
Packaged Medications (23)	7	13	20	26
Oral Hygiene Products (24)	6	12	17	23
Cosmetics and Hand Produc s (25)	5	10	13	18
Hair Products (26)	6	11	17	23
Shaving Products (27)	3	6	8	11
Other Beauty Aids (28)	2	4	7	9
Other Health Aids (29)	60	119	179	239
Other General Merchandise (30)	339	678	1,016	1,355
Total	$1,652	$3,160	$4,685	$6,200
Employment reductions (thousands)				
Paper	4	5	6	6
Plastics	3	4	4	5
Glass	6	11	17	22
Steel	2	4	6	8
Aluminum	0	0	0	1
Total	15	25	33	41

Source: Research Triangle Institute.

5.4.2 Costs

The weighted averages of the projected increases in consumer prices for a 1-cent tax are about 1 percent. The prices of Soaps and Detergents, Soft Drinks, Cereals, Flour, and Macaroni, and Beer would all be increased fairly substantially (table 58). It is likely that the packaging cost pressures on these industries would induce packaging substitutions outside those projected in the model.

The losses in consumer surplus would be over $3 billion annually for a 1-cent tax (table 59).

5.4.3 Cost-Effectiveness Comparison

The costs per unit of effectiveness are presented in table 60. For most measures of effectiveness, the costs increase with higher taxes. As noted above in the analysis of other taxes, tax payments are implicitly included in the estimates of the losses in consumer surplus.

Table 60. Cost-effectiveness comparisons 1970:
Tax on containers

	Tax rate (cents per container)			
	0.5	1.0	1.5	2.0
Cost				
Loss in consumer surplus (million dollars)	$ 1,652	$ 3,160	$ 4,685	$ 6,200
Cost/Effectiveness				
Reductions in solid waste generation (dollars per tonne)	1,066	1,364	1,694	1,948
Reductions in raw materials consumption (dollars per tonne)	(847)	(1,047)	(1,260)	(1,405)
Paper packaging	1,495	2,124	2,956	3,753
Plastics packaging	6,635	9,003	12,871	15,938
Glass packaging	7,246	7,069	6,993	6,974
Steel packaging	4,976	4,766	4,709	4,672
Aluminum packaging	45,889	45,142	44,619	39,744
Reduction in energy utilization (dollars per thousand kWh)	424	531	643	727
Tax payments (million dollars)	1,652	3,138	4,622	6,073

Source: Research Triangle Institute.

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APPENDIX A: DATA SOURCES AND CONSTRUCTION
OF THE MATERIALS BY CONSUMER PRODUCT

A.1. Packaging Data

The analysis of alternative policy instruments required the
development of a data base showing the use of packaging materials
by consumer product. Further, to estimate the parameters of the
packaging model meant that the data would have to be assembled for several
time periods. No such data base sufficient for this study existed prior
to this effort. Because of the absence of complete data, the resulting
data base should not be interpreted as providing precise estimates of
packaging utilization but rather indicative of general magnitudes and
trends. The general need in collecting the data was a matrix: rows for
the packaging material, and columns for the consumer product.

An initial list of packaging materials was prepared based on the
categories used in Modern Packaging Encyclopedia and Planning Guide (MPE)
(ref. 1). This resulted in 28 separate categories of paper, plastics,
glass, and metal packaging materials used for packaging consumer products.
Data were collected on the basis of the 28 categories and subsequently
aggregated to nine packaging types for purposes of analysis and model
development.

The consumer product definitions were developed from the
Supermarketing Annual Report of Consumer Expenditures. Categories of
food products were stratified into perishable and dry grocery types, plus
Pet Foods and Tobacco Products. Nonfood items were broadly classified
into household supplies, health and beauty aids, and general merchandise.
This resulted in an initial listing of 65 consumer product categories.
The basic matrix for which data were gathered was 28 x 65. Concurrent
with the above task of classifying packaging materials and consumer
products, a survey of trade and industry associations was made to
obtain additional data that were not available in known published sources.
The list of contacts made in this effort is shown in table A-1. Many
of these contacts provide valuable data on annual totals of either the
value or quantity of shipments of various packaging materials.

Table A-1. Contacts made to solicit data for materials and end-use matrix

Nat'l. Ass'n. of Container
  Distributors
10101 Lyndon Avenue
Detroit, Michigan 48238

Milk Bottle Crate Mfrs. Council
Keith Building
Cleveland, Ohio 44115

Mechanical Packing Ass'n.
Box 98
Brielle, New Jersey 08730

Fourdrinier Kraft Board Inst.
280 Park Avenue
New York, New York 10017
(212) 687-9226

Internat'l. Material Management Soc.
214-B Huron Towers
2200 Fuller Road
Ann Arbor, Michigan
(313) 761-5858

*Glass Container Mfrs. Inst., Inc.
330 Madison Avenue
New York, New York 10017
(212) 682-5533

Drug, Chemical & Allied Trades
  Ass'n., Inc.
350 Fifth Avenue
New York, New York 10001
(212) 736-8884

American Inst. of Food Distribution
28-06 Broadway
Fair Lawn, New Jersey 07410
(201) 791-5570

Aluminum Foil Containers Mfrs. Ass'n.
Box D
Fontana, Wisconsin 53125
(414) 275-6838

American Veneer Package Ass'n.
1225 1/2 North Orange Avenue
Orlando, Florida 32804

The Associated Cooperate Industries
  of America
818 Olive Street
St. Louis, Missouri 63101

*Can Mfrs. Institute, Inc.
821 15th Street, N.W.
Washington, D.C. 20005
(202) 737-6242

Boxboard Research & Development Ass'n.
350 South Burdick Mall
Kalamazoo, Michigan 49006
(616) 344-0394

Cigar Box Mfrs., Inc.
245 Park Avenue
New York, New York 10017
(212) 682-7700

The Containerization Institute, Inc.
15 East 40th Street
New York, New York 10016
(212) 686-1824

Detachable Container Ass'n.
1629 K Street, N.W.
Washington, D.C. 20006
(202) 659-4032

Corrugated Container Institute
108 South Kentucky Avenue
Box 1752
Lakeland, Florida 33802
(813) 688-5425

Nat'l. Fed. of Food Distributors
1511 K Street, N.W.
Washington, D.C. 20005
(202) 783-7330

*Fibre Box Ass'n.
224 South Michigan Avenue
Chicago, Illinois 60604
(312) 663-0250

*Indicates usable data received.

Wirebound Box Mfrs. Ass'n.
1211 West 22nd Street
Oak Brook, Illinois 60521
(312) 654-3020

Textile Bag Mfrs. Ass'n.
518 Davis Street
Evanston, Illinois 60201
(312) 328-3339

Steel Shipping Container Inst.
2204 Morris Avenue
Union, New Jersey 07083
(201) 688-8750

Soc. of Packaging & Handling
  Engineers
14 East Jackson Street
Chicago, Illinois 60604

Produce Packaging & Marketing
  Ass'n., Inc.
Box 674
Newark, Delaware 19711
(302) 737-2600

Plastic Container Mfrs. Inst.
Box 141
Rumson, New Jersey 07760

Plate, Cup & Container Inst.,
  Inc.
250 Park Avenue
New York, New York 10017

*Paperboard Packaging Council
1250 Connecticut Avenue, N.W.
Washington, D.C.
(202) 872-0180

Paper Shipping Sack Mfrs. Ass'n.
60 East 42nd Street
New York, New York 10017

Nat'l. Decorated Packaging Ass'n.
Suite F 210
Merchandise Mart
Charlotte, North Carolina 28202
(919) 332-2438

Nat'l. Safe Transit Committee, Inc.
45 East 22nd Street
New York, New York 10010
(212) 674-4140

Package Designers Council
299 Madison Avenue
New York, New York 10017
(212) 682-1980

The Packaging Institute, Inc.
342 Madison Avenue
New York, New York 10017
(212) 687-8874

Packaging Machinery Mfrs. Institute
2000 K Street, N.W.
Washington, D.C. 20006
(202) 338-2800

Nat'l. Paper Box Ass'n.
Room 910
121 North Broad Street
Philadelphia, Pennsylvania 19107
(215) 563-8746

Nat'l. Paper Box Suppliers Ass'n.
286 Clawson Street
New Dorp, Staten Island, New York 10306
(212) 351-1765

Nat'l. Inst. of Packaging, Handling &
  Logistic Engineers
Box 7393
Washington, D.C. 20044

Nat'l. Flexible Packaging Ass'n.
12025 Shaker Boulevard
Cleveland, Ohio 44120
(216) 229-6373

Nat'l. Canners Ass'n.
1133 20th Street, N.W.
Washington, D.C. 20036
(202) 338-2080

Nat'l. Barrel & Drum Ass'n.
Suite 807
1028 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 296-8028

*Indicates usable data received.

Annual totals for each of the 28 packaging material categories
were obtained primarily from Modern Packaging Encyclopedia, which lists
the quantity and value of packaging materials shipped, and updates
these data on an annual basis, and from C&P. Some of these data
were also checked and verified with Mr. Cleveland T. Ealy of the
Department of Agriculture (DA) who has been responsible for maintain-
ing current data on the value of materials used in packaging farm
products as part of the annual Farm Bill prepared for Congress.

The packaging data collected measure total production or
shipments in a given year; no allowance for imports and exports was
included except as otherwise noted in the detailed source descriptions
in section A.1.1. Such exclusion introduces an error of less than
one percent in the distribution of totals. In 1970, the value of
consumer products packaging exports was $107,059 thousand (current)
dollars, about 0.8 percent of the total value of domestic production
(ref. 2). The major export item was plastic containers which represent-
ed 20 percent of the value of 1970 exports of consumer products pack-
aging. Imports of consumer products packaging in 1970 were $35,516
thousand (current) dollars, 0.3 percent of the value of domestic product-
ion (ref.2). Metal containers were the major import item.

In general, the data for glass containers and for metal packaging
products are more reliable since greater detail on packaging consump-
tion by end-use categories was available from published data sources.
Paper and plastic packaging materials are not as well documented as to
the exact items that use these individual materials. The summary of
Current Industrial Report data (table A-2) illustrates that glass and
some metals and plastics data are published by end-use product, whereas
most plastic and all paper packaging materials data are kept only on a
national total basis by the particular type of packaging product rather
than by end-use. Subsequently, considering these and other data sources,
the materials-by-end-use matrix was developed with relative confidence in
the data shown in descending order: (1) glass, (2) metals, (3) plastics,
and, (4) paper.

Since some additional data were available for 1963 and 1967 from the

Table A-2. Summary of data listed in Current Industrial Reports and in Containers and Packaging

Packaging Material	Units Used	Type Data	Level of Detail
Glass	Million gross	Shipments	Consumer products: 1) Bottles 2) Jars
Aluminum foil	Thousand pounds	Consumption	Consumer products: 1) Semirigid 2) Flexible
Container closures	Thousand units	Shipments	National totals: 1) Caps (10 categories) 2) Crowns (1 category)
Metal cans	Thousand base boxes	Shipments	Consumer products: 1) Steel 2) Aluminum
Selected plastics	Values($)	Shipments	National totals: 1) Plastic film (5 categories) 2) Foamed plastic 3) Laminated sheets, pads, tubes 4) Packaging & shipping container
Blow-molded plastic bottles	Thousand units	Shipments	Consumer products
Selected flexible packaging	Value ($) and quantity	Shipments	National totals: 1) Bags (3 categories) 2) Printed rolls & sheets 3) Oiled & waxed paper
Paper and paperboard	Short tons	Production	National totals: 1) Wrapping 2) Shipping 3) Other bags & sacks 4) Glassine, greaseproof, vegetable parchment 5) Other

Census of Manufactures, the first step in developing a matrix was to form a complete value and quantity matrix for the year 1967. This matrix then provided a guide with which to develop matrices for the other years of interest in the data base. For each year, the matrix on value of shipments was completed first, using the annual totals discussed above from MPE. The annual totals for value of shipments were developed first in order to check with national totals as reported by the DA, Census Bureau, and various trade associations. Annual totals for the quantity of packaging products shipped were then developed from the various sources discussed above. Where distributions of packaging products by end-use items were available, these were then filled in and adjusted to the annual totals. Where no data were available, a notation was made signifying materials use or nonuse of the packaging material for the particular consumer product. These decisions were made after extensively reviewing the trade literature. The remainder of the annual total quantity was distributed on the basis of consumer expenditures.

Most data were found in the form of shipments of a packaging material for a given calendar year. Some data are for either production or consumption. It was assumed that all materials are produced, the materials are used to package end-use items, and the end-use products are consumed during the same calendar year.

Value data were initially collected using the prices prevailing in the year of production. In order to make meaningful comparisons of the value structure between years, it was necessary to deflate the current dollar values to constant dollars. Efforts were made to obtain separate price indexes for each of the 28 packaging materials. The data source and price series used to adjust dollar measures to 1967 prices are presented in table A-3.

As raw data, quantity information was obtained in various physical units; pounds, base-boxes, number of containers. Quantity data were standardized to short tons on the basis of conversion factors shown in tables A-4 and A-5; short tons were subsequently converted to metric tonnes for presentation and model development.

A.1.1 Specific Packaging Data Sources

The following provides a detailed description of the sources and procedures used for each of the 28 packaging materials to obtain data

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Table A-3. Wholesale price indexes for packaging
(1967=100)

Packaging container	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Paper													
Bags	93.7	92.4	92.1	92.8	89.4	80.5	83.0	91.9	96.5	100.0	92.7	96.2	103.9
Sacks[1]	97.2	95.9	95.6	95.1	93.9	86.4	86.7	92.8	98.5	100.0	94.4	93.2	106.6
Setup boxes[2]	90.9	90.9	90.9	91.1	92.0	93.7	94.5	95.6	97.7	100.0	104.8	108.1	112.5
Folding boxes	96.9	97.2	100.4	95.1	98.5	98.5	95.8	95.5	97.8	100.0	101.6	104.4	108.2
Sanitary foodboard[3]	96.5	97.4	98.7	98.9	99.3	99.1	100.3	98.6	99.1	100.0	100.0	100.1	102.6
Fibre cans[4]	94.6	95.4	96.7	96.9	97.3	97.1	98.3	99.3	97.7	100.0	102.7	104.5	108.3
Container board[5]	106.6	106.6	106.2	97.4	98.5	100.9	103.9	103.0	103.8	100.0	93.1	97.1	99.2
Other paper packaging[6]	90.7	91.5	92.7	92.9	93.3	93.1	94.2	94.6	97.5	100.0	102.5	101.7	100.9
Glass													
Jars	100.5	100.5	94.6	92.6	91.5	91.5	93.3	94.6	97.9	100.0	107.7	115.4	120.7
Bottles, refillable[7]	100.2	100.2	100.9	101.4	99.5	99.5	98.7	99.4	99.7	100.0	107.8	114.7	120.0
Bottles, non-returnable[7]	100.2	100.2	100.9	101.4	99.5	99.5	98.7	99.4	99.7	100.0	107.7	114.3	120.4
Packaging container	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Metal													
Metal cans[8]	89.6	89.4	89.5	91.1	92.6	93.3	94.1	96.0	98.2	100.0	103.7	106.8	112.3
Barrels	98.9	97.7	93.5	93.3	93.3	95.4	96.3	96.3	98.2	100.0	103.3	107.3	114.1
Collapsible tubes	105.2	104.4	102.2	100.6	100.7	100.6	101.2	99.4	99.0	100.0	106.1	111.5	116.9
Other metal packaging[9]	95.5	97.0	96.8	96.5	96.1	96.3	97.1	97.6	98.9	100.0	102.3	107.0	114.2
Aluminum Cans[8]	89.6	89.4	89.5	91.1	92.6	93.3	94.1	96.0	98.2	100.0	103.7	106.8	112.3
Aluminum foil containers[10]	96.1	95.3	98.1	98.5	97.2	97.2	98.0	99.1	99.1	100.0	100.2	105.4	106.2
Collapsible tubes	105.2	104.4	102.2	100.6	101.1	101.0	101.5	99.6	99.2	100.0	104.6	106.0	108.0
Other aluminum packaging[11]	99.8	99.5	104.3	102.2	95.7	90.7	95.1	98.2	98.2	100.0	102.5	108.4	115.2
Plastic													
Flexible plastic packaging[12]	113.4	108.4	108.1	103.2	102.9	100.7	99.9	99.2	99.8	100.0	78.4	79.9	85.8
Molded plastic containers[13]	113.4	108.4	108.1	103.2	102.9	100.7	99.9	99.2	99.8	100.0	98.9	88.3	78.3

Notes on Wholesale Price Indexes, Table A-3

Source: Packaging and Containers, U. S. Department of Commerce, Business and Defense Services Administration, unless otherwise noted.

[1] 1958 and 1959 data are estimated on basis of relative changes in price series for "paper bags".

[2] Series derived from price indexes for candy boxes and shirt boxes, weighted by quantities consumed.

[3] 1967-1970 observations provided by Bureau of Labor Statistics. 1964-1967 series derived from price indexes for milk cartons, frozen food cartons, and cups, weighted by quantities consumed. Prior to 1964, data are estimated on basis of relative changes in price series for "other paper containers".

[4] Data from 1958-1963 are estimated on basis of relative changes in price series for "other paper containers".

[5] Series on container board material.

[6] Wholesale price series for paper products from Business Statistics, U. S. Department of Commerce.

[7] Prior to 1967, series includes all beverage bottles.

[8] Includes steel and aluminum. Prior to 1967, series includes all metal containers.

[9] Series provided by Bureau of Labor Statistics on steel mills, SIC Code 3312.

[10] Aluminum foil material price series from Packaging and Containers.

[11] Aluminum ingot price series from Packaging and Containers.

[12] Plastic PE resin, low, packaging film price series from Packaging and Containers for 1967-1970. Prior to 1967, wholesale price index for plastic resins and material from Handbook of Labor Statistics, Bureau of Labor Statistics.

[13] Plastic PE resin, high, blow molding price series from Packaging and Containers from 1967-1970. Prior to 1967, wholesale price index for plastic resins and material from Handbook of Labor Statistics, Bureau of Labor Statistics.

Table A-4. Conversion units to standardize data into some measure of weight

Packaging material	One unit of weight		Number units of material
Metal caps	1 million pounds	=	70.2 million units
Plastic caps	1 million pounds	=	122.5 million units
Metal crowns	1 million pounds	=	116.6 million units
Collapsible tubes	1 million pounds	=	37.0 million units
Aerosol cans	1 short ton	=	11.3 thousand units

Table A-5. Factors for converting glass containers
into a measure of weight
(pounds per gross)

Year	Beer		Soft drinks		All other
	R	NR	R	NR	
1958-62	99.0	66.0	141.8	107.2	72.6
1963	97.2	65.9	141.8	106.7	73.7
1964	98.2	65.2	140.2	107.4	74.8
1965	91.4	66.5	139.5	98.3	75.7
1966	85.8	68.2	141.3	89.4	76.3
1967	86.4	66.6	141.0	86.4	77.1
1968	86.5	68.4	141.1	87.3	78.9
1969	89.5	68.5	139.5	92.7	78.7
1970	89.9	71.0	137.0	96.6	80.5

Key: R = returnable; NR = nonreturnable

Source: Glass Containers Manufacturers Institute.

stratified by consumer product.

A. **Flexible Paper**

    1.   Waxed and oiled. <u>Current Industrial Reports</u> and <u>C&P</u> were used to obtain annual <u>shipments</u> reported in short tons and dollar value. Total shipments were distributed into consumer product categories on the basis of current value of consumer expenditures. Consumer product users of waxed and oiled paper were identified from information in <u>Paper Yearbook</u> and <u>Paper World</u>.

    2.   Laminated. Same as waxed and oiled.

    3.   Grocery, variety, and specialty bags. <u>MPE</u> was the basic source of annual quantity and value totals. <u>MPE</u> data on value of bags and value of specialty bags used to distribute combined quantity data between grocery and specialty bags. Quantity of shipments was distributed into consumer product categories on basis of current value of consumer expenditures. Product users of bags identified from information in <u>Paper Yearbook</u> and <u>Paper World</u>.

    4.   Glassine. Same as waxed and oiled

    5.   Paper closures. All used for dairy products, with quantity data obtained from <u>C&P</u>.

B. **Rigid Paper or Paperboard**

    1.   Folding boxes. Total annual quantity was found in <u>Paperboard Industry Statistics, American Paper Institute</u>; units are in tons of <u>production</u> for <u>domestic</u> use. From <u>MPE</u>, the end-use distribution was obtained on <u>shipments</u> to each end-use. Data on other food users were distributed on basis of consumer expenditures, with users identified through <u>Paper World</u> or <u>Paper Yearbook</u>.

    2.   Setup boxes. Procedures same as for folding boxes.

    3.   Sanitary foodboard. Total annual quantities were obtained from <u>Paperboard Industry Statistics, American Paper Institute</u>, in tons <u>production</u> for <u>domestic</u> use. The 1967 <u>Census of Manufactures</u> reports 1963 and 1967 distribution of sanitary foodboard between dairy and nondairy. The proportion remained constant between these two observations and was therefore used to obtain quantities for dairy and other foods for the entire period.

Other food users were identified from <u>Paper World</u> and <u>Paper Yearbook</u> and quantities were obtained by distributing other food total by consumer expenditures.

4. Fibre cans. Annual totals were obtained from <u>MPE</u> in short tons and dollars. Distributed into consumer product users on basis of consumer expenditures. Users identified from <u>Paper Yearbook</u> and <u>Paper World</u>.

C. Flexible Plastics

1. Cellophane. <u>(MPE)</u> was used for total annual quantity in millions pounds and dollars and for distribution of total end uses. <u>Modern Plastics</u> was used to determine specific other food and nonfood categories; consumer expenditures were used to distribute.

2. Polyethylene. Procedure as in cellophane

3. Polypropylene. Procedure as in cellophane

4. Plastic sheet. Value reported in <u>MPE</u> was used to determine proportional share of all plastics, then applied to quantity. End-use quantities based on consumer expenditures.

5. Other flexible. Residual quantity, end-use categories devised to consider all other alternatives to above mentioned except where market reports indicated specific other usage.

6. Plastic closures. Quantity (in units) from <u>Current Industrial Reports</u>, all in other nonfood. Dollar value from <u>MPE</u>.

D. Rigid Plastic Containers

1. Bottles. <u>MPE</u> was used for annual total quantity, in million pounds and dollars. <u>Current Industrial Reports</u> data on end-use distribution of units coverted to proportionate distribution and applied to total quantity.

2. Other containers. <u>MPE</u>, annual total quantity, million pounds and dollars. User categories identified from <u>Modern Plastics</u>, total quantity then distributed on basis of consumer expenditures.

E. Steel

1. Steel cans. Total quantity found in <u>MPE</u>, in thousands of tons and dollars. The distribution of shipments in <u>MPE</u> is the basis for end-use data.

2. Aerosol cans. Million units (annual) and dollar value comes from MPE; distributed into user categories on basis of consumer expenditures. Categories are identified from the Can Manufacturer Institute publication, Annual Report: Metal Cans Shipments (various years).

F. Aluminum

   1. Aluminum cans. Total quantity thousands of tons and dollars. MPE distribution of base boxes translated into proportion applied to total.

   2. Collapsible tubes. Data from MPE on several nonfood categories in number of units and dollars.

G. Flexible Aluminum

   1. Aluminum foil. Dollar value and millions pounds of shipments in MPE, distribution obtained from C&P.

   2. Aluminum plates (semirigid foil). MPE has annual total in millions pounds and dollars. End-use categories identified from trade association publications and consumer expenditures were the basis for distribution.

H. Metal Closures

   1. Crowns. Total quantities from C&P in million units; end-use data also found in C&P. Dollar value from MPE.

   2. Caps. Distributed into all end-use categories that use cans or glass jars on basis of consumer expenditures. Totals were obtained from C&P, dollar value from MPE.

I. Glass

   1. Jars. C&P has data on shipments in million gross. The amount distributed in dairy foods came directly from C&P. Other food distributed on basis of consumer expenditure into end-use identified in Glass Containers Annual.

   2. Returnable bottles. All data from C&P in million gross.

   3. Nonreturnable. Total from C&P and beverage data from C&P. Other food distributed as in jars.

A.1.2 Consumer Expenditure Data

   In collecting expenditure data on the identified consumer product categories, each of the products listed in Supermarketing magazine

was classified by SIC code, in order to check and investigate differences between these data and the data obtained from Census information. Consumer expenditures in each of the original 65 categories were obtained for each year during the period 1958 through 1970. Supermarketing magazine provided the basic data for all food expenditures and most nonfood categories. Expenditures for a few general merchandise items were not listed in Supermarketing issues and were therefore obtained from the Bureau of Labor Statistics. The 65 consumer product categories were subsequently aggregated to 30 commodities due to availability of packaging information.

Quantity and value data for 9 packaging materials and 30 consumer products for each year (1958-70) are presented in matrix form in tables A-6 through A-11.

These are the definitions for the codes used in the tables that follow:

a. Column headings are years: 58 = 1958, etc.

b. Horizontal grouping identification numbers are:

ID 1 = Baked Goods
ID 2 = Dairy Products
ID 3 = Frozen Foods
ID 4 = Fresh and Cured Meat
ID 5 = Fresh and Cured Fish and Seafood
ID 6 = Fresh and Cured Poultry
ID 7 = Produce
ID 8 = Distilled Spirits
ID 9 = Wine
ID 10 = Beer
ID 11 = Soft Drinks
ID 12 = Prepared Beverages
ID 13 = Candy and Chewing Gum
ID 14 = Canned Foods
ID 15 = Cereals, Flour, and Macaroni
ID 16 = Pet Foods
ID 17 = Tobacco Products
ID 18 = Other Foods
ID 19 = Soaps and Detergents
ID 20 = Other Cleaning Supplies
ID 21 = Pesticides
ID 22 = Other Household Supplies
ID 23 = Packaged Medications
ID 24 = Oral Hygiene Products
ID 25 = Cosmetics and Hand Products
ID 26 = Hair Products
ID 27 = Shaving Products
ID 28 = Other Beauty Aids
ID 29 = Other Health Aids
ID 30 = Other General Merchandise

ID 31 = Total (consumer products)

c. Line identification numbers are:

(1) Flexible paper and paper closures
(2) Flexible plastics and plastic closures
(3) Metal closures
(4) Flexible aluminum
(5) Rigid paper
(6) Rigid plastics
(7) Glass
(8) Steel
(9) Rigid aluminum
(10) Total (packaging materials)
(PCE) Personal consumption expenditures (million 1967 dollars)

REFERENCES

1. _Modern Packaging Encyclopedia and Planning Guide_. Published
    annually. New York: McGraw-Hill.

2. U.S. Department of Commerce, Bureau of Domestic Commerce, _Containers
    and Packaging_ 24, No. 1 (April 1971).

Table A-6. The quantity structure of packaging by consumer product, 1958-70

(percent distribution)

ID 1	58	59	60	61	62	63	64	65	66	67	68	69	70
1	31.77	30.66	30.70	29.05	30.43	30.15	28.31	28.51	27.18	28.70	28.62	28.55	27.91
2	14.62	14.99	16.00	16.05	14.96	13.23	13.32	12.36	11.36	11.69	12.31	12.09	13.59
3	1.03	0.95	0.84	0.86	0.88	0.85	0.77	0.75	0.72	0.68	0.70	0.71	0.70
4	0.62	0.67	0.55	0.60	0.59	0.65	0.49	0.54	0.48	0.54	0.98	0.83	1.08
5	49.25	49.74	48.77	50.18	49.68	51.59	53.52	54.21	56.80	54.85	53.95	53.17	52.81
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.52	0.39	0.34	0.40	0.34	0.34	0.34	0.41	0.30	0.34	0.37	0.37	0.37
9	2.18	2.60	2.80	2.86	3.12	3.20	3.24	3.21	3.17	2.81	3.06	3.35	3.55
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	7702.5	7851.3	7965.6	8103.5	8170.7	8211.7	8460.5	8610.9	8660.2	8589.0	8872.5	8901.3	8841.1

ID 2	58	59	60	61	62	63	64	65	66	67	68	69	70
1	30.73	30.94	31.21	31.37	30.67	33.11	31.30	30.92	30.08	29.14	28.41	28.13	27.22
2	1.31	1.24	1.32	1.29	1.49	2.32	1.94	1.93	2.19	2.43	2.54	2.69	3.57
3	0.97	0.94	0.90	0.92	0.87	0.90	0.83	0.79	0.77	0.67	0.68	0.68	0.67
4	0.49	0.53	0.51	0.46	0.41	0.45	0.44	0.44	0.40	0.44	0.45	0.40	0.48
5	55.33	55.86	56.42	56.55	58.18	54.91	58.09	59.65	60.47	59.69	60.67	61.08	62.53
6	0.07	0.08	0.21	0.37	0.45	0.51	0.56	0.22	0.46	1.50	0.96	1.59	1.93
7	6.99	7.01	6.55	6.08	5.19	5.04	4.51	4.05	3.31	3.13	3.21	3.11	1.28
8	4.11	3.40	2.88	2.96	2.73	2.77	2.33	2.00	2.31	3.00	3.08	2.32	2.33
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	14743.9	14776.9	14951.4	14863.0	14979.8	15200.2	15205.1	15106.9	14864.3	12621.0	12651.5	12778.8	12681.6

ID 3	58	59	60	61	62	63	64	65	66	67	68	69	70
1	30.39	29.54	29.47	27.95	28.47	27.51	25.88	26.19	24.53	28.04	28.77	28.15	27.27
2	9.35	9.17	9.15	8.78	8.95	9.53	8.89	8.32	8.82	7.55	8.18	8.31	8.50
3	1.00	0.90	0.83	0.82	0.84	0.77	0.71	0.68	0.65	0.66	0.70	0.69	0.68
4	7.86	9.55	10.73	10.98	11.99	11.82	12.31	11.63	11.63	5.97	4.82	6.70	8.11
5	48.82	47.93	46.80	48.35	46.50	47.14	48.94	49.84	51.26	54.26	54.07	52.46	51.60
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.50	0.40	0.34	0.37	0.34	0.31	0.32	0.39	0.26	0.33	0.37	0.36	0.36
9	2.09	2.51	2.68	2.75	2.92	2.92	2.96	2.96	2.86	2.78	3.08	3.34	3.49
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2304.3	2361.9	2435.9	2603.0	2698.4	2805.2	2940.3	3164.6	3283.8	4997.0	5324.6	5575.1	5524.8

ID 4	58	59	60	61	62	63	64	65	66	67	68	69	70
1	40.42	40.03	40.25	38.53	39.82	38.92	38.97	39.69	37.08	39.59	38.52	38.76	38.71
2	2.64	2.71	2.83	3.17	3.58	3.92	4.58	4.01	3.66	3.88	3.74	3.68	3.79
3	1.30	1.23	1.10	1.14	1.15	1.10	1.07	1.05	0.99	0.93	0.95	0.96	0.96
4	0.04	0.04	0.04	0.04	0.03	0.04	0.06	0.06	0.04	0.04	0.04	0.04	0.04
5	55.59	55.99	55.78	57.12	55.42	56.02	55.33	55.19	58.24	55.55	56.75	56.57	56.49
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	18403.5	19483.1	20488.5	20603.3	20756.9	20355.1	22071.0	22204.5	22140.8	22753.0	23168.1	22865.3	22807.0

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued
(percent distribution)

ID 5	58	59	60	61	62	63	64	65	66	67	68	69	70
1	41.11	39.82	40.16	38.62	39.91	38.89	38.98	39.69	37.01	39.12	38.44	38.75	38.71
2	2.83	2.68	2.81	3.20	3.49	3.96	4.83	4.17	3.59	4.02	3.84	3.74	3.82
3	1.54	1.34	1.30	1.27	1.16	1.03	0.94	1.15	1.06	1.07	0.82	1.07	1.05
4	0.05	0.45	0.04	0.04	0.04	0.03	0.06	0.06	0.03	0.05	0.05	0.05	0.05
5	54.47	55.70	55.70	56.86	55.40	56.09	55.19	54.93	58.31	55.73	56.84	56.39	56.36
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	411.3	428.7	438.8	447.6	450.8	483.9	552.2	569.4	554.3	538.0	530.5	532.6	525.4

ID 6	58	59	60	61	62	63	64	65	66	67	68	69	70
1	40.42	39.86	40.24	38.58	39.85	38.92	38.93	39.70	37.07	39.64	38.52	38.75	38.72
2	2.65	2.72	2.85	3.19	3.58	3.93	4.58	4.01	3.65	3.86	3.72	3.70	3.80
3	1.28	1.20	1.10	1.12	1.14	1.09	1.09	1.06	1.01	0.95	0.94	0.98	0.98
4	0.06	0.57	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.04	0.04
5	55.58	55.65	55.75	57.05	55.38	56.01	55.35	55.18	58.23	55.50	56.78	56.53	56.46
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2324.1	2437.3	2480.8	2596.9	2592.2	2742.0	3037.7	3055.3	3185.6	3171.0	3217.3	3283.5	3396.7

ID 7	58	59	60	61	62	63	64	65	66	67	68	69	70
1	36.81	36.22	36.59	34.40	35.91	34.72	35.07	35.33	32.77	35.49	34.58	34.68	34.53
2	8.25	8.70	9.11	10.14	10.03	11.06	11.23	11.05	12.48	11.34	11.34	12.38	12.95
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	54.95	55.08	54.31	55.46	54.05	54.22	53.70	53.62	54.75	53.17	54.08	52.94	52.52
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	9297.5	9656.2	9581.6	9883.6	10212.9	9723.0	9818.6	9897.9	9780.3	9921.0	9759.8	9943.3	10267.4

ID 8	58	59	60	61	62	63	64	65	66	67	68	69	70
1	17.22	17.26	18.58	17.76	18.21	18.85	18.44	19.68	18.48	18.72	18.20	18.91	18.81
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	20.51	20.16	21.04	21.14	20.89	22.17	20.87	20.47	22.89	20.94	20.43	19.92	18.79
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	62.27	62.59	60.38	61.11	60.90	58.98	60.69	59.84	58.63	60.34	61.36	61.17	62.40
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5180.8	5340.1	5514.1	5813.7	5900.3	5968.2	6312.9	6576.4	6673.1	6969.0	7175.5	7122.9	7060.9

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 9	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	100.00
7	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	100.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	669.9	681.4	660.1	714.6	713.4	772.2	808.8	839.3	921.1	938.0	949.9	1297.6	1288.8

ID 10	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.68	6.69	5.98	6.39	5.59
3	11.00	10.41	9.09	8.72	8.41	7.90	7.80	7.47	0.08	0.08	0.10	0.09	0.09
4	0.00	0.00	0.00	0.00	0.00	0.12	0.08	5.86	6.56	5.71	5.33	5.14	4.57
5	7.87	7.65	7.01	6.25	6.24	6.07	5.93	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.36	55.33	52.92	57.32	56.81
7	27.36	28.29	34.11	39.76	43.50	46.63	50.35	51.86	34.32	27.23	29.39	25.32	27.32
8	53.77	53.65	49.79	45.27	41.85	39.27	35.85	34.73	0.00	4.96	6.28	5.74	5.62
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5552.4	5662.0	5482.9	5442.4	5571.6	5702.4	5908.2	6106.4	6244.1	6137.0	6151.8	6226.8	6279.2

ID 11	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.13	2.20	2.27	2.22	1.94	1.76	1.65	1.78	1.47	1.29	1.12	1.02	0.85
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.74	1.44	1.22	1.20	0.96
3	3.75	3.71	3.24	3.35	2.78	2.50	2.25	2.17	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.28	5.30	5.06	5.05	4.28	3.99	3.57	3.55	3.53	2.67	2.35	2.04	1.63
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	84.42	83.42	81.74	77.71	78.29	78.70	77.05	73.31	71.93	72.80	70.19	74.46	77.35
8	4.41	5.36	7.68	11.66	12.72	13.04	15.47	19.20	21.33	21.01	23.26	19.47	16.93
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	1.85	1.82	2.28
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2713.9	2778.2	2788.2	2756.8	2823.5	2782.8	2722.0	3029.6	3151.8	3032.0	3044.0	3140.1	3148.7

ID 12	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.61	2.52	2.64	2.48	2.56	2.64	2.70	2.83	2.83	2.82	2.77	2.78	2.80
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.22	0.20	0.18	0.18	0.18	0.19	0.19	0.18	0.18	0.16	0.16	0.18	0.16
4	0.12	0.11	0.11	0.12	0.15	0.15	0.13	0.12	0.16	0.21	0.18	0.17	0.15
5	9.24	9.07	9.02	8.95	8.92	9.76	9.68	9.43	10.65	9.28	9.63	9.33	9.22
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.11	0.35	0.23	0.37	0.46
7	67.14	65.74	66.58	65.94	66.56	66.89	70.95	70.81	69.69	71.31	70.35	72.21	74.22
8	20.67	22.36	21.47	22.33	21.63	20.37	16.35	16.58	16.38	15.87	16.68	14.96	12.98
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2540.8	2712.5	2810.6	2893.8	2941.6	3033.1	2840.0	2670.7	2684.7	2847.0	2889.6	3029.3	2762.7

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued
(percent distribution)

ID 13	58	59	60	61	62	63	64	65	66	67	68	69	70
1	30.74	30.65	31.09	29.47	30.84	30.34	29.53	31.98	28.64	28.54	29.54	29.40	29.63
2	20.92	20.22	20.53	20.73	20.60	20.13	23.01	21.51	21.47	22.60	21.79	23.05	23.91
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	2.55	2.45	2.27	2.28	2.10	2.10	2.19	2.68	2.09	2.81	2.48	2.71	2.41
5	45.80	46.68	46.11	47.52	46.46	47.02	45.27	43.82	47.80	46.05	46.20	44.84	44.05
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2356.2	2375.9	2524.3	2934.5	3035.1	3034.4	2762.9	2888.7	3332.2	3087.0	2959.3	2810.7	2840.2

ID 14	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.11	0.11	0.10	0.11	0.11	0.12	0.11	0.11	0.11	0.11	0.10	0.11	0.11
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.77	2.89	2.83	2.83	2.75	3.28	3.14	3.21	3.82	3.52	3.34	3.45	3.36
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	17.54	19.17	19.32	19.30	19.61	22.61	22.59	23.64	23.05	25.92	24.47	26.98	27.36
8	79.58	77.83	77.75	77.77	77.54	73.98	74.16	73.04	73.02	69.57	71.01	68.28	67.40
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	1.08	1.17	1.77
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5004.4	5062.1	5272.5	5569.8	5489.3	5718.4	5685.2	5921.5	5790.4	6073.0	6091.7	6260.5	6147.8

ID 15	58	59	60	61	62	63	64	65	66	67	68	69	70
1	45.78	45.87	46.63	45.45	47.21	46.87	47.49	48.52	44.07	46.17	45.55	46.44	45.78
2	4.95	5.08	5.11	5.34	5.23	5.93	6.19	5.83	6.22	8.38	8.55	10.01	10.59
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	49.26	49.05	48.25	49.22	47.56	47.20	46.32	45.65	49.71	45.45	45.90	43.55	43.63
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	1972.8	1968.4	1983.9	2009.0	2028.6	2078.2	2147.0	2216.4	2186.3	2171.0	2230.1	2261.4	2217.6

ID 16	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.03	3.26	3.09	3.36	3.20	3.49	3.55	3.60	3.59	3.21	3.08	3.52	3.47
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.65	1.74	1.62	1.75	1.60	1.74	1.77	1.76	1.75	1.51	1.42	1.72	1.55
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.60	0.93	1.32
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	95.32	95.00	95.28	94.89	95.20	94.77	94.68	94.64	94.66	94.77	94.90	93.78	93.62
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	542.4	560.4	574.7	596.1	622.9	650.5	683.0	735.5	794.5	849.0	904.8	970.7	1031.5

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 17	58	59	60	61	62	63	64	65	66	67	68	69	70
1	32.61	38.92	43.93	44.79	45.72	47.08	47.22	45.80	37.45	39.75	38.31	37.45	38.96
2	6.38	7.65	8.42	8.83	8.78	8.63	8.91	11.55	10.75	10.17	11.06	11.36	10.65
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	2.65	4.06	3.92	4.81	4.28	4.49	4.31	4.65	4.03	3.35	3.04	3.03	3.21
5	58.37	49.37	43.72	41.57	41.22	39.40	39.56	38.00	47.77	46.73	47.60	48.16	47.18
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	7519.4	7952.1	8192.3	8483.0	8571.3	8837.6	8751.3	8992.3	9201.7	9293.0	9132.3	8946.8	9094.0

ID 18	58	59	60	61	62	63	64	65	66	67	68	69	70
1	5.99	5.97	6.09	5.95	5.94	6.13	6.05	6.13	6.00	5.67	5.80	5.61	5.34
2	2.07	2.22	1.88	2.01	1.33	3.30	0.79	0.76	0.98	1.58	2.09	2.00	2.39
3	0.31	0.31	0.27	0.28	0.27	0.27	0.26	0.25	0.25	0.22	0.22	0.21	0.21
4	0.36	0.44	0.40	0.41	0.36	0.37	0.47	0.58	0.58	1.35	1.17	1.43	1.06
5	13.48	14.51	14.38	15.17	14.25	15.06	15.22	15.40	16.68	14.30	14.77	14.03	13.42
6	0.80	1.07	2.15	2.49	2.81	3.31	4.40	2.28	3.08	5.86	5.81	6.34	6.83
7	68.03	67.35	68.00	66.00	67.88	65.80	68.96	69.34	67.69	66.17	65.74	66.56	66.82
8	8.73	7.84	6.51	7.36	6.81	5.41	5.50	4.86	4.34	4.55	4.03	3.44	3.55
9	0.23	0.29	0.31	0.33	0.35	0.36	0.40	0.40	0.40	0.31	0.36	0.38	0.39
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5564.8	5895.6	6168.9	6333.6	6530.4	6612.7	6530.7	6686.3	6751.9	6521.0	6565.4	6646.3	6789.1

ID 19	58	59	60	61	62	63	64	65	66	67	68	69	70
1	7.64	7.28	7.09	6.42	6.59	6.34	6.22	5.87	7.35	7.10	5.95	5.82	6.21
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.06	0.09	0.14	0.17	0.15	0.12	0.27	0.19	0.19	0.18	0.24	0.32
5	91.99	92.19	91.91	90.12	88.79	88.52	88.05	88.12	84.62	84.57	86.10	85.67	84.16
6	0.37	0.47	0.90	3.33	4.46	4.98	5.61	5.74	7.83	8.14	7.78	8.26	9.31
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	1182.9	1253.3	1322.7	1355.2	1406.1	1455.5	1511.9	1560.0	1626.5	1593.0	1630.1	1636.4	1654.7

ID 20	58	59	60	61	62	63	64	65	66	67	68	69	70
1	23.98	21.62	19.98	18.04	15.29	19.27	17.29	16.31	15.11	16.95	17.18	15.06	16.02
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6.29	5.99	5.73	5.40	4.31	5.39	4.60	4.47	4.41	4.21	4.69	4.46	4.33
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	25.80	24.25	23.19	20.99	20.54	26.15	24.24	24.76	15.39	16.48	17.98	16.22	16.49
6	1.32	1.39	2.58	9.39	10.32	15.20	15.65	15.87	16.10	10.00	22.52	21.39	23.98
7	42.03	42.41	40.56	33.41	39.04	21.14	15.30	14.71	21.48	14.13	10.26	16.49	10.25
8	0.58	4.34	7.96	12.77	10.50	12.85	22.91	23.88	27.50	28.83	27.37	26.38	28.93
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	677.1	684.2	710.0	739.6	1111.9	811.8	836.8	851.0	869.1	956.0	942.5	937.6	946.2

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 21	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.97	3.04	2.84	3.16	3.46	4.04	3.58	4.12	3.00	3.63	4.31	4.65	3.47
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	80.81	77.30	73.22	73.45	69.67	74.53	55.46	51.98	57.25	52.50	34.04	32.02	31.94
8	16.22	19.65	23.95	23.39	25.87	21.43	36.97	43.91	39.75	43.87	61.64	63.33	64.09
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	147.3	168.6	166.3	167.6	169.5	166.1	164.2	161.6	157.7	157.0	148.5	146.9	149.9

ID 22	58	59	60	61	62	63	64	65	66	67	68	69	70
1	4.61	4.93	4.41	4.30	4.64	5.02	4.87	5.55	7.06	7.36	6.31	6.30	6.77
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.05	1.02	0.96	1.02	1.04	1.10	1.07	1.20	1.61	1.47	1.30	1.37	1.39
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	67.36	65.87	68.75	68.92	72.48	68.38	67.72	63.58	61.65	57.36	59.56	58.51	56.71
6	0.23	0.29	0.56	2.24	3.16	3.96	4.40	5.42	7.91	8.46	8.24	8.93	10.14
7	23.93	24.71	21.65	20.23	15.53	16.27	15.05	13.85	6.81	12.98	11.74	11.66	10.90
8	2.81	3.57	3.68	3.28	3.15	5.27	6.88	10.41	14.56	12.36	12.85	13.23	14.08
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	1431.6	1529.8	1725.1	1821.1	1904.5	1940.9	1987.0	2075.4	2115.1	2083.0	2130.5	2167.0	2454.3

ID 23	58	59	60	61	62	63	64	65	66	67	68	69	70
1	10.53	10.62	10.51	8.56	9.92	11.39	11.27	12.79	9.86	10.48	12.84	11.85	12.25
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.09	2.19	2.13	1.85	2.06	2.37	2.31	2.61	2.03	1.97	2.53	2.40	2.38
4	0.07	0.07	0.03	0.03	0.03	0.03	0.03	0.18	0.08	0.12	0.14	0.16	0.20
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.51	0.69	0.50	0.40	0.62	0.56	0.58	1.15	0.93	1.15	1.73	1.62	1.75
7	85.89	85.44	85.77	88.09	85.97	83.70	84.01	81.34	85.54	84.02	80.63	82.22	81.32
8	0.06	0.10	0.13	0.16	0.31	0.45	0.32	0.42	0.32	0.36	0.45	0.47	0.50
9	0.84	0.90	0.92	0.91	1.09	1.51	1.48	1.51	1.24	1.50	1.70	1.28	1.59
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	959.1	1001.9	1043.1	1096.9	1169.1	1211.3	1235.8	1305.4	1381.1	1440.0	1536.9	1584.4	1603.3

ID 24	58	59	60	61	62	63	64	65	66	67	68	69	70
1	10.23	10.22	10.51	8.22	9.40	10.72	10.44	12.07	9.03	10.42	12.09	11.25	11.70
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.99	2.16	2.14	1.80	1.91	2.21	2.16	2.43	1.85	1.98	2.37	2.30	2.25
4	0.05	0.05	0.05	0.04	0.04	0.05	0.04	0.17	0.06	0.11	0.15	0.14	0.21
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.48	0.66	0.51	0.39	0.60	0.51	0.52	1.09	0.87	1.15	1.63	1.56	1.69
7	81.81	81.40	80.61	83.89	82.13	78.44	79.23	76.12	82.15	80.36	76.19	77.31	76.60
8	0.08	0.12	0.17	0.13	0.28	0.39	0.30	0.34	0.30	0.32	0.45	0.47	0.49
9	5.36	5.38	6.01	5.55	5.63	7.67	7.31	7.79	5.74	5.67	7.12	6.98	7.05
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	396.9	415.8	439.0	469.1	478.6	498.9	535.6	555.2	580.1	742.0	669.3	673.6	693.5

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 25	58	59	60	61	62	63	64	65	66	67	68	69	70
1	9.37	9.59	9.16	9.54	11.48	9.98	10.11	13.50	10.71	11.61	11.41	11.41	11.88
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.83	1.97	1.87	2.06	2.35	2.07	2.06	2.74	2.22	2.16	2.22	2.35	2.31
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.44	0.60	3.08	3.09	4.74	3.41	3.88	6.01	5.52	6.00	7.90	10.38	10.13
7	87.71	87.02	84.97	84.20	80.22	82.95	82.84	75.82	80.41	79.18	77.49	74.81	74.68
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.64	0.82	0.92	1.11	1.21	1.60	1.12	1.93	1.14	1.05	0.98	1.05	1.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	457.6	469.8	493.1	542.0	543.2	549.5	600.4	714.7	832.1	838.0	860.0	869.3	

ID 26	58	59	60	61	62	63	64	65	66	67	68	69	70
1	9.06	9.19	8.77	8.87	9.88	8.73	9.22	11.21	9.41	10.03	9.74	9.69	9.97
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.79	1.92	1.81	1.92	2.03	1.82	1.90	2.28	1.96	1.85	1.89	2.00	1.93
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.45	0.59	2.93	2.88	4.14	2.98	3.51	4.96	4.88	5.18	6.73	7.38	8.51
7	83.27	83.89	79.58	77.57	69.80	73.29	73.87	61.31	68.13	67.24	65.06	63.95	62.57
8	5.43	4.42	6.91	8.76	14.15	13.18	11.49	20.23	15.63	15.71	16.58	16.97	17.03
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	465.6	478.0	496.8	531.1	589.8	652.5	837.4	943.7	1055.7	1092.0	1143.0	1122.9	1218.7

ID 27	58	59	60	61	62	63	64	65	66	67	68	69	70
1	9.08	8.88	8.68	8.84	9.87	13.12	9.22	12.27	9.87	10.68	10.77	10.06	10.60
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.86	1.90	1.76	1.92	2.05	2.75	1.86	2.45	2.06	2.01	2.06	2.11	2.08
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.47	0.58	2.91	2.88	4.10	4.50	3.55	5.41	5.11	5.54	7.41	9.11	9.01
7	82.46	80.61	78.77	76.77	74.49	66.49	74.37	67.59	72.06	71.63	68.83	68.86	68.67
8	5.52	7.56	7.50	9.23	9.18	12.75	10.73	11.94	10.64	9.99	10.77	9.70	9.49
9	0.61	0.47	0.37	0.35	0.30	0.40	0.27	0.33	0.26	0.15	0.16	0.15	0.15
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	251.3	270.5	296.2	317.7	342.7	363.4	373.5	400.0	438.5	526.0	552.7	585.6	625.2

ID 28	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.66	2.38	2.27	2.29	2.46	2.14	2.18	2.07	2.26	2.42	2.38	2.59	2.89
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.44	0.46	0.54	0.56
3	0.52	0.49	0.47	0.48	0.52	0.45	0.44	0.41	0.14	0.21	0.21	0.24	0.25
4	0.32	0.27	0.26	0.24	0.24	0.20	0.17	0.24	0.00	0.00	0.00	0.00	0.00
5	70.51	72.07	72.60	71.93	74.00	73.96	73.64	75.43	68.44	64.45	63.17	59.23	56.49
6	0.13	0.16	0.78	0.74	1.02	0.75	0.83	0.92	1.17	1.25	1.62	2.35	2.45
7	23.59	21.59	20.63	20.75	17.18	19.39	17.83	12.30	19.17	19.22	16.17	17.32	17.77
8	2.26	3.04	3.00	3.57	4.59	3.12	4.90	8.63	8.35	12.01	15.99	17.73	19.59
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	135.4	142.6	150.7	167.5	175.9	184.2	226.0	252.5	312.3	331.0	388.9	424.2	476.4

Table A-6. The quantity structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 29	58	59	60	61	62	63	64	65	66	67	68	69	70
1	8.37	8.25	8.40	7.71	9.05	8.83	8.57	9.44	8.91	9.04	9.42	8.97	9.12
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.67	1.71	1.71	1.66	1.88	1.83	1.75	1.92	1.85	1.70	1.85	1.78	1.76
4	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.13	0.07	0.03	0.12	0.11	0.16
5	21.65	23.14	24.50	19.90	21.85	23.80	25.71	27.82	23.33	24.30	27.28	28.00	27.25
6	0.41	0.53	0.40	0.36	0.56	0.43	0.43	0.84	0.85	1.00	1.27	1.19	1.31
7	67.82	66.26	64.85	70.22	66.38	64.76	63.29	59.55	64.70	63.65	59.76	60.03	60.04
8	0.06	0.07	0.10	0.13	0.25	0.31	0.22	0.30	0.29	0.28	0.31	0.32	0.35
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2380.6	2443.8	2614.2	2800.4	2807.5	2805.6	2777.2	3011.6	3129.9	2924.0	3000.0	3091.5	3160.8

ID 30	58	59	60	61	62	63	64	65	66	67	68	69	70
1	22.68	22.96	24.64	24.39	25.32	26.19	26.24	26.70	26.74	29.13	28.06	24.85	24.18
2	2.20	2.77	2.89	3.94	4.31	4.02	5.44	6.66	7.16	8.17	8.11	7.80	8.39
3	0.45	0.47	0.47	0.47	0.45	0.53	0.48	0.49	0.48	0.46	0.43	0.35	0.36
4	0.33	0.32	0.33	0.30	0.31	0.38	0.41	0.37	0.43	0.30	0.50	0.38	0.37
5	36.68	36.44	37.26	36.35	38.15	40.49	36.71	33.55	31.59	34.58	36.26	31.12	30.27
6	0.66	0.64	0.94	1.12	1.33	1.60	2.01	3.85	4.69	4.34	5.52	5.35	6.34
7	9.51	10.00	10.50	9.53	6.99	6.89	5.19	4.76	4.12	4.23	3.12	2.71	2.46
8	27.39	26.32	22.88	23.80	23.04	19.78	23.41	23.50	24.67	18.58	17.74	27.14	27.35
9	0.09	0.09	0.10	0.11	0.11	0.12	0.12	0.13	0.13	0.21	0.26	0.23	0.28
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	93579.8	103107.0	106243.7	104182.3	113565.6	121605.6	133580.3	146795.3	160568.9	164900.0	178750.5	186488.3	191036.7

Source: Research Triangle Institute

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Table A-7. The quantity structure of packaging by consumer product, 1958-70
(kilograms per $100 expenditure)

ID 1	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.81	1.90	1.96	1.89	2.08	2.16	2.16	2.27	2.30	2.50	2.38	2.39	2.34
2	0.83	0.93	1.02	1.04	1.02	0.95	1.01	0.99	0.98	1.02	1.02	1.09	1.14
3	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
4	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.08	0.08	0.07	0.09
5	2.81	3.09	3.11	3.26	3.39	3.70	4.07	4.32	4.81	4.78	4.48	4.44	4.42
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03
9	0.12	0.16	0.18	0.19	0.21	0.23	0.25	0.26	0.27	0.25	0.25	0.28	0.30
10	5.70	6.21	6.37	6.49	6.82	7.17	7.61	7.97	8.47	8.72	8.31	8.36	8.37
PCE	7702.5	7851.3	7965.6	8103.5	8170.7	8211.7	8460.5	8610.9	8660.2	8589.0	8872.5	8901.3	8841.1

ID 2	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.87	1.97	1.89	1.94	2.08	2.17	2.17	2.26	2.33	2.58	2.51	2.52	2.45
2	0.08	0.08	0.08	0.08	0.10	0.15	0.13	0.14	0.17	0.21	0.22	0.24	0.32
3	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
4	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
5	3.36	3.55	3.41	3.50	3.94	3.59	4.02	4.36	4.68	5.28	5.35	5.48	5.64
6	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.02	0.04	0.13	0.08	0.14	0.17
7	0.42	0.45	0.40	0.38	0.35	0.33	0.31	0.30	0.26	0.28	0.28	0.28	0.12
8	0.25	0.22	0.17	0.18	0.19	0.18	0.16	0.15	0.18	0.27	0.27	0.21	0.21
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.07	6.36	6.05	6.20	6.78	6.55	6.92	7.30	7.74	8.24	8.23	8.97	9.02
PCE	14743.9	14776.9	14951.4	14863.0	14979.8	15200.2	15205.1	15108.9	14864.3	12621.0	12651.5	12778.8	12681.6

ID 3	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.16	2.26	2.26	2.13	2.28	2.33	2.26	2.31	2.30	2.51	2.37	2.32	2.25
2	0.67	0.70	0.70	0.67	0.72	0.81	0.78	0.73	0.83	0.67	0.67	0.68	0.70
3	0.07	0.07	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
4	0.56	0.73	0.82	0.84	0.96	1.00	1.08	1.03	1.09	0.53	0.40	0.55	0.67
5	3.47	3.66	3.59	3.68	3.73	3.98	4.28	4.40	4.81	4.78	4.45	4.32	4.25
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
9	0.15	0.19	0.21	0.21	0.23	0.25	0.26	0.26	0.27	0.25	0.25	0.28	0.29
10	7.11	7.65	7.67	7.62	8.02	8.45	8.75	8.82	9.38	8.81	8.24	8.24	8.24
PCE	2304.3	2361.9	2435.9	2603.0	2698.4	2805.2	2940.3	3164.6	3283.8	4997.0	5324.6	5575.1	5524.8

ID 4	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.97	1.98	1.96	1.87	2.06	2.08	2.03	2.27	2.42	2.50	2.42	2.57	2.52
2	0.13	0.13	0.14	0.15	0.19	0.21	0.24	0.23	0.24	0.25	0.24	0.24	0.25
3	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.71	2.77	2.71	2.78	2.87	3.00	2.99	3.16	3.30	3.51	3.37	3.75	3.68
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	4.88	4.95	4.86	4.86	5.17	5.35	5.22	5.73	6.52	6.33	6.28	6.64	6.52
PCE	18403.5	19483.1	20488.5	20643.3	20756.9	20355.1	22071.0	22204.5	22160.8	22753.0	23168.1	22865.3	22807.0

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Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued
(kilograms per $100 expenditure)

ID 5

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.76	1.88	1.92	1.84	2.07	2.12	2.09	2.20	2.27	2.46	2.39	2.47	2.54
2	0.12	0.13	0.13	0.15	0.18	0.22	0.25	0.23	0.22	0.25	0.24	0.24	0.25
3	0.07	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.07	0.07	0.05	0.07	0.05
4	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.34	2.63	2.67	2.72	2.88	3.06	2.91	3.04	3.58	3.51	3.54	3.59	3.69
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	4.29	4.73	4.79	4.78	5.19	5.45	5.27	5.54	6.15	6.29	6.23	6.37	6.56
PCE	411.3	428.7	438.8	447.6	450.8	483.9	552.2	569.4	554.3	538.0	530.5	532.6	525.4

ID 6

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.47	2.35	2.40	2.05	2.33	2.36	2.13	2.45	2.51	2.51	2.44	2.52	2.33
2	0.16	0.16	0.17	0.17	0.21	0.24	0.25	0.25	0.25	0.24	0.24	0.24	0.23
3	0.08	0.07	0.07	0.06	0.07	0.07	0.06	0.07	0.07	0.06	0.06	0.06	0.06
4	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	3.39	3.28	3.32	3.03	3.24	3.39	3.39	3.03	3.41	3.95	3.51	3.60	3.67
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.10	5.89	5.96	5.31	5.86	6.06	5.48	6.18	6.78	6.33	6.33	6.50	6.01
PCE	2324.1	2437.3	2480.8	2596.9	2592.2	2742.0	3037.7	3055.3	3185.6	3171.0	3217.3	3283.5	3396.7

ID 7

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.79	1.78	1.90	1.77	1.96	2.13	2.23	2.37	2.35	2.50	2.59	2.56	2.50
2	0.40	0.43	0.47	0.52	0.55	0.68	0.72	0.74	0.89	0.80	0.85	0.92	0.94
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.67	2.70	2.81	2.85	2.94	3.32	3.42	3.60	3.92	3.75	4.05	3.91	3.79
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	4.86	4.90	5.18	5.14	5.44	6.13	6.37	6.71	7.17	7.05	7.49	7.40	7.23
PCE	9297.5	9656.2	9581.6	9883.6	10212.9	9723.0	9818.6	9897.9	9780.3	9921.0	9759.8	9943.3	10267.4

ID 8

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.67	1.77	1.82	1.71	1.80	1.84	1.85	2.03	2.01	2.15	2.04	2.15	2.12
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.99	2.07	2.06	2.04	2.07	2.17	2.09	2.11	2.49	2.40	2.29	2.27	2.12
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	6.04	6.41	5.91	5.89	6.03	5.77	6.07	6.16	6.38	6.53	6.89	6.97	7.04
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	9.70	10.25	9.79	9.64	9.91	9.78	10.01	10.30	10.88	11.48	11.23	11.39	11.28
PCE	5180.8	5340.1	5514.1	5813.7	5900.3	5968.2	6312.9	6576.4	6673.1	6969.0	7175.5	7122.9	7060.9

Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued

(kilograms per $100 expenditure)

ID 9	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	23.48	25.23	27.22	25.25	24.40	24.39	25.09	24.57	21.84	23.40	23.76	20.77	22.11
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	23.48	25.23	27.22	25.25	24.40	24.39	25.09	24.57	21.84	23.40	23.76	20.77	22.11
PCE	669.9	681.4	660.1	714.6	713.4	772.2	808.8	839.3	921.1	938.0	949.9	1297.6	1288.8

ID 10	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.74	2.80	2.62	2.77	2.73	2.73	2.70	2.66	2.52	2.72	2.61	2.90	2.69
4	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04
5	1.96	2.06	2.02	1.99	2.03	2.10	2.05	2.09	2.48	2.33	2.33	2.33	2.20
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	6.82	7.61	9.83	12.65	14.13	16.08	17.40	18.48	19.78	22.54	23.09	26.01	27.36
8	13.41	14.44	14.35	14.40	13.60	13.55	12.39	12.38	12.97	11.09	12.82	11.49	13.16
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.02	2.74	2.60	2.71
10	24.93	26.91	28.81	31.82	32.49	34.49	34.57	35.64	37.79	40.73	43.63	45.37	48.16
PCE	5552.4	5662.0	5482.9	5442.4	5571.6	5702.4	5908.2	6106.4	6244.1	6137.0	6151.8	6226.8	6279.2

ID 11	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.59	0.66	0.71	0.70	0.75	0.79	0.83	0.92	0.93	1.07	1.08	1.13	1.13
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.04	1.11	1.02	1.07	1.07	1.12	1.14	1.13	1.09	1.19	1.18	1.33	1.28
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.47	1.59	1.58	1.61	1.64	1.79	1.81	1.84	2.22	2.21	2.26	2.27	2.17
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	23.46	24.97	25.57	24.70	30.06	35.21	38.95	38.08	45.21	60.24	67.46	82.97	102.88
8	1.23	1.60	2.40	3.71	4.88	5.83	7.82	9.97	13.41	17.39	22.35	21.69	22.51
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	1.78	2.03	3.03
10	27.79	29.93	31.29	31.78	38.40	44.74	50.55	51.95	62.86	82.75	96.11	111.43	133.00
PCE	2713.9	2778.2	2788.2	2756.8	2823.5	2782.8	2722.0	3029.6	3151.8	3032.0	3044.0	3100.1	3148.7

ID 12	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.94	0.83	0.86	0.81	0.81	0.80	0.97	1.08	1.04	1.07	0.99	0.99	1.16
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.08	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.06	0.07
4	0.04	0.04	0.04	0.04	0.05	0.04	0.05	0.05	0.06	0.08	0.07	0.06	0.06
5	3.33	3.00	2.92	2.90	2.83	2.96	3.47	3.61	3.90	3.52	3.44	3.33	3.81
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.13	0.08	0.13	0.19
7	24.18	21.73	21.56	21.40	21.16	20.28	25.45	27.13	25.53	27.03	25.17	25.81	30.67
8	7.44	7.39	6.95	7.25	6.88	6.18	5.86	6.35	6.00	6.02	5.97	5.35	5.36
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	36.01	33.06	32.38	32.45	31.79	30.32	35.87	38.31	36.63	37.50	35.72	35.74	41.33
PCE	2546.8	2712.5	2810.6	2893.8	2941.6	3033.1	2840.0	2670.7	2684.7	2847.0	2885.6	3029.3	2762.7

Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued
(kilograms per $100 expenditure)

ID 13	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.09	2.25	2.22	1.88	2.02	2.11	2.39	2.36	2.13	2.32	2.56	2.77	2.79
2	1.42	1.48	1.46	1.32	1.35	1.40	1.83	1.59	1.60	1.84	1.89	2.17	2.25
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.17	0.18	0.16	0.15	0.14	0.15	0.17	0.20	0.16	0.23	0.21	0.25	0.23
5	3.11	3.43	3.29	3.03	3.04	3.30	3.60	3.23	3.55	3.75	4.00	4.22	4.15
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.80	7.34	7.13	6.37	6.54	6.97	7.95	7.37	7.43	8.13	8.67	9.01	9.01
PCE	2356.2	2375.9	2524.3	2934.5	3035.1	3034.4	2762.9	2888.7	3332.2	3087.0	2959.3	2810.7	2840.2

ID 14	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.59	1.69	1.62	1.59	1.64	1.72	1.66	1.67	2.06	1.98	1.96	1.85	1.82
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	10.07	11.19	11.06	10.88	11.70	11.87	11.94	12.35	12.43	14.57	14.35	14.03	14.85
8	45.69	45.43	44.49	43.85	46.26	38.83	39.19	38.16	39.32	39.11	41.66	36.51	36.59
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.63	0.63	0.56
10	57.42	58.38	57.23	56.38	59.66	52.48	52.85	52.25	53.94	56.22	58.66	53.47	54.29
PCE	5004.4	5062.1	5272.5	5569.8	5489.3	5718.4	5685.2	5921.5	5790.4	6073.0	6091.7	6260.5	6147.8

ID 15	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.57	1.66	1.71	1.63	1.82	1.90	1.90	2.01	2.04	2.24	2.10	2.12	2.09
2	0.17	0.18	0.19	0.19	0.20	0.24	0.25	0.24	0.29	0.41	0.39	0.48	0.48
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.69	1.78	1.77	1.77	1.83	1.91	1.85	1.89	2.30	2.21	2.12	1.99	1.99
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	3.44	3.63	3.67	3.60	3.85	4.05	4.00	4.14	4.63	4.86	4.62	4.57	4.56
PCE	1972.8	1968.4	1983.9	2009.0	2028.6	2078.2	2147.0	2216.4	2186.3	2171.0	2230.1	2261.4	2217.6

ID 16	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.92	1.00	0.96	1.02	1.05	1.03	1.01	1.01	0.98	0.95	0.93	0.92	0.92
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.50	0.53	0.51	0.53	0.52	0.52	0.50	0.49	0.48	0.45	0.43	0.45	0.41
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.18	0.24	0.35
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	28.95	29.22	29.65	28.82	31.19	28.06	26.93	26.58	25.89	28.09	28.72	24.41	24.92
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
10	30.37	30.76	31.12	30.38	32.76	29.60	28.45	28.08	27.36	29.64	30.26	26.03	26.62
PCE	542.4	560.4	574.7	596.1	622.9	650.5	683.0	735.5	794.5	849.0	904.8	970.7	1031.5

Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued

(kilograms per $100 expenditure)

ID 17	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.23	1.16	1.16	1.09	1.13	1.13	1.11	1.05	1.02	1.09	1.05	1.05	1.05
2	0.24	0.23	0.22	0.21	0.22	0.21	C.21	0.27	0.29	0.28	0.30	0.32	0.29
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.10	0.12	0.10	0.12	0.11	0.11	0.10	0.11	0.11	0.09	0.08	0.09	0.09
5	2.21	1.47	1.15	1.01	1.02	0.94	0.93	0.87	1.30	1.28	1.31	1.35	1.28
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	3.78	2.98	2.63	2.42	2.47	2.38	2.36	2.30	2.71	2.74	2.75	2.81	2.71
PCE	7519.4	7952.1	8192.3	8483.0	8571.3	8837.6	8751.3	8992.3	9201.7	9293.0	9132.3	8946.8	9094.0

ID 18	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.23	1.26	1.27	1.23	1.32	1.40	1.42	1.50	1.51	1.57	1.57	1.57	1.52
2	0.42	0.47	0.39	0.41	0.29	0.75	C.17	0.19	0.25	0.44	C.56	0.56	0.68
3	0.06	0.06	0.06	0.06	0.06	0.06	C.06	0.06	0.06	0.06	0.06	0.06	0.06
4	0.07	0.09	0.08	0.08	0.08	0.08	0.11	0.14	0.15	0.37	0.32	0.40	0.30
5	2.77	3.06	2.99	3.13	3.15	3.45	3.57	3.77	4.21	3.95	3.99	3.93	3.81
6	0.16	0.23	0.45	0.51	0.62	0.76	1.03	0.56	0.78	1.62	1.57	1.78	1.94
7	13.97	14.19	14.15	13.60	15.03	15.06	15.69	16.95	17.07	18.29	17.74	18.64	18.99
8	1.79	1.65	1.36	1.52	1.51	1.24	1.29	1.19	1.09	1.26	1.09	0.96	1.01
9	0.05	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.10	0.09	0.10	0.11	0.11
10	20.53	21.07	20.80	20.61	22.14	22.89	23.43	24.44	25.22	27.64	26.98	28.00	28.42
PCE	5564.8	5895.8	6168.9	6333.6	6530.4	6612.7	6530.7	6686.3	6751.9	6521.0	6565.4	6646.3	6789.1

ID 19	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.75	2.76	2.61	2.53	2.57	2.57	2.47	2.43	2.34	2.38	2.21	2.15	2.14
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.02	0.03	0.05	0.06	0.06	0.05	0.11	0.06	0.06	0.07	0.09	0.11
5	33.15	34.92	33.88	35.53	34.69	35.84	34.92	36.48	24.83	28.30	31.98	31.65	29.93
6	0.13	0.18	0.33	1.31	1.74	2.02	2.23	2.38	2.49	2.73	2.89	3.05	3.21
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	36.04	37.88	36.86	39.42	39.07	40.49	39.66	41.40	31.78	33.53	37.14	36.94	34.49
PCE	1182.9	1253.3	1322.7	1355.2	1406.1	1455.5	1511.9	1560.0	1626.5	1593.0	1630.1	1636.4	1654.7

ID 20	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.94	1.96	1.83	1.80	1.33	1.88	1.83	1.79	1.68	1.76	1.66	1.64	1.63
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.51	0.54	0.52	0.54	0.38	0.53	0.49	0.49	0.49	0.45	0.45	0.48	0.44
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.09	2.20	2.12	2.10	1.79	2.55	2.57	2.72	1.71	1.71	1.73	1.76	1.68
6	0.11	0.13	0.24	0.94	0.90	1.48	1.66	1.74	1.79	2.01	2.17	2.32	2.44
7	3.40	3.85	3.71	3.34	3.40	2.06	1.62	1.62	2.39	1.46	0.99	1.79	1.04
8	0.05	0.39	0.73	1.28	0.91	1.25	2.43	2.62	3.06	2.59	2.64	2.86	2.94
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	8.10	9.08	9.15	9.69	8.70	9.74	10.60	10.98	11.12	10.37	9.64	10.86	10.18
PCE	677.1	684.2	710.0	739.6	1111.9	811.8	836.8	851.0	869.1	956.0	942.5	937.6	946.2

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Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued
(kilograms per $100 expenditure)

ID 21

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.49	0.54	0.49	0.54	0.54	0.54	0.50	0.51	0.46	0.46	0.43	0.45	0.42
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	13.40	13.67	12.68	12.58	8.36	9.95	8.26	6.38	8.78	6.69	3.37	3.40	0.00
8	2.69	3.48	4.15	4.01	3.10	2.86	5.14	5.39	6.10	5.59	6.11	6.73	6.84
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	16.59	17.68	17.31	17.13	12.00	13.35	13.90	12.27	15.34	12.74	9.91	10.63	10.67
PCE	147.3	168.6	166.3	167.6	169.5	168.1	164.2	161.6	157.7	157.0	148.5	146.9	149.9

ID 22

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.75	0.79	0.70	0.69	0.72	0.74	0.73	0.73	0.72	0.76	0.72	0.71	0.65
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.17	0.18	0.15	0.16	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.15	0.13
5	11.01	11.47	10.91	11.09	11.30	10.13	10.15	8.36	5.92	5.94	6.83	6.61	5.42
6	0.04	0.05	0.09	0.36	0.49	0.59	0.66	0.71	0.76	0.88	0.95	1.01	0.97
7	3.91	4.31	3.44	3.25	2.42	2.41	2.26	1.82	0.65	1.34	1.35	1.32	1.04
8	0.46	0.62	0.58	0.53	0.49	0.78	1.03	1.37	1.40	1.28	1.47	1.49	1.35
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	16.34	17.42	15.87	16.09	15.59	14.82	14.99	13.15	9.60	10.35	11.47	11.30	9.55
PCE	1431.6	1529.8	1725.1	1821.1	1904.5	1940.9	1987.0	2075.4	2115.1	2083.0	2130.5	2167.0	2454.3

ID 23

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.90	2.94	2.83	2.71	2.73	2.67	2.58	2.52	2.40	2.38	2.19	2.18	2.09
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.58	0.61	0.57	0.59	0.57	0.55	0.53	0.51	0.49	0.45	0.43	0.44	0.41
4	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.03	0.02	0.03	0.02	0.03	0.03
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.14	0.19	0.13	0.13	0.17	0.13	0.13	0.23	0.23	0.26	0.30	0.36	0.30
7	23.69	23.67	23.06	27.92	23.66	19.60	19.21	16.05	20.80	19.19	13.76	15.10	13.90
8	0.02	0.03	0.03	0.05	0.09	0.10	0.07	0.08	0.08	0.08	0.08	0.09	0.08
9	0.23	0.25	0.25	0.29	0.30	0.35	0.34	0.30	0.30	0.34	0.29	0.23	0.27
10	27.58	27.70	26.89	31.70	27.52	23.41	22.87	19.73	24.32	22.73	17.06	18.36	17.09
PCE	959.1	1001.9	1043.1	1096.9	1169.1	1211.3	1235.8	1305.4	1381.1	1440.0	1536.9	1584.4	1603.3

ID 24

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.70	2.68	2.54	2.48	2.52	2.47	2.37	2.35	2.36	2.38	2.21	2.24	2.17
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.53	0.57	0.52	0.54	0.51	0.51	0.49	0.47	0.48	0.45	0.43	0.46	0.42
4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02	0.02	0.03	0.03	0.04
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.13	0.17	0.12	0.12	0.16	0.12	0.12	0.21	0.23	0.26	0.30	0.31	0.31
7	21.57	21.39	19.50	25.27	22.02	18.09	18.00	14.84	21.48	18.38	13.92	15.37	14.22
8	0.02	0.03	0.04	0.04	0.08	0.09	0.07	0.07	0.08	0.07	0.08	0.09	0.09
9	1.41	1.41	1.45	1.67	1.51	1.77	1.66	1.52	1.50	1.30	1.30	1.39	1.31
10	26.37	26.27	24.19	30.13	26.81	23.06	22.72	19.50	26.15	22.88	18.27	19.88	18.56
PCE	396.9	415.8	439.0	469.1	478.6	498.9	535.6	555.2	580.1	742.0	669.3	673.6	693.5

Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued

(kilograms per $100 expenditure)

ID 25

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.54	2.63	2.52	2.48	2.69	2.71	2.60	2.31	2.05	2.39	2.33	2.38	2.42
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
3	0.50	0.54	0.52	0.54	0.55	0.56	0.53	0.47	0.43	0.44	0.45	0.49	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.12	0.16	0.85	0.80	1.11	0.92	1.00	1.03	1.06	1.23	1.61	2.17	2.06
7	23.75	23.83	23.38	21.87	18.79	22.51	21.30	12.97	15.39	16.28	15.83	15.41	15.22
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.17	0.22	0.25	0.29	0.28	0.43	0.29	0.33	0.22	0.22	0.20	0.22	0.20
10	27.08	27.39	27.51	25.98	23.43	27.14	25.71	17.11	19.14	20.56	20.43	20.86	20.38
PCE	457.6	469.8	493.1	542.0	543.2	549.5	600.4	714.7	832.1	838.0	860.0	869.3	888.1

ID 26

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.16	3.09	2.92	2.84	2.85	2.81	2.73	2.60	2.35	2.39	2.21	2.27	2.20
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.62	0.65	0.60	0.61	0.58	0.58	0.56	0.53	0.49	0.44	0.43	0.47	0.42
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.16	0.20	0.98	0.92	1.19	0.96	1.04	1.15	1.22	1.23	1.52	1.73	1.88
7	29.00	28.25	26.52	24.80	20.10	23.57	23.60	14.19	17.05	16.01	14.73	14.98	13.79
8	1.89	1.49	2.30	2.80	4.08	4.24	3.40	4.68	3.91	3.74	3.75	3.57	3.75
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.14	25.02	23.82	22.65	23.42
10	34.83	33.67	33.32	31.98	28.80	32.16	25.60	23.14	25.02	23.82	22.65	23.42	22.03
PCE	465.6	478.0	496.8	531.1	589.8	652.5	837.4	943.7	1055.7	1092.0	1143.0	1122.9	1218.7

ID 27

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.82	2.82	2.70	2.63	2.67	2.62	2.53	2.49	2.38	2.38	2.23	2.14	2.07
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
3	0.58	0.60	0.55	0.57	0.56	0.55	0.51	0.50	0.50	0.45	0.43	0.45	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.14	0.18	0.90	0.86	1.11	0.90	0.97	1.10	1.23	1.23	1.53	1.64	1.76
7	25.57	25.57	24.46	22.81	20.18	20.18	19.98	13.74	13.74	17.37	15.96	14.26	14.63
8	1.71	2.40	2.33	2.74	2.49	2.55	2.94	2.43	2.57	2.22	2.23	2.06	1.96
9	0.19	0.15	0.12	0.10	0.08	0.08	0.07	0.07	0.06	22.28	20.72	21.25	19.57
10	31.01	31.72	31.05	29.71	27.09	27.09	19.98	27.39	20.33	24.10	22.28	20.72	21.25
PCE	251.3	270.5	296.2	317.7	342.7	363.4	373.5	400.0	438.5	526.0	552.7	585.6	625.2

ID 28

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.75	2.80	2.65	2.60	2.68	2.61	2.57	2.51	2.35	2.39	2.29	2.27	2.25
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
3	0.54	0.57	0.54	0.54	0.57	0.54	0.52	0.50	0.49	0.22	0.20	0.21	0.19
4	0.33	0.32	0.30	0.27	0.26	0.25	0.20	0.29	0.22	0.20	0.21	0.19	0.19
5	72.68	84.82	84.60	81.78	80.67	90.04	86.83	91.72	71.23	63.78	60.71	51.80	43.87
6	0.13	0.19	0.90	0.84	1.11	0.91	0.98	1.11	1.22	1.23	1.56	2.05	1.90
7	24.31	25.41	24.05	23.59	18.73	23.60	21.02	14.96	19.95	19.02	15.54	15.15	15.21
8	2.33	3.58	3.49	4.06	5.00	3.79	5.78	10.49	8.69	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	103.07	117.70	116.54	113.68	109.02	121.74	117.90	121.59	104.07	98.96	96.11	87.46	77.66
PCE	135.4	142.6	150.7	167.5	175.9	184.2	226.0	252.5	312.3	331.0	368.9	424.2	476.4

Table A-7. The quantity structure of packaging by consumer product, 1958-70--Continued

(kilograms per $100 expenditure)

ID 29	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.36	2.42	2.37	2.35	2.45	2.45	2.40	2.30	2.38	2.38	2.32	2.27	2.30
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.47	0.50	0.48	0.51	0.51	0.51	0.49	0.47	0.49	0.45	0.45	0.47	0.44
4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02	0.01	0.03	0.03	0.04
5	6.09	6.78	6.90	6.06	5.91	6.61	7.20	6.77	6.22	6.39	6.71	7.43	6.87
6	0.11	0.16	0.11	0.11	0.15	0.12	0.12	0.20	0.23	0.26	0.31	0.32	0.33
7	19.09	19.41	18.27	21.40	17.95	17.99	17.72	14.48	17.25	16.75	14.69	15.94	15.14
8	0.02	0.02	0.03	0.04	0.07	0.09	0.06	0.07	0.08	0.07	0.08	0.09	0.09
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	28.15	29.29	28.17	30.48	27.04	27.79	27.99	24.32	26.66	26.31	24.59	26.55	25.21
PCE	2380.6	2443.8	2614.2	2800.4	2807.5	2805.6	2777.2	3011.6	3129.9	2924.0	3000.0	3091.5	3160.8

ID 30	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.71	0.73	0.71	0.73	0.74	0.69	0.68	0.66	0.62	0.60	0.58	0.58	0.54
2	0.07	0.09	0.08	0.12	0.13	0.11	0.14	0.16	0.16	0.17	0.17	0.18	0.19
3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5	1.14	1.15	1.08	1.09	1.11	1.07	0.95	0.82	0.73	0.71	0.75	0.73	0.68
6	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.09	0.11	0.09	0.11	0.13	0.14
7	0.30	0.32	0.30	0.28	0.20	0.18	0.13	0.12	0.09	0.09	0.06	0.06	0.06
8	0.85	0.83	0.66	0.71	0.67	0.52	0.61	0.58	0.57	0.38	0.37	0.63	0.62
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
10	3.11	3.16	2.89	2.99	2.90	2.63	2.59	2.46	2.30	2.06	2.06	2.34	2.25
PCE	93579.8	103107.0	106243.7	104182.3	113565.6	121605.6	133580.3	146795.3	160568.9	160900.0	178750.5	186488.3	191036.7

Source: Research Triangle Institute

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Table A-8.   The quantity structure of packaging by consumer product, 1958-70

(thousand tonnes)

ID 1	58	59	60	61	62	63	64	65	66	67	68	69	70
1	139.44	149.51	155.77	152.77	169.65	177.63	182.35	195.68	199.40	214.92	210.92	212.38	206.57
2	64.18	73.07	81.15	84.41	83.37	77.93	85.78	84.82	83.33	87.59	90.77	96.62	100.56
3	4.54	4.63	4.26	4.54	4.90	4.99	4.99	5.17	5.26	5.08	5.17	5.26	5.17
4	2.72	3.27	2.81	3.18	3.27	3.81	3.18	3.72	3.54	7.00	7.26	6.17	7.98
5	216.19	242.49	247.39	263.90	276.97	303.91	344.74	372.04	416.68	410.79	397.63	395.54	390.91
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	2.27	1.91	1.72	2.09	1.91	2.00	2.18	2.81	2.18	2.54	2.72	2.72	2.72
9	9.58	12.69	14.20	15.02	17.40	18.82	20.87	22.04	23.22	21.05	22.59	25.22	26.31
10	438.91	487.57	507.31	525.91	557.46	589.09	644.07	686.30	733.61	748.96	737.05	743.90	740.23
PCE	7702.5	7851.3	7965.6	8103.5	8170.7	8211.7	8460.5	8610.9	8660.2	8589.0	8872.5	8901.3	8841.1

ID 2	58	59	60	61	62	63	64	65	66	67	68	69	70
1	275.24	290.58	282.41	288.94	311.44	329.40	329.49	341.11	346.10	325.23	317.16	322.60	311.26
2	11.70	11.66	11.93	11.84	15.15	23.09	20.41	21.27	25.22	27.08	28.40	30.84	40.82
3	8.71	8.80	8.16	8.44	8.80	8.98	8.71	8.71	8.89	7.44	7.62	7.80	7.62
4	4.35	4.99	4.63	4.26	4.17	4.45	4.63	4.90	4.63	4.54	4.99	4.54	5.44
5	495.60	524.54	510.48	520.91	590.77	546.32	611.54	658.17	695.91	666.25	677.41	700.36	715.05
6	0.64	0.73	1.86	3.40	4.58	5.08	5.94	2.45	5.31	16.69	10.75	18.19	22.09
7	62.57	65.87	59.28	55.98	52.68	50.14	47.51	44.64	38.07	34.98	35.83	35.70	14.61
8	36.83	31.93	26.06	27.31	27.74	27.53	24.51	22.12	26.63	33.54	34.39	26.62	26.67
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	895.65	939.09	904.81	921.09	1015.33	994.98	1052.75	1103.37	1150.75	1116.15	1116.54	1146.65	1143.57
PCE	14743.9	14776.9	14951.4	14863.0	14979.8	15200.2	15205.1	15108.9	14864.3	12621.0	12651.5	12778.8	12681.6

ID 3	58	59	60	61	62	63	64	65	66	67	68	69	70
1	49.81	53.34	55.07	55.43	61.60	65.23	66.59	73.12	75.57	125.28	126.19	129.28	124.20
2	15.33	16.56	17.10	17.42	19.37	22.59	22.86	23.22	27.17	33.25	35.88	38.15	38.74
3	1.63	1.63	1.54	1.63	1.81	1.81	1.81	1.91	2.00	2.90	3.08	3.18	3.08
4	12.88	17.24	20.05	21.77	25.95	28.03	31.66	32.48	35.83	26.31	21.14	30.75	36.92
5	80.01	86.55	87.45	95.89	100.61	111.77	125.92	139.16	157.94	239.01	237.14	240.95	235.06
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.82	0.73	0.64	0.73	0.73	0.73	0.82	1.09	0.82	1.45	1.63	1.63	1.63
9	3.42	4.54	5.02	5.45	6.31	6.92	7.62	8.26	8.80	12.25	13.52	15.33	15.88
10	163.90	180.58	166.86	198.32	216.38	237.08	257.28	279.24	308.13	440.45	438.59	459.27	455.50
PCE	2304.3	2361.9	2435.9	2603.0	2698.4	2805.2	2940.3	3164.6	3283.8	4997.0	5324.6	5575.1	5524.8

ID 4	58	59	60	61	62	63	64	65	66	67	68	69	70
1	362.70	385.74	400.80	386.56	427.65	423.93	448.79	505.13	535.88	569.90	560.83	588.05	575.04
2	23.72	26.08	28.17	31.80	38.42	42.73	52.75	51.08	52.84	55.84	54.48	55.84	56.38
3	11.70	11.88	10.98	11.43	12.34	11.98	12.34	13.43	14.24	13.43	13.79	14.52	14.33
4	0.36	0.36	0.36	0.36	0.36	0.45	0.64	0.73	0.54	0.64	0.64	0.64	0.64
5	498.87	539.60	555.48	573.08	595.30	610.27	637.22	702.44	841.79	799.55	826.19	858.30	839.61
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	897.36	963.67	995.79	1003.23	1074.08	1089.36	1151.73	1272.80	1045.30	1039.35	1455.92	1517.34	1486.40
PCE	18403.5	19483.1	20488.5	20643.3	20756.9	20355.1	22071.0	22204.5	22160.8	22753.0	23168.1	22865.3	22807.0

Table A-8. The quantity structure of packaging by consumer product, 1958-70--Continued
(thousand tonnes)

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ID 5	58	59	60	61	62	63	64	65	66	67	68	69	70
1	7.26	8.07	8.44	8.26	9.34	10.25	11.34	12.52	12.61	13.25	12.70	13.15	13.34
2	0.50	0.54	0.59	0.68	0.82	1.04	1.41	1.32	1.22	1.36	1.27	1.27	1.32
3	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.36	0.36	0.36	0.27	0.36	0.36
4	0.01	0.09	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02
5	9.62	11.29	11.70	12.16	12.97	14.79	16.06	17.33	19.87	18.27	18.72	19.14	19.41
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	17.65	20.28	21.01	21.38	23.41	26.36	29.09	31.54	34.07	33.86	33.04	33.95	34.45
PCE	411.3	428.7	438.8	447.6	450.8	483.9	552.2	569.4	554.3	538.0	530.5	532.6	525.4

ID 6	58	59	60	61	62	63	64	65	66	67	68	69	70
1	57.33	57.24	59.51	53.25	60.51	64.68	64.77	74.93	80.11	79.56	78.47	82.65	79.02
2	3.76	3.90	4.22	4.40	5.44	6.53	7.62	7.58	7.89	7.76	7.58	7.86	7.76
3	1.81	1.72	1.63	1.54	1.72	1.81	1.81	2.00	2.18	1.91	1.91	2.09	2.00
4	0.08	0.82	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.09	0.08	0.08	0.08
5	78.84	79.92	82.46	78.74	84.10	93.08	92.08	104.15	125.83	111.40	115.67	120.57	115.21
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	141.83	143.61	147.91	138.02	151.86	166.19	166.37	188.74	216.09	200.72	203.70	213.27	204.07
PCE	2324.1	2437.3	2480.8	2596.9	2592.2	2742.0	3037.7	3055.3	3185.6	3171.0	3217.3	3283.5	3396.7

ID 7	58	59	60	61	62	63	64	65	66	67	68	69	70
1	166.38	171.46	181.71	174.64	199.67	206.84	219.36	234.78	229.79	248.30	253.74	255.01	256.19
2	37.29	41.17	45.22	51.48	55.79	65.86	70.26	73.44	87.50	79.33	83.24	91.04	96.12
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	248.39	260.73	269.71	281.59	300.56	322.96	335.94	356.35	383.84	371.99	396.90	389.28	389.64
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	452.06	473.36	496.65	507.71	556.02	595.67	625.56	664.57	701.13	699.62	733.88	735.33	741.95
PCE	9297.5	9656.2	9581.6	9883.6	10212.9	9723.0	9818.6	9897.9	9780.3	9921.0	9759.8	9943.3	10267.4

ID 8	58	59	60	61	62	63	64	65	66	67	68	69	70
1	86.55	94.44	100.34	99.52	106.41	110.04	116.48	133.27	134.17	149.78	146.69	153.41	149.78
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	103.06	110.32	113.58	118.48	122.11	129.46	131.82	138.62	166.20	167.07	164.66	161.57	149.60
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	312.86	342.51	326.04	342.51	355.92	344.35	383.42	405.20	425.73	482.65	494.48	496.23	496.75
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	502.46	547.26	539.96	560.51	584.44	583.85	631.72	677.09	726.10	799.50	805.83	811.21	796.13
PCE	5180.8	5340.1	5514.1	5813.7	5900.3	5968.2	6312.9	6576.4	6673.1	6969.0	7175.5	7122.9	7060.9

Table A-8.   The quantity structure of packaging by consumer product, 1958-70--Continued

(thousand tonnes)

ID 9	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	225.72	269.46	284.93
7	157.26	171.95	179.69	180.46	174.09	188.31	202.96	206.24	201.13	219.45	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	157.26	171.95	179.69	180.46	174.09	188.31	202.96	206.24	201.13	219.45	225.72	269.46	284.93
PCE	669.9	681.4	660.1	714.6	713.4	772.2	808.8	839.3	921.1	938.0	949.9	1297.6	1288.8

ID 10	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	152.23	158.58	143.61	150.96	152.32	155.40	159.30	162.57	157.58	167.20	160.48	180.62	169.10
4	0.00	0.00	0.00	0.00	0.00	2.27	1.63	1.81	2.00	2.00	2.63	2.45	2.81
5	108.95	116.58	110.68	108.32	112.95	119.48	121.02	127.55	154.77	142.70	143.16	145.24	138.08
6	0.00	0.00	0.00	0.00	0.00	0.00	1028.30	1128.52	1235.39	1383.03	1420.25	1619.78	1717.91
7	378.72	431.13	538.91	688.60	787.41	917.21	732.20	755.77	809.68	680.57	788.87	715.27	826.31
8	744.36	817.48	786.56	783.89	757.65	772.47	0.00	0.00	0.00	124.03	168.57	162.14	169.88
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1384.26	1523.76	1579.76	1731.77	1810.32	1966.83	2042.46	2176.23	2359.41	2499.52	2683.96	2825.01	3024.09
PCE	5552.4	5662.0	5482.9	5442.4	5571.6	5702.4	5908.2	6106.4	6244.1	6137.0	6151.8	6226.8	6279.2

ID 11	58	59	60	61	62	63	64	65	66	67	68	69	70
1	16.06	18.33	19.78	19.41	21.05	21.95	22.68	27.94	29.21	32.30	32.75	35.56	35.65
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.11	34.38	36.11	35.83	41.91	40.19
3	28.30	30.84	28.30	29.39	30.12	31.12	31.03	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	39.83	44.09	44.18	44.27	46.36	49.71	49.17	55.79	69.95	66.97	68.68	71.22	68.40
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1153.78	1424.94	1826.60	2053.61	2605.29	3239.45
7	636.81	693.59	713.04	680.89	848.74	979.96	1060.23	302.16	422.60	527.13	680.46	681.13	708.93
8	33.29	44.54	67.00	102.20	137.86	162.37	212.85	0.00	0.00	19.94	54.26	63.74	95.30
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	754.29	831.39	872.30	876.17	1084.12	1245.12	1375.96	1573.78	1981.08	2509.04	2925.59	3498.85	4187.92
PCE	2713.9	2778.2	2788.2	2756.8	2823.5	2782.8	2722.0	3029.6	3151.8	3032.0	3044.0	3140.1	3148.7

ID 12	58	59	60	61	62	63	64	65	66	67	68	69	70
1	23.95	22.59	24.04	23.32	23.95	24.31	27.49	28.94	27.85	30.39	28.67	30.12	32.02
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.00	1.81	1.63	1.72	1.72	1.72	1.91	1.81	1.81	1.72	1.63	1.72	1.81
4	1.09	1.00	1.00	1.09	1.36	1.36	1.27	1.54	2.27	1.91	1.81	1.72	1.72
5	84.73	81.29	82.10	84.01	83.37	89.72	98.61	96.53	104.69	100.07	95.52	100.97	105.33
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.04	3.76	2.36	3.99	5.22
7	615.85	589.50	605.98	619.14	622.44	615.15	722.74	724.56	685.31	769.43	727.39	781.84	847.40
8	189.60	200.49	195.43	209.66	202.29	187.31	166.50	169.50	161.11	171.27	172.48	162.20	148.18
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
10	917.22	896.68	910.18	938.93	935.14	919.58	1018.61	1023.21	983.36	1078.92	1033.95	1062.66	1141.74
PCE	2546.8	2712.5	2810.6	2893.8	2941.6	3033.1	2840.0	2670.7	2684.7	2847.0	2859.4	3029.3	2762.7

Table A-8. The quantity structure of packaging by consumer product, 1958-70--Continued

(thousand tonnes)

ID 13	58	59	60	61	62	63	64	65	66	67	68	69	70
1	49.26	53.43	55.97	55.07	61.24	64.14	64.86	68.13	70.94	71.67	75.75	77.75	79.20
2	33.52	35.24	36.97	38.74	40.91	42.55	50.53	45.81	53.16	56.75	55.88	60.96	63.91
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	4.08	4.26	4.08	4.26	4.17	4.05	4.81	5.72	5.17	7.05	6.35	7.17	6.44
5	73.39	81.38	83.01	88.81	92.26	100.25	95.43	93.35	118.39	115.63	118.48	118.57	117.75
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	160.26	174.32	180.03	186.88	198.59	211.38	219.63	213.01	247.67	251.09	256.47	264.45	267.31
PCE	2356.2	2375.9	2524.3	2934.5	3035.1	3034.4	2762.9	2888.7	3332.2	3087.0	2959.3	2810.7	2840.2

ID 14	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	3.27	3.27	2.99	3.36	3.45	3.54	3.36	3.54	3.54	3.63	3.72	3.72	3.72
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	79.65	85.37	85.37	88.72	89.99	98.52	94.26	99.16	119.21	120.19	119.30	115.58	112.13
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	503.88	566.46	582.91	605.96	642.19	678.68	672.62	731.42	719.92	884.85	874.30	903.22	913.15
8	2286.60	2299.93	2346.00	2442.36	2539.40	2220.29	2228.13	2259.58	2280.52	2375.31	2537.56	2285.84	2249.46
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.27	38.52	39.21	59.15
10	2873.39	2955.03	3017.27	3140.40	3275.03	3001.03	3004.36	3093.69	3123.18	3414.25	3573.40	3347.57	3337.91
PCE	5004.4	5062.1	5272.5	5569.8	5489.3	5718.4	5685.2	5921.5	5790.4	6073.0	6091.7	6260.5	6147.8

ID 15	58	59	60	61	62	63	64	65	66	67	68	69	70
1	31.03	32.75	33.93	32.84	36.83	39.46	40.73	44.54	44.63	48.72	46.90	47.99	46.27
2	3.36	3.63	3.72	3.86	4.08	4.99	5.31	5.39	6.31	8.85	8.80	10.34	10.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	33.38	35.02	35.11	35.56	37.10	39.74	39.74	41.91	50.35	47.95	47.27	45.06	44.09
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	67.77	71.40	72.76	72.26	78.02	84.19	85.78	91.81	101.29	105.52	102.97	103.33	101.06
PCE	1972.8	1968.4	1983.9	2009.0	2028.6	2078.2	2147.0	2216.4	2186.3	2171.0	2230.1	2261.4	2217.6

ID 16	58	59	60	61	62	63	64	65	66	67	68	69	70
1	4.99	5.62	5.53	6.08	6.53	6.71	6.89	7.44	7.80	8.07	8.44	8.89	9.53
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.72	2.99	2.90	3.18	3.27	3.36	3.45	3.63	3.81	3.81	3.90	4.35	4.26
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	1.63	2.36	3.63
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	157.04	163.75	170.40	171.82	194.28	182.50	183.94	195.48	205.73	238.52	259.84	236.98	257.07
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11
10	164.75	172.37	178.84	181.07	204.08	192.57	194.28	206.55	217.34	251.67	273.81	252.69	274.60
PCE	542.4	560.4	574.7	596.1	622.9	650.5	683.0	735.5	794.5	849.0	904.8	970.7	1031.5

Table A-8. The quantity structure of packaging by consumer product, 1958-70--Continued
(thousand tonnes)

ID 17

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	92.81	92.26	94.62	92.08	96.80	99.79	97.34	94.80	93.53	101.11	96.16	94.26	95.89
2	18.14	18.14	18.14	18.14	18.60	18.14	18.37	23.90	26.85	25.86	27.76	28.58	26.22
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	7.53	9.62	8.44	9.89	9.07	9.43	8.89	9.62	10.07	8.53	7.62	7.62	7.89
5	166.11	117.03	94.17	85.46	87.27	82.83	81.56	78.65	119.30	118.24	119.48	121.20	116.12
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	284.59	237.05	215.37	205.57	211.74	210.20	206.16	206.98	249.75	254.33	251.02	251.66	248.12
PCE	7519.4	7952.1	8192.3	8483.0	8571.3	8837.6	8751.3	8992.3	9201.7	9293.0	9132.3	8946.8	9094.0

ID 18

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	68.40	74.21	78.20	77.66	85.91	92.81	92.63	100.15	102.15	102.15	102.79	104.42	103.06
2	23.60	27.59	24.10	26.18	19.21	45.88	11.41	12.41	16.76	28.44	37.00	37.19	46.03
3	3.54	3.81	3.45	3.72	3.90	4.08	3.99	4.08	4.17	3.95	3.90	3.95	3.95
4	4.13	5.44	5.18	5.35	5.26	5.53	7.17	9.48	9.80	24.40	20.77	26.58	20.50
5	154.04	180.26	184.52	198.04	206.02	227.98	232.97	251.75	283.95	257.65	261.64	261.09	258.91
6	9.18	13.32	27.62	32.48	40.64	50.12	67.31	37.29	52.48	105.55	102.92	117.98	131.73
7	777.22	836.50	872.73	861.53	981.41	995.95	1024.73	1133.21	1152.57	1192.64	1164.53	1238.81	1289.36
8	99.79	97.34	83.59	96.02	98.46	81.85	84.13	79.48	73.88	81.92	71.40	64.02	68.57
9	2.59	3.56	4.01	4.30	5.04	5.04	5.46	6.08	6.53	6.89	6.35	7.13	7.50
10	1142.50	1242.04	1263.41	1305.28	1445.86	1513.66	1530.41	1634.38	1702.66	1802.38	1771.30	1861.21	1929.71
PCE	5564.8	5895.8	6168.9	6333.6	6530.4	6612.7	6530.7	6686.3	6751.9	6521.0	6565.4	6646.3	6789.1

ID 19

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	32.57	34.56	34.56	34.29	36.20	37.38	37.29	37.92	38.01	37.51	36.02	35.20	35.47
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.27	0.45	0.73	0.91	0.91	0.73	1.72	1.00	1.00	1.09	1.45	1.81
5	392.18	437.72	448.07	481.45	487.80	521.64	527.90	569.09	437.36	451.79	521.28	517.83	480.36
6	1.59	2.22	4.40	17.78	24.49	29.35	33.66	37.06	40.46	43.50	47.08	49.94	53.12
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	426.34	474.78	487.48	534.25	549.40	589.27	599.57	645.79	516.83	534.20	605.46	604.42	570.76
PCE	1182.9	1253.3	1322.7	1355.2	1406.1	1455.5	1511.9	1560.0	1626.5	1593.0	1630.1	1636.4	1654.7

ID 20

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	13.15	13.43	12.97	13.34	14.79	15.24	15.33	15.24	14.61	16.80	15.60	15.33	15.42
2	0.00	0.00	0.00	0.00	4.17	4.26	4.08	4.17	4.26	4.17	4.26	4.54	4.17
3	3.45	3.72	3.72	3.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.13	14.88	16.33	16.33	16.51	15.88
5	14.15	15.06	15.06	15.51	19.87	20.68	21.50	14.83	15.56	19.23	20.46	21.77	23.09
6	0.73	0.86	1.68	6.94	9.98	12.02	13.88	13.75	20.76	14.00	9.32	16.78	9.87
7	23.05	26.34	26.34	24.69	37.77	16.72	13.57	20.32	22.32	26.58	28.58	24.86	27.85
8	0.32	2.69	5.17	9.43	10.16	10.16	10.16	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	54.85	62.10	64.94	73.91	96.74	79.09	88.69	93.45	96.65	99.11	90.83	101.78	96.28
PCE	677.1	684.2	710.0	739.6	1111.9	811.8	836.8	851.0	865.1	956.0	942.5	937.6	946.2

Table A-8.   The quantity structure of packaging by consumer product, 1958-70--Continued

(thousand tonnes)

ID 21

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.73	0.91	0.82	0.91	0.91	0.91	0.82	0.82	0.73	0.73	0.64	0.73	0.64
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	19.75	23.05	21.08	21.08	14.17	16.72	13.57	10.31	13.85	10.50	5.01	5.00	5.11
8	3.96	5.86	6.89	6.71	5.26	4.81	2.44	8.71	9.62	8.77	5.07	9.89	10.25
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	24.44	29.92	28.79	28.70	20.34	22.44	22.82	19.84	24.19	20.00	14.72	15.61	16.00
PCE	147.3	168.6	166.3	167.6	169.5	168.1	164.2	161.6	157.7	157.0	148.5	146.9	149.9

ID 22

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	10.80	12.07	12.07	12.61	13.79	14.42	14.52	15.15	15.15	15.88	15.42	15.42	15.88
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.45	2.72	2.63	2.99	3.08	3.18	3.18	3.27	3.27	3.18	3.18	3.36	3.27
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	157.58	175.54	188.24	201.94	215.19	196.68	201.67	173.46	125.19	123.65	145.51	143.25	133.00
6	0.54	0.77	1.54	6.58	9.39	11.39	13.11	14.79	16.06	18.23	20.14	21.86	23.77
7	55.99	65.86	59.27	59.27	46.11	46.81	44.82	37.78	13.84	27.98	28.67	28.56	25.57
8	6.57	9.53	10.07	9.62	9.34	15.15	20.50	28.40	29.57	26.65	31.39	32.39	33.02
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	233.93	266.49	273.82	293.01	296.91	287.63	297.79	272.84	203.08	215.57	244.31	244.84	234.50
PCE	1431.6	1529.8	1725.1	1821.1	1904.5	1940.9	1987.0	2075.4	2115.1	2083.0	2130.5	2167.0	2454.3

ID 23

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	27.85	29.48	29.48	29.76	31.93	32.30	31.84	32.93	33.11	34.29	33.66	34.07	33.57
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	5.53	6.08	5.99	6.44	6.62	6.71	6.53	6.71	6.80	6.44	6.62	6.99	6.53
4	0.18	0.18	0.09	0.09	0.09	0.09	0.09	0.45	0.27	0.41	0.36	0.45	0.54
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	1.36	1.91	1.41	1.41	2.00	1.59	1.63	2.95	3.13	3.76	4.54	4.72	4.81
7	227.24	237.12	240.53	306.27	276.64	237.37	237.43	209.46	287.27	276.30	211.41	239.20	222.81
8	0.16	0.27	0.36	0.54	1.00	1.27	0.91	1.09	1.09	1.19	1.18	1.36	1.36
9	2.23	2.50	2.59	3.18	3.52	4.28	4.17	3.90	4.17	4.40	4.45	3.72	4.35
10	264.56	277.54	280.45	347.68	321.80	283.61	282.60	257.50	335.85	327.29	262.21	290.91	273.98
PCE	959.1	1001.9	1043.1	1096.9	1169.1	1211.3	1235.8	1305.4	1381.1	1440.0	1536.9	1584.4	1603.3

ID 24

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	10.70	11.16	11.16	11.61	12.07	12.34	12.70	13.06	13.70	17.69	14.79	15.06	15.06
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.09	2.36	2.27	2.54	2.45	2.54	2.54	2.63	2.63	2.81	3.36	2.90	2.90
4	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.18	0.09	0.18	0.18	0.18	0.27
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.50	0.73	0.54	0.54	0.77	0.59	0.64	1.18	1.32	1.95	2.00	2.09	2.18
7	85.62	88.92	85.62	118.55	105.39	90.26	96.42	82.41	124.61	136.40	93.16	103.53	98.62
8	0.08	0.14	0.18	0.18	0.36	0.45	0.36	0.36	0.45	0.54	0.54	0.64	0.64
9	5.61	5.88	6.39	7.84	7.23	8.83	8.89	8.44	8.71	9.62	8.71	9.34	9.07
10	104.65	109.23	106.21	141.32	128.32	115.06	121.70	108.27	151.69	160.74	122.28	133.92	128.74
PCE	396.9	415.8	439.0	469.1	478.6	498.9	535.6	555.2	580.1	742.0	669.3	673.6	693.5

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Table A-8. The quantity structure of packaging by consumer product, 1958-70--Continued

(thousand tonnes)

ID 25

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	11.61	12.34	12.43	13.43	14.61	14.88	15.60	16.51	17.06	19.99	20.05	20.68	21.50
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.27	2.54	2.54	2.90	2.99	3.08	3.18	3.36	3.54	3.72	3.90	4.26	4.17
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.54	0.77	4.17	4.35	6.03	5.08	5.99	7.35	8.80	10.34	13.88	18.82	18.33
7	108.68	111.97	115.27	118.55	102.08	123.70	127.90	92.72	128.07	136.40	136.16	135.66	135.14
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.80	1.05	1.24	1.57	1.54	2.39	1.72	2.36	1.81	1.81	1.72	1.91	1.81
10	123.90	128.67	135.65	140.80	127.25	149.13	154.39	122.29	159.28	172.27	175.71	161.34	180.95
PCE	457.6	469.8	493.1	542.0	543.2	549.5	600.4	714.7	832.1	838.0	860.0	869.3	888.1

ID 26

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	14.70	14.79	14.52	15.06	16.78	18.33	22.86	24.49	24.86	26.09	25.22	25.49	26.76
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.90	3.08	2.99	3.27	3.45	3.81	4.72	4.99	5.17	4.81	4.90	5.26	5.17
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.73	0.95	4.85	4.90	7.03	6.26	8.71	10.84	12.88	13.47	17.42	19.41	22.86
7	135.03	135.03	131.73	131.74	118.56	153.80	183.14	133.92	179.98	174.88	168.41	168.20	168.02
8	8.80	7.11	11.43	14.88	24.04	27.67	28.49	44.18	41.28	40.85	42.91	44.63	45.72
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	162.16	160.97	165.52	169.84	169.86	209.86	247.91	218.43	264.17	260.10	258.86	263.01	268.54
PCE	465.6	478.0	496.8	531.1	589.8	652.5	837.4	943.7	1055.7	1092.0	1143.0	1122.9	1218.7

ID 27

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	7.08	7.62	7.98	8.35	9.16	9.53	9.43	9.98	10.43	12.51	12.34	12.52	12.07
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.45	1.63	1.63	1.81	1.91	2.00	1.91	2.00	2.18	2.36	2.36	2.63	2.54
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.36	0.50	2.68	2.72	3.81	3.27	3.63	4.00	5.40	6.49	8.48	11.34	11.02
7	64.25	69.16	72.45	72.45	69.16	48.27	76.06	54.95	76.15	83.54	78.82	85.68	84.01
8	4.30	6.49	6.89	8.71	8.53	9.25	10.98	9.71	11.25	11.70	12.34	12.07	11.61
9	0.47	0.40	0.34	0.33	0.28	0.29	0.27	0.27	0.27	0.18	0.18	0.18	0.18
10	77.91	85.80	91.98	94.37	92.85	72.60	102.28	81.30	105.68	117.18	114.52	124.42	122.34
PCE	251.3	270.5	296.2	317.7	342.7	363.4	373.5	400.0	438.5	526.0	552.7	585.6	625.2

ID 28

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.72	3.99	3.99	4.35	4.72	4.81	5.81	6.35	7.35	7.91	8.44	9.62	10.70
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.73	0.82	0.82	0.91	1.00	1.00	1.18	1.27	1.54	1.45	1.63	2.00	2.09
4	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.73	0.45	0.73	0.73	0.91	0.91
5	98.43	120.93	127.46	136.99	141.89	165.84	196.23	231.61	222.45	211.11	223.99	219.72	209.02
6	0.18	0.27	1.36	1.41	1.95	1.68	2.22	2.81	3.81	4.08	5.76	8.71	9.07
7	32.93	36.23	36.23	39.52	32.94	43.47	47.51	37.78	62.30	62.95	57.34	64.26	65.74
8	3.16	5.11	5.26	6.80	8.80	6.99	13.06	26.49	27.13	39.34	56.70	65.77	72.49
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	139.60	167.80	175.58	190.43	191.75	224.23	266.46	307.04	325.02	327.56	354.58	370.58	370.01
PCE	135.4	142.6	150.7	167.5	175.9	184.2	226.0	252.5	312.3	331.0	368.9	424.2	476.4

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Table A-8. The quantity structure of packaging by consumer product, 1958-70--Continued
(thousand tonnes)

ID 29	58	59	60	61	62	63	64	65	66	67	68	69	70
1	56.06	59.06	61.87	65.77	68.67	68.86	66.59	69.13	74.39	69.57	69.49	70.31	72.67
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	11.16	12.25	12.61	14.15	14.24	14.24	13.61	14.06	15.42	13.06	13.61	14.61	14.06
4	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.95	0.57	0.23	0.85	0.86	1.27
5	145.06	165.65	180.44	169.83	165.84	185.52	199.86	203.76	194.65	186.97	201.22	229.79	217.18
6	2.72	3.81	2.95	3.08	4.26	3.36	3.36	6.17	7.08	7.67	9.39	9.80	10.43
7	454.48	474.23	477.53	599.39	503.88	500.83	491.99	436.11	539.93	489.65	446.73	492.66	479.49
8	0.41	0.48	0.73	1.09	1.91	2.45	1.72	2.18	2.45	2.17	2.27	2.63	2.81
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	670.18	715.76	736.42	853.61	759.09	779.55	777.41	732.36	834.52	769.32	737.56	820.68	796.92
PCE	2380.6	2443.8	2614.2	2800.4	2807.5	2805.6	2777.2	3011.6	3129.9	2924.0	3000.0	3091.5	3140.8

ID 30	58	59	60	61	62	63	64	65	66	67	68	69	70
1	660.08	748.98	757.42	758.51	834.99	838.25	909.56	962.72	989.21	987.89	1032.39	1082.38	1040.10
2	64.09	90.27	88.91	122.47	141.98	128.82	188.52	240.00	264.81	276.88	298.33	339.75	360.70
3	13.06	15.24	14.33	14.61	14.97	16.96	16.60	17.60	17.87	15.69	15.97	16.78	15.69
4	9.73	10.28	10.09	9.36	10.18	12.08	14.17	13.25	15.88	10.21	18.33	16.63	15.97
5	1067.41	1188.79	1145.70	1130.64	1258.01	1296.12	1272.53	1209.48	1168.75	1172.46	1334.13	1355.26	1302.19
6	19.19	20.82	28.94	34.70	43.77	51.26	69.72	138.85	173.41	147.01	202.99	234.60	272.51
7	276.64	326.04	322.74	296.39	230.54	220.65	179.84	171.70	152.29	143.40	114.66	117.81	105.93
8	797.12	858.61	703.33	740.06	759.67	633.92	811.29	847.06	912.56	630.13	652.61	1181.87	1176.31
9	2.63	2.87	3.05	3.30	3.76	3.93	4.08	4.54	4.63	7.28	9.45	10.17	11.95
10	2909.96	3261.90	3074.51	3110.05	3297.87	3201.09	3466.31	3605.19	3699.41	3390.95	3678.85	4355.25	4301.46
PCE	93579.8	103107.0	106243.7	104182.3	113565.6	121605.6	133580.3	146795.3	160568.9	164900.0	178750.5	186488.3	191036.7

ID 31	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2279.52	2457.06	2514.57	2492.89	2736.29	2803.52	2933.34	3145.98	3227.63	3367.16	3381.58	3491.99	3417.51
2	299.21	347.87	360.22	411.42	443.14	484.15	535.22	590.20	653.07	688.97	729.37	798.06	849.26
3	266.54	281.59	260.09	274.70	280.42	287.76	291.39	302.19	301.82	306.54	301.28	333.78	316.88
4	47.95	58.60	58.07	61.24	65.68	73.76	79.84	87.11	91.47	97.26	96.57	110.69	114.86
5	4345.48	4700.15	4702.38	4814.32	5127.30	5327.25	5531.73	5743.47	5991.95	5917.64	6254.31	6346.94	6172.94
6	38.26	47.66	84.01	120.29	158.71	181.03	229.79	281.46	346.73	401.75	468.16	543.23	610.32
7	4928.82	5291.44	5467.35	5822.95	6002.10	6272.33	6660.73	6808.43	7482.09	8350.00	8339.75	9407.14	10202.84
8	4375.48	4554.38	4427.72	4634.11	4789.38	4348.26	4551.33	4778.58	5045.12	4902.16	5383.21	5554.49	5671.89
9	27.33	33.48	36.83	40.99	45.10	50.92	53.71	56.34	58.51	236.95	328.32	338.20	401.62
10	16608.57	17772.24	17911.23	18672.90	19648.11	19828.97	20867.08	21793.76	23198.39	24268.43	25282.55	26924.89	27758.11
PCE	196875.4	209949.1	216015.3	216877.9	228353.5	236958.3	251902.9	267900.1	283287.5	288088.9	303431.1	312319.9	317611.6

Source: Research Triangle Institute

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Table A-9. The value structure of packaging by consumer product, 1958-70
(percent distribution)

ID 1	58	59	60	61	62	63	64	65	66	67	68	69	70
1	14.23	12.95	12.71	11.66	11.26	11.61	10.73	10.48	10.80	10.56	10.69	10.20	9.66
2	33.47	34.08	34.46	33.41	35.60	32.44	31.53	28.12	26.36	27.24	27.43	27.62	27.81
3	1.31	1.15	1.10	1.12	1.13	1.07	1.03	1.02	0.89	0.93	0.94	0.86	0.85
4	1.87	1.92	1.40	1.57	1.47	1.64	1.26	1.23	1.01	1.83	1.76	1.36	1.71
5	33.21	34.31	33.10	32.49	31.05	34.74	35.35	35.49	39.31	40.38	39.99	39.62	39.68
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	11.28	10.27	11.64	13.88	13.42	12.70	14.08	16.76	15.00	12.76	12.73	13.24	13.33
9	4.62	5.32	5.60	5.87	6.06	5.80	6.02	6.91	6.64	5.51	6.46	7.11	6.95
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	7702.5	7851.3	7965.6	8103.5	8170.7	8211.7	8460.5	8610.9	8660.2	8589.0	8872.5	8901.3	8841.1

ID 2	58	59	60	61	62	63	64	65	66	67	68	69	70
1	23.99	23.40	23.57	23.62	21.86	25.20	23.79	23.06	21.70	18.73	18.70	17.51	15.70
2	6.22	5.55	5.46	5.19	6.21	8.00	7.60	7.26	7.76	7.63	7.32	7.05	8.69
3	1.90	1.75	1.84	1.93	1.85	1.72	1.68	1.64	1.39	1.25	1.25	1.13	1.09
4	2.26	2.36	2.01	1.95	1.72	1.71	1.70	1.56	1.21	1.18	1.10	0.89	1.03
5	57.53	59.70	59.70	59.30	60.49	58.64	58.35	60.20	60.33	60.06	61.74	62.49	62.70
6	0.34	0.40	1.09	1.43	1.51	1.48	1.62	0.96	1.79	4.69	3.10	5.11	6.06
7	3.32	3.22	2.94	2.63	2.23	2.02	1.81	1.60	1.29	1.11	1.15	1.13	0.46
8	4.45	3.63	3.39	3.95	4.14	4.22	3.45	3.71	4.54	5.34	5.63	4.70	4.30
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	14743.9	14776.9	14951.4	14863.0	14979.8	15200.2	15205.1	15108.9	14864.3	12621.0	12651.5	12778.8	12681.6

ID 3	58	59	60	61	62	63	64	65	66	67	68	69	70
1	13.20	11.83	11.76	10.78	9.83	9.36	8.81	8.86	8.61	10.97	10.96	10.31	9.76
2	20.77	19.78	19.18	17.89	20.04	20.76	19.08	18.04	18.99	17.96	18.59	18.14	17.81
3	1.23	1.04	1.04	1.03	1.00	0.86	0.84	0.85	0.71	0.91	0.96	0.86	0.86
4	22.99	25.90	26.08	27.42	28.12	26.53	28.13	24.39	21.43	11.80	8.79	11.25	13.32
5	31.90	31.34	30.63	30.08	27.10	28.05	29.00	30.03	31.36	40.38	40.84	40.08	40.09
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	5.64	5.25	6.13	7.36	8.62	9.76	9.20	11.98	13.59	12.05	13.24	12.18	11.12
9	4.28	4.87	5.18	5.43	5.28	4.68	4.94	5.85	5.30	5.91	6.62	7.18	7.05
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2304.3	2361.9	2435.9	2603.0	2698.4	2805.2	2940.3	3164.6	3283.8	4997.0	5324.6	5575.1	5524.8

ID 4	58	59	60	61	62	63	64	65	66	67	68	69	70
1	27.28	25.67	25.69	24.27	23.47	22.46	21.36	21.64	20.90	21.46	20.80	20.77	20.33
2	11.18	10.90	10.70	11.44	13.98	13.92	16.59	14.73	13.12	12.80	11.44	10.49	10.14
3	2.49	2.26	2.23	2.33	2.35	2.09	2.06	2.11	1.74	1.82	1.83	1.74	1.79
4	0.18	0.16	0.14	0.15	0.15	0.14	0.16	0.20	0.19	0.11	0.12	0.11	0.10
5	56.46	58.64	58.41	58.05	55.17	56.56	52.83	53.57	57.21	58.08	60.81	63.23	64.39
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	4.81	6.96	7.76	5.71	5.01	3.67	3.26
8	2.40	2.36	2.83	3.77	4.90	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	18403.5	19483.1	20488.5	20643.3	20756.9	20355.1	22071.0	22204.5	22160.8	22753.0	23168.1	22865.3	22807.0

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Table A-9. The value structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 5

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	27.54	25.20	25.57	24.28	23.54	22.47	21.20	21.49	20.86	21.66	20.72	20.68	20.31
2	11.96	10.52	10.79	11.44	13.65	14.06	17.33	15.15	12.90	13.10	11.72	10.61	10.19
3	2.92	2.43	2.61	2.59	2.38	1.97	1.79	2.28	1.89	2.07	1.59	1.93	1.85
4	0.23	1.92	0.17	0.17	0.16	0.13	0.23	0.19	0.08	0.15	0.14	0.13	0.13
5	54.86	57.55	58.16	57.38	55.17	56.69	52.34	52.94	57.31	57.59	60.85	62.77	64.23
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	2.48	2.38	2.70	3.94	5.10	4.69	7.11	7.95	6.97	6.05	4.98	3.87	3.19
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	411.3	428.7	438.8	447.6	450.8	483.9	552.2	569.4	554.3	538.0	530.5	532.6	525.4

ID 6

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	27.28	25.10	25.65	24.29	23.48	22.46	21.34	21.66	20.91	21.50	20.82	20.75	20.33
2	11.14	10.77	10.79	11.45	13.98	13.94	16.58	14.73	13.11	12.76	11.38	10.54	10.16
3	2.45	2.16	2.23	2.28	2.32	2.08	2.10	2.12	1.78	1.85	1.81	1.78	1.81
4	0.26	2.43	0.21	0.24	0.22	0.19	0.18	0.16	0.11	0.13	0.10	0.09	0.10
5	56.45	57.24	58.30	57.95	55.09	56.54	52.85	53.57	57.22	58.08	60.91	63.13	64.37
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	2.41	2.30	2.82	3.79	4.91	4.79	6.95	7.76	6.87	5.68	4.97	3.71	3.24
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2324.1	2437.3	2480.8	2596.9	2592.2	2742.0	3037.7	3055.3	3185.6	3171.0	3217.3	3283.5	3396.7

ID 7

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	22.85	21.30	21.51	20.26	18.63	17.36	17.62	18.10	16.55	16.81	16.18	15.67	15.21
2	24.64	24.75	24.96	25.47	32.29	33.26	33.33	30.15	32.24	31.77	30.53	31.03	31.77
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	51.33	52.90	52.36	52.71	47.35	47.42	47.01	48.90	48.17	48.57	50.23	49.88	50.22
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	1.12	1.05	1.17	1.56	1.73	1.96	2.03	2.86	3.03	2.85	3.06	3.43	2.80
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	9297.5	9656.2	9581.6	9883.6	10212.9	9723.0	9818.6	9897.9	9780.3	9921.0	9799.8	9943.3	10267.4

ID 8

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	18.07	17.12	18.12	16.87	16.03	16.48	16.94	18.14	17.46	17.37	16.09	15.45	14.76
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	35.39	35.40	36.67	37.09	36.85	40.37	38.43	37.82	41.32	40.72	38.83	37.78	35.43
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	46.54	47.48	45.20	46.04	47.12	43.15	44.63	44.04	41.22	41.91	45.09	46.77	49.81
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5180.8	5340.1	5514.1	5813.7	5900.3	5968.2	6312.9	6576.4	6673.1	6969.0	7175.5	7122.9	7060.9

Table A-9. The value structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 9

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	100.00	100.00	100.00	100.00
7	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	669.9	681.4	660.1	714.6	713.4	772.2	808.8	839.3	921.1	938.0	949.9	1297.6	1288.8

ID 10

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	21.86	21.69	20.98	20.03	19.91	18.47	20.05	19.14	15.58	16.46	13.88	13.76	11.96
4	0.00	0.00	0.00	0.00	0.00	0.54	0.39	0.36	0.33	0.28	0.30	0.25	0.26
5	8.31	9.11	8.37	7.15	7.18	7.61	7.55	7.29	8.49	7.53	6.85	6.81	6.02
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.79	25.33	31.60	31.04
7	15.09	12.49	15.52	17.99	20.49	22.09	24.18	24.24	25.03	40.47	41.15	36.15	39.47
8	54.74	56.71	55.12	54.82	52.41	51.09	47.84	48.97	50.57	10.46	12.05	11.03	11.23
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5552.4	5662.0	5482.9	5442.4	5571.6	5702.4	5908.2	6106.4	6244.1	6137.0	6151.8	6226.8	6279.2

ID 11

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.14	3.19	3.11	2.66	2.13	1.97	1.83	1.74	1.46	1.18	0.92	0.74	0.64
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	17.14	16.63	15.38	14.94	12.57	10.95	10.12	8.79	5.93	5.16	3.92	3.29	2.80
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.13	4.15	3.44	2.93
5	12.82	13.58	12.43	11.26	9.41	9.28	7.94	6.98	6.69	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.58	41.06	52.39	54.14
7	56.57	54.42	51.62	43.81	45.43	46.28	44.07	39.66	39.90	45.51	44.88	35.50	33.30
8	10.33	12.18	17.46	27.39	30.45	31.52	36.03	42.84	46.02	2.44	5.06	4.63	6.19
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2713.9	2778.2	2788.2	2756.8	2823.5	2782.8	2722.0	3029.6	3151.8	3032.0	3044.0	3140.1	3148.7

ID 12

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.57	2.39	2.48	2.16	2.04	2.13	2.35	2.41	2.51	2.41	2.29	2.17	2.13
2	0.00	0.00	0.00	0.00	0.00	0.59	0.66	0.62	0.56	0.53	0.51	0.47	0.47
3	0.66	0.60	0.58	0.59	0.60	0.59	0.90	0.74	0.80	1.00	0.79	0.67	0.58
4	0.86	0.78	0.68	0.75	0.93	0.93	0.90	0.36	0.70	1.95	1.29	2.10	2.60
5	14.93	15.25	15.16	14.35	14.21	16.35	16.89	16.10	17.99	16.65	17.12	16.88	16.80
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.71	45.93	45.35	45.63	48.50	51.49
7	48.78	47.59	47.67	44.22	44.71	44.59	49.34	32.07	31.51	32.10	32.36	29.22	25.91
8	32.21	33.40	33.43	37.93	37.50	35.41	25.87	0.00	0.00	0.00	0.00	0.00	0.02
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2546.8	2712.5	2810.6	2893.8	2941.6	3033.1	2840.0	2670.7	2684.7	2847.0	2859.6	3029.3	2762.7

Table A-9. The value structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 13	58	59	60	61	62	63	64	65	66	67	68	69	70
1	11.98	11.48	11.53	10.48	9.49	9.11	8.34	8.50	7.35	6.85	6.90	6.19	5.94
2	40.89	40.80	40.21	39.10	41.21	39.46	41.05	37.15	35.50	33.91	31.71	31.74	31.26
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	6.69	6.21	5.12	5.26	4.39	4.16	4.15	4.38	2.81	3.41	2.77	2.62	2.22
5	26.86	28.56	28.05	27.27	24.13	24.89	22.28	20.56	21.36	21.08	21.43	19.68	19.17
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	13.58	12.95	15.08	17.89	20.78	22.38	24.17	29.41	32.98	34.74	37.19	39.78	41.41
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2356.2	2375.9	2524.3	2934.5	3035.1	3034.4	2762.9	2888.7	3332.2	3087.0	2959.3	2810.7	2840.2

ID 14	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.24	0.24	0.23	0.23	0.23	0.25	0.25	0.25	0.21	0.21	0.21	0.20	0.20
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	3.16	3.59	3.40	3.02	2.88	3.68	3.48	3.35	3.97	3.80	3.65	3.88	3.71
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	9.01	10.25	9.88	8.62	8.64	10.08	10.00	9.76	9.35	9.90	9.72	11.22	11.07
8	87.58	85.92	86.49	88.13	88.26	86.00	86.27	86.64	86.46	84.56	84.61	82.72	81.65
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53	1.82	1.98	2.97
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5004.4	5062.1	5272.5	5569.8	5489.3	5718.4	5685.2	5921.5	5790.4	6073.0	6091.7	6260.5	6147.8

ID 15	58	59	60	61	62	63	64	65	66	67	68	69	70
1	31.90	30.64	31.32	31.08	29.81	29.15	29.13	30.42	27.26	25.72	25.37	24.87	23.75
2	17.94	17.23	16.71	16.16	20.69	21.24	23.03	20.23	20.26	26.96	26.20	28.45	28.98
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	50.16	52.13	51.96	52.76	49.50	49.61	47.84	49.35	52.48	47.32	48.43	46.68	47.27
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	1972.8	1968.4	1983.9	2009.0	2028.6	2078.2	2147.0	2216.4	2186.3	2171.0	2230.1	2261.4	2217.6

ID 16	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.90	2.07	1.86	1.72	1.47	1.62	1.69	1.59	1.67	1.36	1.32	1.41	1.32
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	3.21	3.41	3.37	3.33	3.03	3.18	3.43	3.21	2.80	2.51	2.36	2.60	2.31
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.19	1.32	1.91	2.55
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	94.89	94.53	94.77	94.95	95.49	95.20	94.88	95.19	95.53	94.94	95.00	94.02	93.77
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	542.4	560.4	574.7	596.1	622.9	650.5	683.0	735.5	794.5	849.0	904.8	970.7	1031.5

Table A-9. The value structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 17

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	19.74	20.92	23.61	23.65	22.20	22.68	21.98	17.27	13.84	14.83	13.46	12.26	12.71
2	16.96	19.80	21.40	21.32	23.61	22.99	22.62	25.89	24.19	21.61	21.43	21.77	20.50
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	9.63	13.32	11.51	14.06	12.01	11.87	11.52	9.35	6.99	5.66	4.40	3.85	4.10
5	47.45	39.05	34.60	30.26	28.70	27.63	27.40	21.97	27.51	29.69	28.56	27.89	28.48
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	6.22	6.92	8.88	10.72	13.48	14.83	16.48	25.53	27.47	28.21	32.14	34.22	34.22
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	7519.4	7952.1	8192.3	8483.0	8571.3	8837.6	8751.3	8992.3	9201.7	9293.0	9132.3	8946.8	9094.0

ID 18

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	5.52	5.18	5.22	4.92	4.92	4.52	5.15	5.33	5.27	4.29	4.28	3.94	3.57
2	10.82	10.90	8.78	8.08	7.50	16.35	5.33	5.65	6.27	8.60	10.54	9.85	11.19
3	0.83	0.78	0.74	0.79	0.80	0.68	0.80	0.82	0.69	0.62	0.60	0.52	0.50
4	2.29	2.63	2.15	2.26	2.11	1.84	2.76	3.21	2.71	5.17	4.25	4.72	3.35
5	19.13	20.96	20.59	20.81	20.54	20.06	23.24	24.47	26.04	21.36	22.18	21.11	20.02
6	3.88	5.21	9.28	9.98	10.06	9.18	11.45	6.25	8.13	12.48	12.01	12.71	12.62
7	43.60	41.85	41.44	39.45	41.00	34.81	40.75	43.44	41.25	34.69	35.62	36.66	37.29
8	12.86	11.20	10.45	12.25	11.47	11.25	8.77	8.72	7.69	10.42	8.95	8.79	9.89
9	1.07	1.29	1.36	1.47	1.60	1.32	1.74	2.12	1.95	1.36	1.56	1.65	1.55
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	5564.6	5895.8	6168.9	6333.6	6530.4	6612.7	6530.7	6686.3	6751.9	6521.0	6565.4	6646.3	6789.1

ID 19

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	5.36	4.65	4.43	3.89	3.76	3.55	3.45	2.95	3.63	3.37	2.78	2.57	2.58
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.24	0.34	0.51	0.62	0.54	0.43	0.79	0.48	0.43	0.38	0.46	0.57
5	92.90	92.85	90.77	84.10	82.35	82.63	81.27	75.22	70.52	73.68	75.30	74.40	71.94
6	1.73	2.26	4.46	11.50	13.27	13.28	14.85	21.04	25.37	22.21	21.54	22.57	24.90
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	1182.9	1253.3	1322.7	1355.2	1406.1	1455.5	1511.9	1560.0	1626.5	1593.0	1630.1	1636.4	1654.7

ID 20

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	21.18	18.68	16.36	12.65	8.01	11.57	10.94	8.16	8.79	9.29	8.28	7.45	7.05
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	15.02	14.28	14.33	11.72	7.56	10.19	9.79	7.83	7.80	7.93	7.65	7.09	6.38
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	32.76	33.02	30.04	22.66	17.51	26.22	25.55	21.06	15.11	16.63	16.22	15.89	14.92
6	7.74	9.06	16.75	37.53	28.23	43.54	47.27	57.98	61.43	61.68	64.35	65.90	67.90
7	23.29	24.96	22.52	15.44	38.68	8.48	6.44	4.97	6.86	5.67	3.50	3.63	3.77
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	677.1	684.2	710.0	739.6	1111.9	811.8	836.8	851.0	869.1	956.0	942.5	937.6	946.2

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Table A-9.   The value structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 21	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	13.66	13.77	14.85	16.80	23.18	20.35	23.32	29.18	19.48	26.62	4.55	37.70	33.19
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	86.34	86.23	85.15	83.20	76.82	79.65	76.68	70.82	80.52	73.38	95.45	62.30	66.81
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	147.3	168.6	166.3	167.6	169.5	168.1	164.2	161.6	157.7	157.0	148.5	146.9	149.9

ID 22	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.82	3.48	3.26	3.08	3.03	3.29	3.20	3.33	4.32	4.21	3.52	3.31	3.35
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.34	2.17	2.17	2.26	2.26	2.28	2.36	2.51	2.83	2.89	2.45	2.31	2.30
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	80.12	79.76	80.41	75.95	76.77	74.89	74.15	64.82	60.23	60.31	62.15	60.58	57.63
6	1.28	1.68	3.30	9.16	10.75	12.39	13.81	23.73	30.03	27.73	27.25	29.08	32.23
7	12.45	12.92	10.87	9.55	7.19	7.15	6.47	5.60	2.59	4.86	4.63	4.72	4.09
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	1431.6	1529.8	1725.1	1821.1	1904.5	1940.9	1987.0	2075.4	2115.1	2083.0	2130.5	2167.0	2454.3

ID 23	58	59	60	61	62	63	64	65	66	67	68	69	70
1	12.47	11.44	11.98	10.22	10.74	12.53	12.14	12.34	10.52	10.63	11.35	10.45	9.75
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6.71	6.50	7.43	6.84	7.44	8.07	8.38	8.81	6.58	6.86	7.55	6.80	6.34
4	0.52	0.46	0.22	0.19	0.20	0.22	0.22	1.01	0.44	0.62	0.55	0.60	0.69
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	4.04	5.58	4.52	2.75	3.50	2.89	2.97	8.07	6.53	6.70	5.07	8.89	8.99
7	64.10	62.54	63.44	68.81	65.11	60.64	59.36	52.95	60.08	56.09	50.72	56.32	54.47
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	12.15	13.47	12.42	11.18	13.01	15.84	16.93	16.83	15.84	19.10	20.76	16.93	19.77
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	959.1	1001.9	1043.1	1096.9	1169.1	1211.3	1235.8	1305.4	1381.1	1440.0	1536.9	1584.4	1603.3

ID 24	58	59	60	61	62	63	64	65	66	67	68	69	70
1	7.53	6.75	7.14	6.42	6.79	7.28	6.95	7.07	6.30	7.03	6.60	5.82	5.69
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	3.98	3.93	4.03	4.35	4.60	4.72	4.84	4.99	3.94	4.88	4.38	3.82	3.67
4	0.25	0.22	0.20	0.19	0.20	0.20	0.19	0.58	0.21	0.35	0.37	0.30	0.45
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	2.33	3.31	2.76	1.72	2.26	1.66	1.66	4.66	3.97	4.05	5.28	5.00	5.29
7	37.96	36.54	37.13	42.88	41.48	35.66	34.58	30.12	37.73	35.51	29.56	30.99	31.32
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	47.96	49.26	48.33	44.45	40.67	50.48	51.78	52.58	47.85	48.08	53.81	54.07	53.58
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	396.9	415.8	439.0	469.1	478.6	498.9	535.6	555.2	580.1	742.0	669.3	673.6	693.5

Table A-9. The value structure of packaging by consumer product, 1958-70--Continued

(percent distribution)

ID 25	58	59	60	61	62	63	64	65	66	67	68	69	70
1	11.63	10.65	8.53	9.51	10.06	9.63	9.96	9.61	8.90	9.78	8.51	7.26	7.25
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	6.15	6.05	5.32	6.36	6.89	6.28	6.82	6.85	5.62	6.25	5.59	4.79	4.71
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	3.61	5.03	22.63	17.57	21.69	15.68	18.29	31.24	30.16	29.04	34.88	40.90	39.78
7	68.90	65.68	53.45	55.18	49.69	53.45	53.27	36.48	43.99	43.76	40.90	37.05	38.70
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.12	10.00	9.57
9	9.71	12.59	10.08	11.39	11.68	14.95	11.71	15.81	11.32	11.17	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	457.6	469.8	493.1	542.0	543.2	549.5	600.4	714.7	832.1	838.0	860.0	869.3	888.1

ID 26	58	59	60	61	62	63	64	65	66	67	68	69	70
1	13.02	12.09	9.61	10.77	11.24	11.24	11.44	11.57	10.20	11.12	9.55	8.65	8.03
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.26	6.46	7.04	6.27	5.74	5.18
3	6.97	6.96	6.05	7.23	7.72	7.36	7.94	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.40	34.72	32.96	39.05	40.89	44.11
6	4.26	5.89	25.39	19.99	24.58	18.33	20.80	42.77	48.61	48.89	45.13	44.58	42.68
7	75.75	75.06	58.95	62.00	56.46	63.07	59.82	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	465.6	478.0	496.8	531.1	589.8	652.5	837.4	943.7	1055.7	1092.0	1143.0	1122.5	1218.7

ID 27	58	59	60	61	62	63	64	65	66	67	68	69	70
1	12.06	11.14	9.16	10.37	10.50	14.36	11.01	11.16	9.86	10.86	9.87	7.80	7.80
2	0.00	0.00	0.00	0.00	0.00	0.00	7.48	7.82	6.26	7.03	6.37	5.24	5.10
3	6.70	6.58	5.72	6.97	7.29	9.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.94	33.48	32.33	40.18	43.75	42.63
6	4.10	5.51	24.26	19.28	22.78	23.48	20.22	41.57	47.33	47.80	41.56	41.52	42.77
7	67.37	68.68	56.19	59.22	55.89	48.46	57.91	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	9.77	8.09	4.67	4.16	3.54	4.24	3.38	3.51	3.07	1.98	2.01	1.69	1.70
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	251.3	270.5	296.2	317.7	342.7	363.4	373.5	400.0	438.5	526.0	552.7	585.6	625.2

ID 28	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.16	1.76	1.62	1.71	1.71	1.48	1.52	1.40	1.61	1.68	1.65	1.73	1.89
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	1.03	1.06	1.08	1.15	1.23
3	1.14	0.99	1.01	1.10	1.21	0.97	1.04	0.94	0.51	0.76	0.64	0.71	0.70
4	1.70	1.31	1.08	1.10	1.08	0.88	0.76	0.00	0.00	0.00	0.00	0.00	0.00
5	82.20	84.15	81.93	82.76	83.85	85.27	85.62	86.56	82.37	82.73	82.01	77.74	76.00
6	0.70	0.91	4.38	3.15	3.70	2.47	2.78	4.51	5.49	4.69	6.68	9.69	10.32
7	12.11	10.88	9.97	10.19	8.44	8.94	8.27	5.60	9.00	8.78	7.93	8.88	9.85
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	135.4	142.6	150.7	167.5	175.9	184.2	226.0	252.5	312.3	331.0	368.9	424.2	476.4

Table A-9. The value structure of packaging by consumer product, 1958-70--Continued
(percent distribution)

ID 29	58	59	60	61	62	63	64	65	66	67	68	69	70
1	9.33	8.36	8.43	8.38	8.97	8.84	8.42	8.54	8.70	8.43	8.04	6.92	6.97
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	5.03	4.78	5.24	5.58	6.22	5.75	5.79	6.08	5.49	5.44	5.32	4.60	4.51
4	0.30	0.26	0.23	0.23	0.25	0.23	0.24	0.70	0.34	0.13	0.45	0.38	0.53
5	34.72	36.92	38.86	33.36	35.23	39.76	42.13	42.78	38.46	41.73	43.53	44.56	42.85
6	3.00	4.07	3.18	2.24	2.91	2.06	2.03	5.56	5.44	5.34	6.43	5.98	6.44
7	47.62	45.61	44.06	50.20	46.42	43.35	41.39	36.35	41.56	38.93	36.23	37.56	38.69
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	2380.6	2443.8	2614.2	2800.4	2807.5	2805.6	2777.2	3011.6	3129.9	2924.0	3000.0	3091.5	3160.8

ID 30	58	59	60	61	62	63	64	65	66	67	68	69	70
1	15.93	15.25	16.06	15.43	14.20	14.65	13.90	13.11	13.08	13.64	12.92	10.97	10.19
2	8.59	10.70	11.59	12.82	17.41	17.84	22.13	24.52	24.91	27.57	26.75	25.03	25.55
3	0.87	0.87	0.94	0.95	0.88	0.96	0.87	0.86	0.73	0.76	0.69	0.56	0.53
4	1.55	1.39	1.28	1.21	1.17	1.37	1.42	1.09	1.09	0.71	1.06	0.75	0.70
5	37.96	38.83	39.10	36.46	35.81	39.10	33.18	28.61	26.58	30.52	31.99	27.85	27.09
6	2.34	2.32	3.06	3.33	3.16	3.25	3.17	5.59	6.51	5.48	6.54	6.13	6.65
7	4.30	4.60	4.72	4.08	2.85	2.67	1.87	1.61	1.35	1.33	1.04	0.95	0.90
8	27.82	25.43	22.65	25.17	23.96	19.62	22.94	24.04	25.19	19.27	18.20	27.03	27.60
9	0.64	0.62	0.60	0.57	0.56	0.53	0.51	0.57	0.56	0.73	0.81	0.73	0.78
10	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
PCE	93579.8	103107.0	106243.7	104182.3	113565.6	121605.6	133580.3	146795.3	160568.9	164900.0	178790.5	186488.3	191036.7

Source: Research Triangle Institute

Table A-10.   The value structure of packaging by consumer product, 1958-70

(cents per dollar expenditure)

ID 1	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.48	0.49	0.52	0.49	0.51	0.52	0.51	0.54	0.57	0.59	0.57	0.55	0.55
2	1.13	1.30	1.40	1.40	1.60	1.45	1.51	1.44	1.38	1.47	1.46	1.50	1.59
3	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4	0.06	0.07	0.06	0.07	0.07	0.07	0.06	0.06	0.05	0.10	0.09	0.07	0.10
5	1.12	1.31	1.34	1.36	1.40	1.55	1.69	1.82	2.06	2.18	2.12	2.15	2.27
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.38	0.39	0.47	0.58	0.60	0.57	0.67	0.86	0.79	0.69	0.68	0.72	0.76
9	0.16	0.20	0.23	0.25	0.27	0.26	0.29	0.35	0.35	0.32	0.34	0.39	0.40
10	3.38	3.82	4.06	4.20	4.50	4.47	4.79	5.12	5.24	5.41	5.31	5.44	5.73
PCE	7702.5	7851.3	7965.6	8103.5	8170.7	8211.7	8460.5	8610.9	8660.2	8589.0	8872.5	8901.3	8841.1

ID 2	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.56	0.59	0.58	0.58	0.59	0.68	0.68	0.70	0.72	0.75	0.77	0.74	0.73
2	0.15	0.14	0.14	0.13	0.17	0.22	0.22	0.22	0.26	0.31	0.30	0.30	0.40
3	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.04	0.05
5	1.34	1.51	1.48	1.47	1.63	1.51	1.67	1.83	2.01	2.41	2.54	2.66	2.90
6	0.01	0.01	0.03	0.04	0.04	0.04	0.05	0.03	0.06	0.19	0.13	0.22	0.28
7	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.05	0.05	0.02
8	0.10	0.09	0.08	0.10	0.11	0.11	0.10	0.11	0.15	0.21	0.23	0.20	0.20
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.34	2.52	2.47	2.47	2.69	2.71	2.86	3.04	3.32	4.01	4.11	4.25	4.63
PCE	14743.9	14776.9	14951.4	14863.0	14979.8	15200.2	15205.1	15108.9	14864.3	12621.0	12651.5	12778.8	12681.6

ID 3	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.57	0.59	0.60	0.55	0.56	0.56	0.54	0.55	0.57	0.59	0.57	0.54	0.53
2	0.90	0.98	0.97	0.92	1.14	1.24	1.17	1.11	1.25	0.97	0.96	0.95	0.97
3	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05
4	1.00	1.29	1.32	1.41	1.60	1.58	1.72	1.50	1.41	0.64	0.45	0.59	0.73
5	1.39	1.55	1.55	1.54	1.54	1.67	1.78	1.85	2.06	2.18	2.11	2.10	2.19
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.25	0.26	0.31	0.38	0.49	0.58	0.56	0.74	0.89	0.65	0.68	0.64	0.61
9	0.19	0.24	0.26	0.28	0.30	0.28	0.30	0.36	0.35	0.32	0.34	0.38	0.38
10	4.35	4.96	5.07	5.13	5.67	5.96	6.13	6.16	6.57	5.41	5.17	5.23	5.46
PCE	2304.3	2361.9	2435.9	2603.0	2698.4	2805.2	2940.3	3164.6	3283.8	4997.0	5324.6	5575.1	5524.8

ID 4	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.52	0.51	0.52	0.49	0.50	0.50	0.48	0.54	0.59	0.59	0.58	0.60	0.60
2	0.21	0.22	0.21	0.23	0.30	0.31	0.38	0.37	0.37	0.35	0.32	0.30	0.30
3	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.08	1.18	1.17	1.16	1.18	1.26	1.20	1.33	1.63	1.60	1.69	1.82	1.89
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.05	0.05	0.06	0.08	0.11	0.11	0.16	0.19	0.20	0.18	0.14	0.11	0.10
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1.92	2.00	2.01	2.00	2.14	2.22	2.27	2.48	2.84	2.76	2.76	2.78	2.94
PCE	18403.5	19483.1	20488.5	20643.3	20756.9	20355.1	22071.0	22204.5	22160.8	22753.0	23168.1	22865.3	22807.0

Table A-10. The value structure of packaging by consumer product, 1958-70--Continued

(cents per dollar expenditure)

ID 5	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.47	0.49	0.51	0.48	0.51	0.51	0.49	0.52	0.56	0.59	0.57	0.57	0.60
2	0.20	0.20	0.21	0.23	0.29	0.32	0.40	0.37	0.35	0.36	0.32	0.29	0.30
3	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.06	0.05	0.06	0.04	0.05	0.06
4	0.00	0.04	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5	0.93	1.12	1.15	1.14	1.19	1.28	1.21	1.28	1.54	1.60	1.68	1.74	1.90
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.04	0.05	0.05	0.08	0.11	0.11	0.16	0.19	0.19	0.17	0.14	0.11	0.09
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1.70	1.94	1.98	1.97	2.15	2.26	2.31	2.42	2.68	2.78	2.76	2.78	2.96
PCE	411.3	428.7	438.8	447.6	450.8	483.9	552.2	569.4	554.3	538.0	530.5	532.6	525.4

ID 6	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.66	0.61	0.63	0.53	0.57	0.57	0.51	0.58	0.62	0.59	0.58	0.55	0.55
2	0.27	0.26	0.27	0.25	0.38	0.35	0.40	0.39	0.39	0.35	0.32	0.30	0.28
3	0.06	0.05	0.05	0.05	0.06	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05
4	0.01	0.06	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.36	1.39	1.44	1.27	1.34	1.42	1.26	1.43	1.69	1.60	1.70	1.72	1.78
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.06	0.06	0.07	0.08	0.12	0.12	0.17	0.21	0.20	0.16	0.14	0.10	0.09
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.40	2.43	2.47	2.19	2.43	2.52	2.38	2.68	2.96	2.76	2.80	2.82	2.71
PCE	2324.1	2437.3	2480.8	2596.9	2592.2	2742.0	3037.7	3055.3	3185.6	3171.0	3217.3	3283.5	3396.7

ID 7	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.48	0.46	0.50	0.46	0.48	0.51	0.53	0.56	0.58	0.59	0.62	0.60	0.59
2	0.51	0.54	0.58	0.58	0.83	0.98	1.01	0.93	1.12	1.12	1.17	1.20	1.23
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1.07	1.15	1.22	1.19	1.21	1.39	1.42	1.51	1.68	1.71	1.92	1.90	1.95
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.02	0.02	0.03	0.04	0.04	0.06	0.06	0.09	0.11	0.10	0.12	0.12	0.11
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.08	2.17	2.33	2.26	2.56	2.94	3.02	3.10	3.49	3.52	3.82	3.81	3.89
PCE	9297.5	9656.2	9581.6	9883.6	10212.9	9723.0	9818.6	9897.9	9780.3	9921.0	9759.8	9943.3	10267.4

ID 8	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.41	0.42	0.44	0.39	0.37	0.37	0.38	0.43	0.45	0.47	0.45	0.45	0.45
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.80	0.88	0.89	0.85	0.85	0.91	0.87	0.85	1.07	1.10	1.09	1.10	1.09
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1.05	1.18	1.10	1.06	1.09	0.97	1.01	1.03	1.06	1.13	1.26	1.36	1.53
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.25	2.48	2.43	2.30	2.32	2.25	2.26	2.34	2.58	2.69	2.80	2.91	3.08
PCE	5180.8	5340.1	5514.1	5813.7	5900.3	5968.2	6312.9	6576.4	6673.1	6969.0	7175.5	7122.5	7060.9

Table A-10. The value structure of packaging by consumer product, 1958-70--Continued

(cents per dollar expenditure)

ID 9	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	4.06	4.63	5.06	4.54	4.41	4.11	4.16	4.12	3.64	3.81	4.36	4.06	4.81
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	4.06	4.63	5.06	4.54	4.41	4.11	4.16	4.12	3.64	3.81	4.36	4.06	4.81
PCE	669.9	681.4	660.1	714.6	713.4	772.2	808.8	839.3	921.1	938.0	949.9	1297.6	1288.8

ID 10	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.06	2.08	2.19	2.33	2.32	2.15	2.26	2.31	1.95	2.32	2.23	2.29	2.25
4	0.00	0.00	0.00	0.00	0.00	0.06	0.04	0.04	0.04	0.04	0.05	0.04	0.05
5	0.78	0.87	0.87	0.83	0.84	0.88	0.85	0.88	1.06	1.06	1.10	1.13	1.13
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1.42	1.20	1.62	2.10	2.38	2.55	2.73	2.92	3.13	3.49	4.08	5.25	5.83
8	5.17	5.44	5.75	6.38	6.10	5.89	5.39	5.90	6.32	5.70	6.63	6.00	7.42
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.47	2.00	1.90	2.11
10	9.44	9.59	10.43	11.64	11.64	11.54	11.27	12.05	12.50	14.09	16.10	16.61	18.80
PCE	5552.4	5662.0	5482.9	5442.4	5571.6	5702.4	5908.2	6106.4	6244.1	6137.0	6151.8	6226.8	6279.2

ID 11	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.14	0.16	0.17	0.16	0.15	0.16	0.17	0.19	0.21	0.23	0.24	0.24	0.24
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.78	0.82	0.85	0.90	0.90	0.88	0.96	0.98	0.84	1.01	1.01	1.05	1.07
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.59	0.67	0.69	0.67	0.68	0.75	0.75	0.77	0.95	1.01	1.07	1.10	1.12
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	2.59	2.70	2.85	2.63	3.27	3.73	4.16	4.40	5.67	7.57	10.57	16.73	20.64
8	0.47	0.60	0.96	1.64	2.19	2.54	3.40	4.76	6.54	8.94	11.56	11.34	12.69
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	1.30	1.48	2.36
10	4.58	4.96	5.52	6.00	7.19	8.07	9.44	11.11	14.21	19.65	25.75	31.94	38.12
PCE	2713.9	2778.2	2788.2	2756.8	2823.5	2782.8	2722.0	3029.6	3151.8	3032.0	3044.0	3140.1	3148.7

ID 12	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.23	0.20	0.21	0.18	0.17	0.16	0.20	0.23	0.23	0.23	0.22	0.21	0.25
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.06	0.05	0.05	0.05	0.05	0.05	0.04	0.06	0.06	0.05	0.05	0.04	0.05
4	0.08	0.06	0.06	0.06	0.08	0.07	0.08	0.07	0.07	0.10	0.08	0.06	0.07
5	1.33	1.27	1.26	1.22	1.17	1.24	1.44	1.52	1.67	1.60	1.63	1.62	1.96
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.19	0.12	0.20	0.30
7	4.34	3.97	3.97	3.74	3.68	3.38	4.21	4.51	4.26	4.37	4.35	4.44	6.01
8	2.87	2.79	2.79	3.21	3.08	2.69	2.55	3.03	2.93	3.09	3.09	2.80	3.02
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	8.91	8.34	8.34	8.47	8.23	7.59	8.54	9.45	9.28	9.64	9.53	9.58	11.67
PCE	2546.8	2712.5	2810.6	2893.8	2941.6	3033.1	2840.0	2670.7	2684.7	2847.0	2889.6	3029.3	2762.7

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Table A-10. The value structure of packaging by consumer product, 1958-70--Continued

(cents per dollar expenditure)

ID 13	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.56	0.58	0.58	0.49	0.49	0.51	0.56	0.56	0.52	0.56	0.61	0.64	0.66
2	1.90	2.08	2.04	1.82	2.14	2.20	2.75	2.46	2.53	2.75	2.81	3.30	3.48
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.31	0.32	0.26	0.24	0.23	0.23	0.28	0.29	0.20	0.28	0.25	0.27	0.25
5	1.24	1.45	1.42	1.27	1.25	1.39	1.49	1.36	1.52	1.71	1.90	2.05	2.13
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.63	0.46	0.76	0.83	1.08	1.25	1.62	1.94	2.35	2.82	3.29	4.13	4.61
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	4.64	5.09	5.07	4.65	5.20	5.56	6.71	6.61	7.12	8.11	8.86	10.39	11.13
PCE	2356.2	2375.9	2524.3	2934.5	3035.1	3034.4	2762.9	2888.7	3332.2	3087.0	2959.3	2810.7	2840.2

ID 14	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.64	0.72	0.70	0.67	0.68	0.72	0.69	0.70	0.88	0.90	0.93	0.90	0.94
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1.81	2.04	2.04	1.90	2.03	1.98	1.98	2.05	2.08	2.36	2.47	2.59	2.90
8	17.61	17.12	17.83	19.43	20.75	16.89	17.06	18.20	19.20	20.11	21.53	19.08	20.63
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.46	0.46	0.75
10	20.10	19.93	20.62	22.05	23.51	19.64	19.77	21.01	22.21	23.78	25.45	23.07	25.27
PCE	5004.4	5062.1	9272.5	5569.8	9489.3	5718.4	5685.2	5921.5	5790.4	6073.0	6051.7	6260.5	6147.8

ID 15	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.43	0.44	0.46	0.44	0.45	0.47	0.47	0.49	0.51	0.55	0.53	0.51	0.51
2	0.24	0.25	0.25	0.23	0.32	0.34	0.37	0.33	0.38	0.57	0.54	0.59	0.63
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.68	0.75	0.77	0.74	0.75	0.80	0.77	0.80	0.99	1.01	1.00	0.98	1.02
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1.35	1.45	1.47	1.40	1.52	1.62	1.61	1.61	1.88	2.13	2.07	2.07	2.16
PCE	1972.8	1968.4	1983.9	2009.0	2028.6	2078.2	2147.0	2216.4	2186.3	2171.0	2230.1	2261.4	2217.6

ID 16	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.22	0.24	0.23	0.23	0.22	0.21	0.21	0.21	0.22	0.21	0.21	0.19	0.20
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.38	0.40	0.42	0.45	0.44	0.41	0.42	0.43	0.37	0.38	0.37	0.35	0.35
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.21	0.26	0.38
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	11.16	11.01	11.88	12.77	13.99	12.21	11.72	12.68	12.63	14.45	14.85	12.76	14.05
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
10	11.76	11.65	12.54	13.45	14.65	12.82	12.35	13.32	13.22	15.22	15.63	13.57	14.99
PCE	542.4	560.4	574.7	596.1	622.9	650.5	683.0	735.5	794.5	849.0	904.8	970.7	1031.5

Table A-10. The value structure of packaging by consumer product, 1958-70--Continued

(cents per dollar expenditure)

ID 17

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.37	0.33	0.34	0.33	0.32	0.32	0.31	0.29	0.28	0.29	0.29	0.29	0.29
2	0.32	0.32	0.31	0.30	0.35	0.33	0.32	0.43	0.49	0.42	0.47	0.51	0.47
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.18	0.21	0.17	0.20	0.18	0.17	0.16	0.16	0.14	0.11	0.10	0.09	0.09
5	0.88	0.62	0.50	0.42	0.42	0.39	0.39	0.37	0.56	0.58	0.62	0.66	0.66
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.12	0.11	0.13	0.15	0.20	0.21	0.23	0.43	0.55	0.55	0.70	0.81	0.79
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1.86	1.60	1.44	1.39	1.46	1.42	1.41	1.67	2.02	1.97	2.17	2.36	2.31
PCE	7519.4	7952.1	8192.3	8483.0	8571.3	8837.6	8751.3	8992.3	9201.7	9293.0	9132.3	8946.8	9094.0

ID 18

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.32	0.32	0.33	0.31	0.31	0.33	0.33	0.34	0.36	0.36	0.36	0.36	0.35
2	0.63	0.67	0.55	0.51	0.48	1.18	0.34	0.37	0.43	0.73	0.90	0.89	1.10
3	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4	0.13	0.16	0.13	0.14	0.13	0.13	0.18	0.21	0.19	0.45	0.36	0.43	0.33
5	1.11	1.30	1.29	1.31	1.30	1.45	1.48	1.58	1.80	1.80	1.89	1.90	1.96
6	0.22	0.32	0.58	0.63	0.64	0.66	0.73	0.40	0.56	1.10	1.02	1.15	1.24
7	2.52	2.59	2.60	2.48	2.60	2.51	2.60	2.81	2.85	2.95	3.03	3.31	3.65
8	0.74	0.69	0.66	0.77	0.73	0.81	0.56	0.56	0.53	0.88	0.76	0.79	0.97
9	0.06	0.08	0.09	0.09	0.10	0.10	0.10	0.14	0.13	0.11	0.13	0.15	0.15
10	5.78	6.19	6.29	6.29	6.33	7.21	6.37	6.47	6.92	8.44	8.52	9.02	9.80
PCE	5564.8	5895.8	6168.9	6333.6	6530.4	6612.7	6530.7	6686.3	6751.9	6521.0	6565.4	6646.3	6789.1

ID 19

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.76	0.74	0.72	0.69	0.65	0.64	0.61	0.60	0.59	0.59	0.56	0.53	0.54
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
4	0.00	0.04	0.06	0.09	0.11	0.10	0.08	0.16	0.08	0.08	0.08	0.09	14.93
5	13.25	14.82	14.66	14.87	14.31	15.03	14.50	15.35	11.52	12.95	15.16	15.34	5.17
6	0.25	0.36	0.72	2.03	2.31	2.42	2.65	4.29	4.14	3.89	4.34	4.66	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	14.26	15.96	16.15	17.68	17.37	18.19	17.84	20.40	16.33	17.50	20.13	20.62	20.75
PCE	1182.9	1253.3	1322.7	1355.2	1406.1	1455.5	1511.9	1560.0	1626.5	1593.0	1630.1	1636.4	1654.7

ID 20

	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.54	0.53	0.50	0.49	0.34	0.47	0.46	0.44	0.43	0.44	0.42	0.40	0.41
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.37	0.39	0.38	0.37
3	0.38	0.40	0.44	0.45	0.32	0.42	0.41	0.43	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.84	0.93	0.92	0.88	0.74	1.07	1.07	1.14	0.73	0.78	0.82	0.85	0.86
6	0.20	0.26	0.51	1.45	1.19	1.77	1.97	3.15	2.98	2.86	3.26	3.54	3.93
7	0.59	0.71	0.69	0.60	1.63	0.35	0.27	0.27	0.33	0.24	0.18	0.20	0.22
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.55	2.83	3.05	3.87	4.21	4.07	4.18	5.43	4.85	4.69	5.06	5.38	5.79
FCE	677.1	684.2	710.0	739.6	1111.9	811.8	836.8	851.0	869.1	956.0	942.5	937.6	946.2

Table A-10. The value structure of packaging by consumer product, 1958-70--Continued

(cents per dollar expenditure)

ID 21	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.37	0.40	0.41	0.46	0.45	0.43	0.42	0.44	0.36	0.39	0.37	0.39	0.35
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	2.34	2.50	2.35	2.25	1.50	1.67	1.37	1.06	1.47	1.08	7.68	0.64	0.71
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.71	2.90	2.76	2.71	1.96	2.10	1.79	1.50	1.82	1.48	2.04	1.03	1.07
PCE	147.3	168.6	166.3	167.6	169.5	168.1	164.2	161.6	157.7	157.0	148.5	146.9	149.9

ID 22	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.21	0.21	0.19	0.19	0.18	0.19	0.18	0.18	0.18	0.19	0.18	0.18	0.16
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.13	0.13	0.13	0.14	0.14	0.14	0.13	0.14	0.12	0.13	0.13	0.12	0.11
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.40	4.87	4.72	4.64	4.66	4.25	4.22	3.52	2.54	2.71	3.24	3.21	2.79
6	0.07	0.10	0.19	0.56	0.65	0.70	0.79	1.29	1.26	1.25	1.42	1.54	1.54
7	0.68	0.79	0.64	0.58	0.44	0.41	0.37	0.30	0.11	0.22	0.24	0.25	0.22
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	5.49	6.10	5.87	6.11	6.07	5.67	5.69	5.42	4.21	4.49	5.21	5.29	4.84
PCE	1431.6	1529.8	1725.1	1821.1	1904.5	1940.9	1987.0	2075.4	2115.1	2083.0	2130.5	2167.0	2494.3

ID 23	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.81	0.79	0.77	0.74	0.69	0.67	0.64	0.62	0.61	0.59	0.55	0.53	0.52
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.43	0.45	0.48	0.49	0.48	0.44	0.44	0.45	0.38	0.38	0.37	0.35	0.34
4	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.05	0.03	0.03	0.03	0.03	0.04
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.26	0.39	0.29	0.20	0.23	0.16	0.16	0.41	0.38	0.37	0.44	0.45	0.48
7	4.15	4.33	4.10	4.96	4.20	3.29	3.14	2.68	3.47	3.12	2.48	2.88	2.93
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.79	0.93	0.80	0.81	0.84	0.86	0.90	0.85	0.92	1.06	1.01	0.86	1.06
10	6.47	6.93	6.46	7.22	6.45	5.43	5.29	5.06	5.78	5.56	4.89	5.11	5.37
PCE	959.1	1001.9	1043.1	1096.9	1169.1	1211.3	1235.8	1305.4	1381.1	1440.0	1536.9	1584.4	1603.3

ID 24	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.75	0.72	0.70	0.67	0.64	0.62	0.59	0.58	0.60	0.59	0.56	0.55	0.54
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.40	0.42	0.43	0.46	0.43	0.40	0.41	0.41	0.37	0.39	0.37	0.36	0.35
4	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.03	0.03	0.03	0.04
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.23	0.36	0.27	0.18	0.21	0.14	0.14	0.38	0.38	0.37	0.45	0.47	0.51
7	3.78	3.92	3.62	4.49	3.91	3.04	2.94	2.48	3.59	2.49	2.51	2.93	2.99
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	4.77	5.28	4.71	4.66	4.21	4.30	4.40	4.33	4.55	4.64	4.56	5.11	5.12
10	9.95	10.72	9.74	10.48	9.43	8.52	8.50	8.23	9.51	8.41	8.48	9.45	9.55
PCE	396.9	415.8	439.0	469.1	478.6	498.9	535.6	555.2	580.1	742.0	669.3	673.6	693.5

Table A-10.   The value structure of packaging by consumer product, 1958-70--Continued
(cents per dollar expenditure)

ID 25	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.71	0.71	0.69	0.67	0.68	0.68	0.65	0.57	0.52	0.58	0.56	0.59	0.61
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.37	0.40	0.43	0.45	0.47	0.44	0.44	0.41	0.33	0.38	0.39	0.39	0.39
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.22	0.33	1.83	1.24	1.47	1.11	1.19	1.86	1.76	1.76	2.42	3.30	3.52
7	4.18	4.36	4.33	3.91	3.37	3.78	3.47	2.17	2.57	2.45	2.84	2.96	3.23
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.59	0.84	0.82	0.81	0.79	1.06	0.76	0.94	0.66	0.68	0.70	0.81	0.80
10	6.07	6.64	8.09	7.09	6.78	7.06	6.51	5.95	5.84	6.85	6.95	8.08	8.35
PCE	457.6	469.8	493.1	542.0	543.2	549.5	600.4	714.7	832.1	858.9	866.0	969.3	888.1

ID 26	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.88	0.83	0.80	0.77	0.72	0.70	0.68	0.64	0.60	0.59	0.56	0.56	0.55
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.47	0.48	0.50	0.52	0.50	0.46	0.47	0.46	0.38	0.37	0.37	0.37	0.35
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.29	0.41	2.11	1.43	1.58	1.15	1.24	2.08	2.03	1.76	2.29	2.64	3.02
7	5.10	5.17	4.91	4.43	3.62	3.95	3.56	2.37	2.84	2.21	2.24	2.57	2.02
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	6.73	6.89	8.33	7.15	6.42	6.27	5.95	5.55	5.84	5.93	5.36	6.43	6.84
PCE	465.6	478.0	496.8	531.1	589.8	652.5	837.4	943.7	1055.1	1092.0	1143.0	1122.5	1216.7

ID 27	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.78	0.76	0.74	0.71	0.68	0.66	0.63	0.62	0.63	0.59	0.57	0.55	0.52
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.43	0.45	0.46	0.48	0.47	0.43	0.43	0.43	0.39	0.38	0.37	0.35	0.34
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.27	0.38	1.96	1.33	1.47	1.08	1.16	1.99	2.05	1.75	2.15	2.45	2.24
7	4.37	4.68	4.53	4.08	3.61	2.22	3.31	2.30	2.90	2.33	2.32	2.20	2.05
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.63	0.55	0.38	0.29	0.23	0.19	0.19	0.19	0.19	0.11	0.12	0.11	0.11
10	6.49	6.81	8.06	6.89	6.46	4.59	5.72	5.53	6.12	5.43	5.73	6.75	6.86
PCE	251.3	270.5	296.2	317.7	342.7	363.4	373.5	400.0	438.5	326.9	552.7	585.6	625.2

ID 28	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.76	0.75	0.73	0.71	0.68	0.65	0.64	0.62	0.60	0.39	0.58	0.56	0.56
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.40	0.43	0.45	0.46	0.48	0.43	0.44	0.44	0.38	0.37	0.38	0.37	0.37
4	0.60	0.56	0.48	0.46	0.43	0.39	0.32	0.42	0.19	0.27	0.23	0.23	0.21
5	29.05	35.99	36.60	34.23	33.27	37.75	36.06	38.59	30.50	29.11	28.76	25.12	22.56
6	0.25	0.39	1.95	1.30	1.47	1.09	1.17	2.01	2.03	1.76	2.34	3.13	3.07
7	4.28	4.65	4.46	4.21	3.35	3.96	3.48	2.50	3.33	3.09	2.78	2.90	2.93
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	35.34	42.77	44.68	41.36	39.67	44.27	42.12	44.57	37.03	35.19	35.09	32.31	29.69
PCE	135.4	142.6	150.7	167.5	175.9	184.2	226.0	252.5	312.3	331.0	368.9	424.2	476.4

Table A-10. The value structure of packaging by consumer product, 1958-70--Continued

(cents per dollar expenditure)

ID 29	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.65	0.65	0.65	0.64	0.62	0.62	0.60	0.57	0.60	0.59	0.59	0.56	0.58
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.35	0.37	0.40	0.42	0.43	0.40	0.41	0.40	0.38	0.38	0.39	0.37	0.37
4	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.01	0.03	0.03	0.04
5	2.44	2.88	2.99	2.54	2.44	2.77	2.99	2.85	2.66	2.92	3.18	3.60	3.53
6	0.21	0.32	0.24	0.17	0.20	0.14	0.14	0.37	0.38	0.37	0.47	0.48	0.53
7	3.34	3.55	3.39	3.82	3.21	3.02	2.94	2.42	2.88	2.72	2.65	3.04	3.19
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	7.01	7.79	7.68	7.61	6.91	6.97	7.09	6.65	6.93	6.99	7.30	8.09	8.25
PCE	2380.6	2443.8	2614.2	2800.4	2807.5	2805.6	2777.2	3011.6	3129.9	2924.0	3000.0	3091.5	3160.8

ID 30	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.19	0.19	0.19	0.19	0.18	0.17	0.17	0.16	0.15	0.15	0.14	0.14	0.13
2	0.10	0.13	0.14	0.16	0.22	0.20	0.26	0.30	0.29	0.29	0.30	0.32	0.33
3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
5	0.46	0.49	0.47	0.45	0.46	0.45	0.40	0.35	0.31	0.32	0.35	0.35	0.35
6	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.07	0.08	0.06	0.07	0.08	0.09
7	0.05	0.06	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01
8	0.33	0.32	0.27	0.31	0.31	0.22	0.27	0.29	0.30	0.20	0.20	0.34	0.36
9	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10	1.20	1.26	1.19	1.25	1.28	1.14	1.19	1.21	1.17	1.06	1.11	1.27	1.29
PCE	93579.8	103107.0	106243.7	104182.3	113565.6	121605.6	133580.3	146795.3	160568.9	164900.0	178790.5	186488.3	191036.7

Source: Research Triangle Institute

Table A-11. The value structure of packaging by consumer product, 1958-70

(million 1967 dollars)

ID 1	58	59	60	61	62	63	64	65	66	67	68	69	70
1	37.04	38.84	41.08	39.63	41.43	42.58	43.08	46.23	49.01	50.88	50.37	49.37	48.94
2	87.09	102.19	111.41	113.58	130.94	118.99	127.73	124.01	119.65	126.49	129.30	133.71	140.95
3	3.41	3.44	3.56	3.81	4.15	3.94	4.18	4.48	4.06	4.33	4.43	4.15	4.32
4	4.87	5.75	4.52	5.34	5.42	6.02	5.09	5.44	4.56	8.49	8.30	6.58	8.69
5	86.40	102.89	107.03	110.46	114.22	127.42	143.19	156.51	178.45	187.51	188.48	191.79	201.06
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	29.35	30.79	37.62	47.20	49.38	46.59	57.03	73.91	68.10	50.24	59.98	64.11	67.54
9	12.03	15.97	18.10	19.97	22.29	21.27	24.38	30.46	30.15	27.43	30.43	34.43	35.24
10	260.19	299.86	323.33	339.98	367.83	366.81	405.08	441.06	453.99	464.37	471.30	484.13	506.74
PCE	7702.5	7851.3	7965.6	8103.5	8170.7	8211.7	8460.5	8610.9	8660.2	8589.0	8872.5	8901.3	8841.1

ID 2	58	59	60	61	62	63	64	65	66	67	68	69	70
1	82.60	87.23	87.18	86.82	88.02	103.74	101.55	106.06	107.18	94.82	97.28	95.14	92.07
2	21.41	20.70	20.19	19.07	25.03	32.94	33.10	33.40	38.31	38.65	38.07	38.31	50.99
3	6.55	6.54	6.02	7.09	7.46	7.10	7.30	7.55	6.36	6.33	6.53	6.15	6.37
4	7.79	8.79	7.43	7.16	6.93	7.03	7.41	7.17	5.97	5.99	5.71	4.84	5.52
5	198.07	222.56	220.85	218.02	243.62	229.85	254.00	276.88	298.04	304.12	321.11	339.55	367.78
6	1.17	1.48	4.02	5.27	6.06	6.09	6.09	7.07	4.43	8.84	23.76	16.18	27.74
7	11.43	12.01	10.88	9.66	8.98	8.13	7.86	7.38	6.37	5.63	5.98	6.13	2.69
8	15.31	13.53	12.53	14.53	16.67	17.38	15.01	17.06	22.42	27.04	29.30	25.56	25.20
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	344.32	372.82	369.91	367.64	402.76	411.64	435.31	459.92	493.99	506.45	520.11	543.46	586.58
PCE	14743.9	14776.9	14951.4	14863.0	14979.8	15200.2	15205.1	15108.9	14864.3	12021.0	12651.5	12776.8	12681.6

ID 3	58	59	60	61	62	63	64	65	66	67	68	69	70
1	13.23	13.86	14.52	14.38	15.05	15.64	15.88	17.28	18.58	20.65	30.16	30.05	29.42
2	20.82	23.18	23.69	23.87	30.69	34.69	34.40	35.17	40.96	48.53	51.17	52.86	53.70
3	1.23	1.21	1.29	1.37	1.54	1.43	1.52	1.65	1.54	2.47	2.64	2.50	2.58
4	23.05	30.35	32.21	36.59	43.06	44.32	50.72	47.54	46.23	31.89	24.19	32.79	40.18
5	31.98	36.72	37.84	40.13	41.49	46.86	52.30	58.54	67.64	109.10	112.41	116.83	120.90
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	5.65	6.16	7.58	9.82	13.19	16.31	16.60	23.35	29.31	32.56	36.45	35.49	33.52
9	4.30	5.71	6.40	7.25	8.09	7.82	8.90	11.41	11.42	15.56	18.21	20.53	21.27
10	100.26	117.19	123.53	133.41	153.10	167.06	180.32	194.94	215.68	270.16	275.23	291.48	301.57
PCE	2304.3	2361.9	2435.9	2603.0	2698.4	2805.2	2940.3	3164.6	3283.8	4997.0	5324.6	5575.1	5524.8

ID 4	58	59	60	61	62	63	64	65	66	67	68	69	70
1	96.33	100.22	105.71	100.27	104.44	101.61	107.00	119.36	131.72	134.88	133.94	136.71	136.33
2	39.48	42.55	44.02	47.27	62.21	62.96	83.13	81.23	82.67	80.45	73.66	69.02	68.00
3	8.80	8.83	9.17	9.61	10.46	9.46	10.34	11.64	11.00	11.43	11.81	11.44	11.99
4	0.65	0.64	0.58	0.61	0.60	0.72	1.02	1.06	0.70	0.77	0.73	0.68	0.69
5	199.38	228.94	240.32	239.86	245.49	255.86	264.67	295.51	360.52	364.97	391.63	416.17	431.85
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	8.48	9.22	11.63	15.59	21.81	21.76	34.85	42.83	43.53	35.90	32.28	24.16	21.85
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	353.12	390.39	411.43	413.20	445.01	452.37	501.02	551.62	630.13	628.40	644.06	658.18	670.71
PCE	18403.9	19483.1	20488.5	20643.3	20756.9	20355.1	22071.0	22204.5	22160.8	22753.0	23168.1	22865.3	22807.0

Table A-11. The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 5	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.93	2.10	2.23	2.15	2.28	2.46	2.70	2.96	3.10	3.15	3.03	3.06	3.16
2	0.84	0.88	0.94	1.01	1.32	1.54	2.21	2.09	1.92	1.46	1.71	1.57	1.58
3	0.20	0.20	0.23	0.23	0.23	0.22	0.23	0.31	0.28	0.31	0.23	0.29	0.30
4	0.02	0.16	0.01	0.02	0.02	0.01	0.03	0.03	0.01	0.02	0.02	0.02	0.02
5	3.84	4.79	5.06	5.09	5.35	6.20	6.67	7.29	8.51	8.61	8.90	9.28	9.99
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.17	0.20	0.24	0.35	0.49	0.51	0.91	1.09	1.03	0.90	0.73	0.57	0.50
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	7.01	8.33	8.71	8.84	9.70	10.94	12.74	13.77	14.85	14.96	14.63	14.79	15.55
PCE	411.3	428.7	438.8	447.6	450.8	483.9	552.2	569.4	554.3	538.0	530.5	532.6	525.4

ID 6	58	59	60	61	62	63	64	65	66	67	68	69	70
1	15.23	14.87	15.70	13.81	14.78	15.50	15.44	17.71	19.69	18.82	18.74	19.21	18.72
2	6.22	6.38	6.60	6.51	8.80	9.62	12.00	12.05	12.35	11.18	10.24	9.76	9.35
3	1.36	1.28	1.36	1.30	1.46	1.43	1.52	1.73	1.68	1.62	1.63	1.64	1.67
4	0.15	1.44	0.13	0.14	0.14	0.13	0.13	0.13	0.11	0.11	0.09	0.09	0.09
5	31.51	33.91	35.68	32.96	34.68	39.02	38.25	43.81	53.89	50.85	54.83	58.46	59.26
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	1.35	1.36	1.72	2.15	3.09	3.31	5.03	6.35	6.47	4.97	4.48	3.03	2.98
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	55.81	59.24	61.20	56.87	62.95	69.02	72.37	81.78	94.17	87.55	90.01	92.60	92.07
PCE	2324.1	2437.3	2480.8	2596.9	2592.2	2742.0	3037.7	3055.3	3185.6	3171.0	3217.3	3283.5	3396.7

ID 7	58	59	60	61	62	63	64	65	66	67	68	69	70
1	44.19	44.54	47.93	45.30	48.77	49.57	52.30	55.48	56.48	58.77	60.59	59.29	60.70
2	47.75	51.77	55.63	56.96	84.52	94.96	98.92	92.41	110.03	111.07	114.36	118.92	126.77
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	99.27	110.62	116.69	117.86	123.94	135.41	139.53	149.91	164.39	169.80	188.14	188.75	200.41
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	2.17	2.20	2.61	3.48	4.53	5.59	6.04	8.76	10.34	9.55	11.46	11.45	11.17
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	193.38	209.13	222.85	223.60	261.77	285.53	296.79	306.56	341.24	349.59	374.55	378.41	399.05
PCE	9297.5	9656.2	9581.6	9883.6	10212.9	9723.0	9818.6	9897.9	9780.3	9921.0	9799.8	9943.3	10267.4

ID 8	58	59	60	61	62	63	64	65	66	67	68	69	70
1	21.03	22.64	24.29	22.56	21.91	22.15	24.13	27.98	30.09	32.42	32.33	32.05	32.06
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	41.19	46.81	49.14	49.59	50.36	54.28	54.75	58.32	71.18	76.04	78.05	78.34	76.94
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	54.16	62.78	60.57	61.56	64.39	58.01	63.59	67.90	71.01	78.68	90.63	96.99	108.16
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	116.38	132.22	134.00	133.71	136.66	134.44	142.47	154.19	172.28	187.74	201.02	207.38	217.16
PCE	5180.8	5340.1	5514.1	5813.7	5900.3	5968.2	6312.9	6576.4	6673.1	6969.0	7175.5	7122.9	7060.9

Table A-11.   The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 9

ID 9	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	27.22	31.52	33.38	32.43	31.49	31.73	33.66	34.56	33.55	35.77	41.37	52.67	62.04
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	27.22	31.52	33.38	32.43	31.49	31.73	33.66	34.56	33.55	35.77	41.37	52.67	62.04
PCE	669.9	681.4	660.1	714.6	713.4	772.2	808.8	839.3	921.1	938.0	949.9	1297.6	1288.8

ID 10

ID 10	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	114.51	117.81	119.98	126.94	129.12	122.80	133.56	140.90	121.65	142.36	137.43	142.33	141.41
4	0.00	0.00	0.00	0.00	0.00	3.59	2.62	2.66	2.57	2.42	3.01	2.61	3.06
5	43.54	49.46	47.89	45.34	46.58	50.09	50.27	53.66	66.28	65.14	67.86	70.43	71.02
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	79.08	67.97	88.77	114.02	132.85	145.32	161.04	178.40	195.43	214.35	250.82	326.76	366.33
8	286.81	308.08	315.24	347.43	339.83	336.09	318.64	360.50	394.78	349.95	407.81	373.81	465.90
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.41	123.23	118.20	132.52
10	523.95	543.22	571.87	633.73	648.37	657.89	666.12	736.11	780.72	864.63	990.16	1034.14	1180.24
PCE	5552.4	5662.0	5482.9	5442.4	5571.6	5702.4	5908.2	6106.4	6244.1	6137.0	6151.8	6226.8	6279.2

ID 11

ID 11	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.90	4.39	4.79	4.40	4.33	4.42	4.70	5.87	6.55	7.03	7.22	7.43	7.63
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	21.29	22.91	23.65	24.72	25.53	24.59	26.01	29.56	26.54	30.74	30.69	33.03	33.61
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	15.92	18.71	19.11	18.53	19.12	20.84	20.42	23.47	29.96	30.87	32.55	34.53	35.18
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	70.26	74.99	79.37	72.47	92.26	103.93	113.30	133.44	178.69	241.72	321.82	525.41	649.87
8	12.83	16.79	26.85	45.30	61.84	70.79	92.63	144.13	205.05	271.05	351.77	355.96	399.72
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.53	39.67	46.47	74.34
10	124.20	137.79	153.77	165.42	203.08	224.57	257.06	336.47	447.79	595.64	783.72	1002.83	1200.35
PCE	2713.9	2778.2	2788.2	2756.8	2823.5	2782.8	2722.0	3029.6	3151.8	3032.0	3044.0	3140.1	3148.7

ID 12

ID 12	58	59	60	61	62	63	64	65	66	67	68	69	70
1	5.82	5.41	5.82	5.28	4.93	4.89	5.69	6.08	6.25	6.42	6.32	6.29	6.85
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.50	1.35	1.36	1.45	1.46	1.36	1.60	1.57	1.40	1.47	1.40	1.36	1.52
4	1.95	1.76	1.60	1.83	2.26	2.15	2.18	1.86	1.99	2.75	2.18	1.93	1.88
5	33.86	34.49	35.52	35.16	34.38	37.62	40.96	40.61	44.68	45.68	47.17	48.96	54.17
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	1.74	5.36	3.54	6.05	8.40
7	110.65	107.64	111.70	108.32	108.19	102.62	119.67	120.35	114.50	124.42	125.71	140.71	166.01
8	73.06	75.56	78.33	92.92	90.73	81.49	72.46	80.90	78.55	88.07	89.16	84.77	83.55
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
10	226.84	226.21	230.33	244.96	241.95	230.14	242.57	252.26	249.26	274.37	275.48	290.11	322.43
PCE	2546.8	2712.5	2810.6	2893.8	2941.6	3033.1	2840.0	2670.7	2684.7	2847.0	2889.6	3029.3	2762.7

Table A-11. The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 13	58	59	60	61	62	63	64	65	66	67	68	69	70
1	13.09	13.88	14.77	14.28	14.96	15.37	15.47	16.23	17.44	17.16	18.10	18.07	18.78
2	44.66	49.33	51.47	53.31	60.99	66.62	76.10	70.96	84.25	84.92	83.10	92.73	98.78
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	7.31	7.51	6.56	7.16	6.93	7.03	7.70	8.37	6.67	8.54	7.27	7.64	7.01
5	29.33	34.53	35.91	37.17	38.05	42.03	41.30	39.27	50.70	52.78	56.16	57.49	60.57
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	14.83	15.66	19.31	24.39	32.77	37.78	44.81	56.18	78.27	87.00	97.47	116.20	130.87
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	109.21	120.91	128.02	136.32	157.69	168.83	185.38	191.01	237.34	250.41	262.10	292.14	316.00
PCE	2356.2	2375.9	2524.3	2934.5	3035.1	3034.4	2762.9	2888.7	3332.2	3087.0	2959.3	2810.7	2840.2

ID 14	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.46	2.43	2.50	2.82	2.92	2.80	2.81	3.07	2.73	3.09	3.19	2.93	3.11
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	31.83	36.22	36.93	37.13	37.11	41.31	39.15	41.71	51.05	54.86	56.55	56.04	57.67
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	90.64	103.42	107.41	105.91	111.49	113.20	112.37	121.45	120.28	143.05	150.76	162.07	178.12
8	881.05	866.77	940.24	1082.49	1139.00	966.04	969.66	1077.82	1111.95	1221.58	1311.81	1194.60	1268.49
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.07	28.16	28.52	46.14
10	1005.99	1008.84	1087.09	1228.35	1290.52	1123.35	1123.99	1244.05	1286.01	1444.05	1550.07	1444.22	1553.54
PCE	5004.4	5062.1	5272.5	5569.8	5489.3	5718.4	5685.2	5921.5	5790.4	6073.0	6091.7	6260.5	6147.8

ID 15	58	59	60	61	62	63	64	65	66	67	68	69	70
1	8.49	8.73	9.16	8.77	9.21	9.79	10.05	10.87	11.20	11.50	11.73	11.62	11.39
2	4.77	4.91	4.89	4.56	6.39	7.13	7.95	7.23	8.33	12.07	12.12	13.30	13.90
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	13.34	14.86	15.19	14.88	15.30	16.66	16.50	17.63	21.56	21.89	22.40	21.82	22.68
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	26.60	28.50	29.23	28.21	30.91	33.58	34.50	35.73	41.09	46.25	46.26	46.74	47.97
PCE	1972.8	1968.4	1983.9	2009.0	2028.6	2078.2	2147.0	2216.4	2186.3	2171.0	2230.1	2261.4	2217.6

ID 16	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.21	1.35	1.34	1.38	1.34	1.35	1.43	1.56	1.75	1.76	1.86	1.86	2.04
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.05	2.22	2.43	2.67	2.77	2.65	2.89	3.15	2.94	3.24	3.34	3.43	3.57
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54	1.87	2.51	3.95
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	60.51	61.71	68.28	76.15	87.14	79.40	80.05	93.24	100.31	122.65	134.33	123.85	140.94
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08
10	63.77	65.28	72.04	80.20	91.25	83.40	84.37	97.95	105.00	129.19	141.40	131.73	154.97
PCE	542.4	560.4	574.7	596.1	622.9	650.5	683.0	735.5	794.5	849.0	904.8	970.7	1031.5

Table A-11. The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 17	58	59	60	61	62	63	64	65	66	67	68	69	70
1	27.62	26.61	27.80	27.96	27.84	28.51	27.16	26.00	25.71	27.11	26.69	25.84	26.65
2	23.73	25.17	25.20	25.20	29.61	28.90	27.96	38.98	44.93	39.49	42.50	45.89	42.98
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	13.47	16.93	13.56	16.62	15.06	14.92	14.24	14.08	12.99	10.34	8.72	8.12	8.59
5	66.39	49.65	40.74	35.77	35.99	34.73	33.87	33.09	51.09	54.25	56.64	58.77	59.73
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	8.70	8.80	10.45	12.67	16.90	18.63	20.37	38.45	51.03	51.55	63.73	72.12	71.77
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	139.90	127.17	117.74	118.21	125.39	125.69	123.61	150.61	185.75	182.74	198.28	210.74	209.71
PCE	7519.4	7952.1	8192.3	8485.0	8571.3	8837.6	8751.3	8992.3	9201.7	9293.0	9132.3	8946.8	9094.0

ID 18	58	59	60	61	62	63	64	65	66	67	68	69	70
1	17.77	18.91	20.23	19.58	20.34	21.52	21.46	23.04	24.62	23.63	23.93	23.61	23.77
2	34.84	39.77	34.04	32.18	31.03	77.92	22.19	24.45	29.30	47.36	58.91	59.33	74.43
3	2.66	2.83	2.88	3.13	3.31	3.23	3.35	3.54	3.22	3.40	3.34	3.15	3.34
4	7.39	9.59	8.32	8.99	8.73	8.75	11.48	13.88	12.64	29.58	23.77	28.34	22.31
5	61.56	76.48	79.83	82.89	84.96	95.58	96.76	105.91	121.61	117.61	124.02	126.60	133.17
6	12.50	19.01	35.98	39.72	41.61	43.76	47.67	27.03	37.96	71.45	67.16	76.26	83.95
7	140.35	152.67	160.67	157.11	169.58	165.92	169.64	187.97	192.60	192.60	195.17	219.87	248.04
8	41.38	40.86	40.51	48.78	47.42	53.62	38.53	37.74	35.89	57.35	50.05	52.73	65.77
9	3.45	4.70	5.29	5.85	6.60	6.29	7.24	9.16	9.11	7.49	8.75	9.91	10.34
10	321.90	364.82	387.75	398.24	413.57	476.58	416.31	432.72	466.95	550.48	559.11	599.79	665.11
PCE	5564.8	5895.8	6168.9	6333.6	6530.4	6612.7	6530.7	6686.3	6751.9	6521.0	6565.4	6646.3	6789.1

ID 19	58	59	60	61	62	63	64	65	66	67	68	69	70
1	9.05	9.31	9.46	9.32	9.18	9.38	9.30	9.39	9.64	9.40	9.13	8.67	8.87
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.48	0.73	1.22	1.51	1.43	1.16	2.52	1.29	1.21	1.25	1.55	1.97
5	156.74	185.72	193.85	201.51	201.16	218.70	219.26	230.41	187.31	206.22	247.10	251.08	247.07
6	2.92	4.52	9.52	27.55	32.42	35.16	40.06	66.96	67.38	61.93	70.69	76.18	85.50
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	168.71	200.03	213.56	239.60	244.26	264.68	269.78	318.27	265.61	278.76	328.16	337.48	343.42
PCE	1182.9	1253.3	1322.7	1355.2	1406.1	1455.5	1511.9	1560.0	1626.5	1593.0	1630.1	1636.4	1654.7

ID 20	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.66	3.62	3.55	3.62	3.75	3.83	3.82	3.77	3.71	4.17	3.95	3.78	3.86
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.59	2.76	3.11	3.36	3.54	3.37	3.42	3.62	3.29	3.55	3.65	3.57	3.49
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.66	6.39	6.52	6.49	8.19	8.67	8.93	9.73	6.37	7.45	7.74	8.01	8.17
6	1.34	1.75	3.63	10.75	13.21	14.46	16.52	26.80	25.91	27.38	30.71	33.21	37.17
7	4.02	4.83	4.88	4.42	18.09	2.81	2.25	2.30	2.89	2.27	1.67	1.83	2.06
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	17.26	19.35	21.69	28.65	46.78	33.07	34.95	46.22	42.17	44.83	47.73	50.40	54.74
PCE	677.1	684.2	710.0	739.6	1111.9	811.8	835.8	851.0	869.1	956.0	922.5	937.6	946.2

Table A-11. The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 21	58	59	60	61	62	63	64	65	66	67	68	69	70
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.55	0.67	0.68	0.76	0.77	0.72	0.68	0.71	0.56	0.62	0.54	0.57	0.53
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	3.45	4.22	3.91	3.78	2.55	2.21	2.25	1.72	2.32	1.70	11.40	0.95	1.07
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	4.00	4.89	4.59	4.54	3.32	3.52	2.94	2.43	2.88	2.32	11.94	1.52	1.60
PCE	147.3	168.6	166.3	167.6	169.5	168.1	164.2	161.6	157.7	157.0	148.5	146.9	149.9

ID 22	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.00	3.25	3.30	3.42	3.50	3.62	3.62	3.75	3.84	3.94	3.91	3.80	3.97
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.84	2.02	2.20	2.52	2.61	2.51	2.66	2.83	2.52	2.70	2.72	2.65	2.73
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	62.98	74.48	81.44	84.52	88.74	82.46	83.76	72.97	53.62	56.44	68.98	69.06	68.41
6	1.00	1.57	3.34	10.19	12.43	13.64	15.60	26.72	26.74	25.96	30.24	33.35	38.26
7	9.78	12.06	11.00	10.63	8.31	7.83	7.31	6.31	2.31	4.55	5.14	5.02	5.33
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	78.61	93.38	101.28	111.28	115.59	110.10	112.96	112.57	89.03	93.59	110.98	114.66	118.69
PCE	1431.6	1529.8	1725.1	1821.1	1904.5	1940.9	1987.0	2075.4	2115.1	2083.0	2130.5	2167.0	2454.3

ID 23	58	59	60	61	62	63	64	65	66	67	68	69	70
1	7.74	7.94	8.07	8.08	8.10	8.11	7.94	8.15	8.40	8.50	8.53	8.46	8.40
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	4.16	4.52	5.00	5.42	5.61	5.31	5.48	5.82	5.25	5.48	5.67	5.50	5.46
4	0.32	0.32	0.15	0.15	0.15	0.14	0.15	0.66	0.35	0.49	0.42	0.48	0.59
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	2.51	3.88	3.04	2.18	2.64	1.90	1.94	5.33	5.21	5.36	6.81	7.20	7.74
7	39.77	43.41	42.72	54.46	49.11	39.87	38.81	34.98	47.95	40.87	38.10	45.56	46.92
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	7.54	9.35	8.36	8.85	9.81	10.42	11.07	11.11	12.64	15.28	15.59	13.70	17.03
10	62.04	69.42	67.35	79.14	75.43	65.75	65.38	66.05	79.81	80.00	75.12	80.90	86.13
PCE	959.1	1001.9	1043.1	1096.9	1169.1	1211.3	1235.8	1305.4	1381.1	1440.0	1536.9	1584.4	1603.3

ID 24	58	59	60	61	62	63	64	65	66	67	68	69	70
1	2.97	3.01	3.05	3.16	3.06	3.10	3.17	3.23	3.48	4.39	3.75	3.71	3.77
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.57	1.75	1.89	2.14	2.08	2.01	2.21	2.28	2.17	2.86	2.49	2.43	2.43
4	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.27	0.12	0.22	0.21	0.19	0.30
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.92	1.48	1.18	0.84	1.02	0.71	0.76	2.13	2.19	2.78	3.00	3.18	3.50
7	14.99	16.28	15.87	21.07	18.72	15.17	15.75	13.77	20.80	22.16	16.78	19.73	20.74
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	18.94	21.95	20.66	21.85	20.16	21.47	23.58	24.04	26.39	30.00	30.55	34.42	35.47
10	39.48	44.56	42.75	49.15	45.13	42.93	45.54	45.71	55.15	62.40	56.76	63.66	66.21
PCE	396.9	415.8	439.0	469.1	478.6	498.9	535.6	555.2	580.1	702.0	669.3	673.6	693.5

Table A-11. The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 25	58	59	60	61	62	63	64	65	66	67	68	69	70
1	3.23	3.32	3.40	3.65	3.70	3.74	3.89	4.09	4.32	4.96	5.08	5.10	5.38
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.71	1.89	2.12	2.44	2.54	2.44	2.66	2.91	2.73	3.17	3.34	3.36	3.49
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	1.00	1.57	9.03	6.75	7.98	6.09	7.13	13.28	14.65	14.72	20.84	28.71	29.50
7	19.12	20.49	21.33	21.19	18.30	20.75	20.80	15.50	21.37	22.18	24.43	26.01	28.70
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	2.70	3.93	4.02	4.37	4.30	5.80	4.57	6.72	5.50	5.66	6.05	7.02	7.09
10	27.76	31.20	39.91	38.41	36.82	38.81	39.06	42.49	48.58	50.69	59.74	70.20	74.16
PCE	457.6	469.8	493.1	542.0	543.2	549.5	600.4	714.7	832.1	838.0	860.0	869.3	888.1

ID 26	58	59	60	61	62	63	64	65	66	67	68	69	70
1	4.08	3.98	3.97	4.09	4.26	4.60	5.70	6.06	6.30	6.07	6.39	6.28	6.70
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	2.18	2.29	2.50	2.75	2.92	3.01	3.96	4.32	3.99	4.09	4.20	4.15	4.32
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	1.34	1.94	10.50	7.59	9.31	7.50	10.37	19.59	21.45	19.18	26.15	29.61	36.80
7	23.75	24.71	24.38	23.54	21.38	25.80	29.81	22.46	30.03	28.45	30.22	32.20	35.60
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	31.35	32.93	41.36	37.97	37.86	40.91	49.83	52.37	61.78	58.19	66.96	72.24	83.42
PCE	465.6	478.0	496.8	531.1	589.8	652.5	837.4	943.7	1055.7	1092.0	1143.0	1122.9	1218.7

ID 27	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.97	2.05	2.19	2.27	2.32	2.39	2.35	2.47	2.65	3.10	3.13	3.08	3.25
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.09	1.21	1.36	1.53	1.61	1.58	1.60	1.73	1.68	2.01	2.02	2.07	2.12
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.67	1.02	5.79	4.22	5.04	3.91	4.32	7.95	8.99	9.23	12.73	17.30	17.74
7	10.99	12.65	13.41	12.96	12.37	8.68	12.37	9.20	12.70	13.65	13.17	16.41	17.80
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	1.59	1.49	1.12	0.91	0.78	0.71	0.72	0.78	0.82	0.57	0.64	0.67	0.71
10	16.31	18.42	23.87	21.88	22.14	16.66	21.36	22.12	26.85	28.56	31.69	39.53	41.62
PCE	251.3	270.5	296.2	317.7	342.7	363.4	373.5	400.0	438.5	526.0	552.7	585.6	625.2

ID 28	58	59	60	61	62	63	64	65	66	67	68	69	70
1	1.03	1.08	1.09	1.18	1.19	1.21	1.45	1.57	1.86	1.96	2.14	2.37	2.68
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.55	0.61	0.68	0.76	0.85	0.79	0.99	1.10	1.19	1.24	1.40	1.57	1.74
4	0.81	0.80	0.73	0.76	0.75	0.72	0.73	1.06	0.59	0.88	0.83	0.97	0.99
5	39.34	51.31	55.14	57.33	58.51	69.53	81.50	97.43	95.27	96.36	106.18	106.54	107.51
6	0.33	0.55	2.94	2.18	2.58	2.01	2.65	5.08	6.34	5.81	8.65	13.28	14.60
7	5.79	6.63	6.71	7.06	5.89	7.29	7.88	6.31	10.40	10.23	10.27	12.31	13.04
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	47.86	60.97	67.31	69.28	69.78	81.54	95.19	112.56	115.66	116.48	129.47	137.04	141.46
PCE	135.4	142.6	150.7	167.5	175.9	184.2	226.0	252.5	312.3	331.0	368.9	424.2	476.4

Table A-11. The value structure of packaging by consumer product, 1958-70--Continued

(million 1967 dollars)

ID 29	58	59	60	61	62	63	64	65	66	67	68	69	70
1	15.58	15.91	16.93	17.87	17.41	17.28	16.60	17.11	18.87	17.25	17.63	17.32	18.18
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	8.39	9.10	10.54	11.90	12.07	11.26	11.41	12.19	11.91	11.12	11.65	11.51	11.76
4	0.50	0.50	0.47	0.49	0.48	0.46	0.47	1.39	0.74	0.27	0.98	0.94	1.38
5	57.97	70.28	78.07	71.08	58.39	77.78	83.01	85.72	83.38	83.35	95.38	111.42	111.71
6	5.01	7.75	6.38	3.78	5.64	4.02	4.00	11.15	11.78	10.91	14.16	14.04	16.79
7	79.52	86.83	88.52	106.98	90.11	84.80	81.55	72.83	90.10	79.61	79.39	93.92	100.88
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	166.98	190.37	200.90	213.10	194.11	195.60	197.03	200.38	216.77	204.52	215.11	250.05	260.70
PCE	2380.6	2443.8	2614.2	2800.4	2807.5	2805.6	2777.2	3011.6	3129.9	2924.0	3000.0	3091.5	3160.8

ID 30	58	59	60	61	62	63	64	65	66	67	68	69	70
1	179.04	198.05	203.56	200.27	205.68	203.64	221.02	233.12	246.28	239.28	255.47	258.85	251.96
2	96.49	138.98	145.91	166.39	252.27	247.92	352.61	436.01	465.00	483.42	528.84	590.59	631.57
3	9.83	11.32	11.98	12.28	12.69	13.41	13.92	15.25	13.90	13.36	13.67	13.23	13.12
4	17.42	18.10	16.21	15.73	16.89	19.10	22.70	19.39	20.42	12.97	20.97	17.73	17.38
5	426.60	504.39	495.67	473.22	518.78	543.41	528.54	508.81	500.54	535.19	632.41	657.14	669.77
6	26.29	30.08	38.83	43.17	45.75	45.12	50.53	99.47	122.52	95.17	125.24	144.64	164.68
7	48.32	59.71	59.84	52.92	41.25	37.09	29.81	28.70	25.46	23.31	20.61	22.43	22.21
8	312.56	330.32	287.17	326.75	347.11	272.69	365.39	427.58	474.26	337.91	355.78	637.91	682.33
9	7.15	8.01	7.55	7.35	8.17	7.43	8.14	10.13	10.56	12.74	16.06	17.17	19.32
10	1123.70	1298.96	1267.72	1298.08	1448.59	1389.80	1593.05	1778.46	1882.90	1753.76	1977.05	2359.68	2472.34
PCE	93579.6	103107.0	106243.7	104182.3	113565.6	121605.6	133580.3	146795.3	160568.9	160900.0	178790.5	186488.3	191036.7

ID 31	58	59	60	61	62	63	64	65	66	67	68	69	70
1	620.80	655.10	681.10	663.50	681.80	700.00	729.70	775.40	818.70	822.20	841.40	841.00	835.50
2	428.10	505.80	525.00	549.90	727.80	784.20	878.30	958.00	1041.70	1086.00	1144.00	1226.00	1313.00
3	200.50	209.20	217.30	231.00	237.70	227.40	244.30	261.90	233.00	261.00	258.00	263.00	265.00
4	85.80	103.20	93.30	102.90	109.00	116.60	127.90	127.50	118.00	117.90	110.50	118.00	125.00
5	1736.70	1994.20	2034.40	2015.00	2118.40	2233.50	2297.60	2416.20	2566.20	2701.20	2964.70	3077.50	3175.00
6	57.00	76.60	134.20	165.20	185.70	184.30	208.60	315.80	361.70	380.00	440.00	511.70	580.20
7	843.30	904.74	945.35	980.48	1005.30	981.38	1029.73	1065.04	1178.76	1289.21	1437.45	1807.37	2076.50
8	1754.20	1788.00	1860.30	2150.01	2271.90	2027.98	2136.00	2489.89	2712.30	2757.49	3040.59	3176.72	3476.10
9	57.70	71.10	71.50	76.40	80.20	81.20	88.60	103.80	106.60	242.14	317.32	331.58	399.60
10	5784.09	6307.93	6562.43	6934.38	7413.79	7336.55	7740.71	8514.91	9136.05	9457.13	10553.94	11352.86	12245.88
PCE	196875.4	269949.1	216015.3	216877.9	228353.5	236958.3	251902.9	267900.1	283287.5	288068.9	303431.1	312319.9	317611.6

Source: Research Triangle Institute

Appendix B: TRENDS IN CONSUMER EXPENDITURES AND PACKAGING

B.1   Introduction

Consumption patterns and packaging trends were analyzed for each
of the 30 consumer products* to provide a basis for identifying and
projecting probable future trends in packaging solid wastes.

The methodology employed to project 1980 packaging consumption
was discussed in detail in chapter 3. Market shares of each of the
30 products were projected to 1980, extrapolating data from 1958
to 1971 (table B-1). Total expenditures on each consumer product
were calculated from the estimated market shares and total personal
consumption projections provided by the Bureau of Labor Statistics
(table B-2). A statistical linear time trend was extrapolated to
estimate the consumption of packaging by weight per $100 of commodity
expenditure in 1980 (table B-3); total packaging for each consumer
commodity was computed as the product of total expenditures and
packaging per $100 of expenditure (table B-4).

Although the approach yielded estimates of packaging for
each consumer product, the individual projections must be considered
less reliable than the aggregate estimate. However, an analysis
of trends in the packaging technology of each consumer product
and the changing role of each consumer product package provides
insights into the determinants of the aggregate trends. Packaging
requirements and competitive trends in materials application within
each consumer product are discussed below.

B.2   Baked Goods (1)

Purchases of Baked Goods* accounted for 2.8 percent of consumer
expenditures on goods in 1970, and 2.7 percent of all consumer
products packaging on a weight basis. Baked Goods include such
products as bread and rolls, crackers and cookies, and sweet goods.
Most of these products are "fresh baked goods," which must be sold
within a very short time after baking.

Consumer expenditures on Baked Goods increased 1.16 percent
annually over the 1958-70 period, primarily due to population growth
and the increases in consumer expenditures for higher quality and

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*The 30 product categories (see table B-2) are capitalized herein.

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Table B-1. Market share trends for consumer products
(percent)

Consumer product (consumer product category number)	Observed 1958	1971	Predicted 1980	Estimated equation
A. Consumer Expenditures on Food and Kindred Products as Share of Total Food Expenditures				
Baked Goods (1)	8.82	8.46	8.35	8.703 - 0.016Y $R^2 = 0.525$ (118.16) (3.64)
Dairy Products (2)	16.89	12.34	8.28	17.186 - 0.404Y $R^2 = 0.893$ (12.78) (9.99)
Frozen Foods (3)	2.64	5.46	7.60	2.011 + 0.263Y $R^2 = 0.831$ (14.20) (7.67)
Fresh and Cured Meat (4)	21.08	22.29	22.95	21.575 + 0.063Y $R^2 = 0.350$ (58.02) (2.54)
Fresh and Cured Fish and Seafood (5)	0.47	0.48	0.50	Estimated at 1958-1971 average share
Fresh and Cured Poultry (6)	2.66	3.29	3.81	2.630 + 0.053Y $R^2 = 0.919$ (51.99) (11.59)
Produce (7)	10.65	9.84	8.76	10.655 - 0.086Y $R^2 = 0.743$ (37.35) (5.89)
Distilled Spirits (8)	5.93	7.10	7.96	5.855 + 0.095Y $R^2 = 0.942$ (72.31) (13.92)
Wine (9)	0.77	1.21	1.53	0.643 + 0.040Y $R^2 = 0.780$ (15.46) (6.53)
Beer (10)	6.36	6.02	6.04	Estimated at 1958-1971 average share
Soft Drinks (11)	3.11	2.99	3.00	Estimated at 1958-1971 average share
Prepared Beverages (12)	2.92	2.82	2.52	3.055 - 0.024Y $R^2 = 0.379$ (17.42) (2.71)
Candy and Chewing Gum (13)	2.70	2.70	2.90	Estimated at 1958-1971 average share
Canned Foods (14)	5.70	5.58	5.83	Estimated at 1958-1971 average share
Cereals, Flour, and Macaroni (15)	2.25	2.14	2.17	Estimated at 1958-1971 average share
Pet Foods (16)	0.62	0.99	1.27	0.552 + 0.033Y $R^2 = 0.930$ (30.64) (12.59)
Tobacco Products (17)				Market shares of tobacco products and other general merchandise were not estimated; personal consumption expenditures in 1980 for these categories were projected by Bureau of Labor Statistics
Other Foods (18)	6.43	6.29	6.33	Estimated as residual share of foods
B. Consumer Expenditures on Household Supplies Subcategories as Share of Total Expenditures on Household Supplies				
Soaps and Detergents (19)	34.40	31.98	33.20	Estimated at 1958-1971 average share
Other Cleaning Supplies (20)	19.69	18.10	19.11	Estimated at 1958-1971 average share
Pesticides (21)	4.27	2.89	1.56	4.451 - 0.132Y $R^2 = 0.944$ (10.51) (14.21)
Other Household Supplies (22)	41.64	47.03	46.13	Estimated as residual share of household supplies
C. Consumer Expenditures on Health and Beauty Aids Subcategories as Share of Total Expenditures on Health and Beauty Aids				
Health aids	74.04	62.52	52.04	75.684 - 1.075Y $R^2 = 0.945$ (43.24) (14.30)
Shares of health aids:				
Packaged Medications (23)	25.66	30.67	33.58	24.819 + 0.398Y $R^2 = 0.884$ (50.217) (9.540)
Oral Hygiene Products (24)	10.62	13.32	15.46	10.266 + 0.236Y $R^2 = 0.666$ (20.01) (4.90)
Other Health Aids (29)	63.72	56.01	50.96	Estimated as residual share of health aids
Beauty aids	25.96	37.48	47.96	24.32 + 1.075Y $R^2 = 0.945$ (39.85) (14.30)
Shares of beauty aids:				
Cosmetics and Hand Products (25)	34.96	27.72	22.22	35.147 - 0.588 $R^2 = 0.898$ (24.30) (10.30)
Hair Products (26)	35.57	38.10	37.58	Estimated at 1958-1971 average share
Shaving Products (27)	19.16	19.15	19.25	Estimated at 1958-1971 average share
Other Beauty Aids (28)	10.31	15.03	20.94	Estimated as residual share of beauty aids
Other General Merchandise (30)				Market shares of tobacco products and other general merchandise were not estimated; personal consumption expenditures in 1980 for these categories were projected by Bureau of Labor Statistics.

Numbers in parentheses below B estimate are t-statistics.

Source: Research Triangle Institute.

Table B-2. Personal consumption expenditures, 1970 and 1980
(millions of 1967 dollars)

Consumer product (consumer product category number)	1970		1980	
Food and kindred products		($ 112,704.3)		($ 146,695.3)
Perishables		64,043.9		81,011.7
Baked Goods (1)	$ 8,841.1		$ 11,190.2	
Dairy Products (2)	12,681.6		11,096.4	
Frozen Foods (3)	5,524.8		10,453.1	
Fresh and Cured Meat (4)	22,806.9		30,756.3	
Fresh and Cured Fish and Seafood (5)	525.4		670.1	
Fresh and Cured Poultry (6)	3,396.7		5,105.9	
Produce (7)	10,267.4		11,739.7	
Beverages		20,540.3		28,210.0
Distilled Spirits (8)	7,060.9		10,667.5	
Wine (9)	1,288.8		2,050.4	
Beer (10)	6,279.2		8,094.5	
Soft Drinks (11)	3,148.7		4,020.4	
Prepared Beverages (12)	2,762.7		3,377.2	
Other foods and kindred products		28,120.1		37,473.6
Candy and Chewing Gum (13)	2,840.2		3,886.4	
Canned Foods (14)	6,147.8		7,813.0	
Cereals, Flour, and Macaroni (15)	2,217.6		3,183.3	
Pet Foods (16)	1,031.5		1,701.9	
Tobacco Products (17)	9,093.9		12,681.0	
Other Foods (18)	6,789.1		8,208.0	
General merchandise		(204,907.9)		(320,516.7)
Household supplies		5,205.1		8,941.4
Soaps and Detergents (19)	1,654.7		2,968.5	
Other Cleaning Supplies (20)	946.2		1,708.7	
Pesticides (21)	149.9		139.5	
Other Household Supplies (22)	2,454.3		4,124.7	
Health and beauty aids		8,666.2		13,576.2
Packaged Medications (23)	1,603.3		2,372.4	
Oral Hygiene Products (24)	693.5		1,092.3	
Cosmetics and Hand Products (25)	888.1		1,446.8	
Hair Products (26)	1,218.8		2,446.9	
Shaving Products (27)	625.2		1,254.0	
Other Beauty Aids (28)	476.5		1,363.4	
Other Health Aids (29)	3,160.8		3,600.4	
Other General Merchandise (30)		191,036.6		297,999.1
Total consumer expenditures on durables and nondurables		$ 317,612.2		$ 467,212.0

Source: Research Triangle Institute.

Table B-3. Quantity of packaging per expenditure by consumer product, 1970 and 1980 (kilograms per $100 expenditure)

Consumer product (consumer product category number)	Observed 1970	Predicted 1980	Estimated equation
Baked Goods (1)	8.37	11.41	$Q = 5.934 + 0.249Y$ $R^2 = 0.901$ (27.96) (10.02)
Dairy Products (2)	9.02	11.99	$Q = 5.636 + 0.289Y$ $R^2 = 0.091$ (28.53) (3.23)
Frozen Foods (3)	8.24	9.83	$Q = 7.615 + 0.103Y$ $R^2 = 0.412$ (16.27) (2.78)
Fresh and Cured Meat (4)	6.52	8.40	$Q = 4.602 + 0.173Y$ $R^2 = 0.878$ (26.32) (8.89)
Fresh and Cured Fish and Seafood (5)	6.56	8.51	$Q = 4.386 + 0.187Y$ $R^2 = 0.956$ (42.70) (15.46)
Fresh and Cured Poultry (6)	6.01	6.06	1958-1970 average
Produce (7)	7.23	10.24	$Q = 4.737 + 0.250Y$ $R^2 = 0.931$ (30.23) (12.14)
Distilled Spirits (8)	11.28	12.97	$Q = 9.476 + 0.159Y$ $R^2 = 0.687$ (51.31) (6.00)
Wine (9)	22.11	19.14	$Q = 25.766 - 0.301Y$ $R^2 = 0.456$ (38.33) (10.03)
Beer (10), Soft Drinks (11)			The approach used to project packaging of soft drinks and beer differed from the estimating procedure summarized in this table. For a discussion of the projections of packaging used for beer and soft drinks, see the section on beverages which follows.
Prepared Beverages (12)	41.33	35.20	1958-1970 average
Candy and Chewing Gum (13)	9.41	11.14	$Q = 6.349 + 0.218Y$ $R^2 = 0.713$ (16.27) (5.23)
Canned Foods (14)	54.29	55.63	1958-1970 average
Cereals, Flour, and Macaroni (15)	4.56	5.91	$Q = 3.444 + 0.113Y$ $R^2 = 0.861$ (26.29) (8.25)
Pet Foods (16)	26.62	23.71	$Q = 31.452 - 0.352Y$ $R^2 = 0.498$
Tobacco Products (17)	2.71	2.67	1958-1970 average
Other Foods (18)	28.42	35.93	$Q = 19.540 + 0.745Y$ $R^2 = 0.932$ (51.23) (6.53)
Soaps and Detergents (19)	34.49	37.21	1958-1970 average
Other Cleaning Supplies (20)	10.18	13.47	$Q = 8.523 + 0.225Y$ $R^2 = 0.450$ (15.62) (2.90)
Pesticides (21)	10.67	4.52	$Q = 17.368 - 0.593Y$ $R^2 = 0.710$ (21.34) (5.16)
Other Household Supplies (22)	9.55	3.05	$Q = 17.528 - 0.658Y$ $R^2 = 0.841$ (28.68) (7.60)
Packaged Medications (23)	17.09	7.26	$Q = 29.740 - 1.022Y$ $R^2 = 0.743$ (23.54) (5.72)
Oral Hygiene Products (24)	18.56	12.01	$Q = 27.740 - 0.715Y$ $R^2 = 0.594$ (21.39) (3.90)
Cosmetics and Hand Products (25)	20.38	11.32	$Q = 27.775 - 0.748Y$ $R^2 = 0.638$ (22.56) (4.29)
Hair Products (26)	22.03	9.40	$Q = 35.010 - 1.164Y$ $R^2 = 0.873$ (39.06) (9.17)
Shaving Products (27)	19.57	8.37	$Q = 31.361 - 1.045Y$ $R^2 = 0.739$ (24.01) (5.65)
Other Beauty Aids (28)	77.66	67.86	$Q = 121.100 - 2.420Y$ $R^2 = 0.476$ (22.25) (3.14)
Other Health Aids (29)	26.21	27.20	1958-1971 average
Other General Merchandise (30)	2.25	1.08	$Q = 3.171 - 0.095Y$ $R^2 = 0.921$ (53.65) (11.45)

Source: Research Triangle Institute.

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Table B-4. Packaging consumption, 1958, 1970, and 1980
(thousands of tonnes)

Consumer product (consumer product category number)	1958	1970	1980
Food and kindred products	(11,466.11)	(20,397.69)	(36,458.49)
Perishables	3,007.36	4,806.17	7,786.80
Baked Goods (1)	$ 438.91	$ 740.23	$ 1,276.80
Dairy Products (2)	895.91	1,143.57	1,330.50
Frozen Foods (3)	163.90	455.50	1,027.50
Fresh and Cured Meat (4)	897.36	1,486.40	2,583.50
Fresh and Cured Fish and Seafood (5)	17.65	34.45	57.00
Fresh and Cured Poultry (6)	141.83	204.07	309.40
Produce (7)	452.06	741.95	1,202.10
Beverages	3,715.49	9,434.81	
Distilled Spirits (8)	502.46	796.13	1,383.60
Wine (9)	157.26	284.93	392.40
Beer (10)	1,384.26	3,024.09	5,043.44
Soft Drinks (11)	754.29	4,187.92	12,004.85
Prepared Beverages (12)	917.22	1,141.74	1,188.80
Other foods and kindred products	4,693.26	6,156.71	8,658.60
Candy and Chewing Gum (13)	160.26	267.31	432.90
Canned Foods (14)	2,873.39	3,337.91	4,346.40
Cereals, Flour, and Macaroni (15)	67.77	101.06	188.10
Pet Foods (16)	164.25	274.60	403.50
Tobacco Products (17)	284.59	246.12	338.60
Other Foods (18)	1,142.50	1,929.71	2,949.10
General Merchandise	(5,192.48)	(7,360.48)	(7,391.60)
Household supplies	739.56	917.54	1,466.60
Soaps and Detergents (19)	426.34	570.76	1,104.60
Other Cleaning Supplies (20)	54.85	96.28	230.20
Pesticides (21)	24.44	16.00	6.00
Other Household Supplies (22)	233.93	234.50	125.80
Health and beauty aids	1,542.96	2,141.48	2,706.60
Packaged Medications (23)	264.56	273.98	172.20
Oral Hygiene Products (24)	104.65	128.74	131.20
Cosmetics and Hand Products (25)	123.90	180.95	163.80
Hair Products (26)	162.16	268.54	230.00
Shaving Products (27)	77.91	122.34	104.90
Other Beauty Aids (28)	139.60	370.01	925.20
Other Health Aids (29)	670.18	796.92	979.30
Other General Merchandise (30)	2,909.96	4,301.46	3,218.40
Total packaging	16,658.59	27,758.17	43,850.09

Source: Research Triangle Institute.

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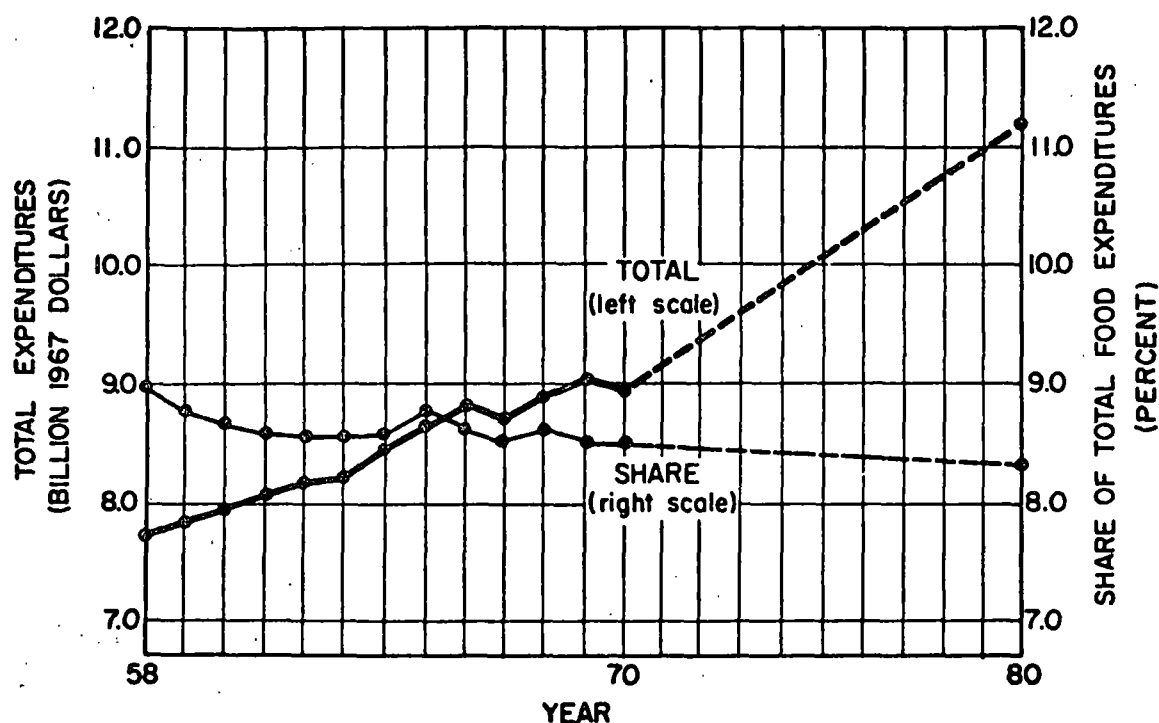
Figure B-1. Baked Goods (1) consumption (Source: Supermarketing and Research Triangle Institute).

more expensive baked goods. However, expenditures on Baked Goods as a share of total food expenditures has decreased from 8.8 to 8.4 percent. If these trends continue, the 1980 share will be about 8.3 percent, or $11.2 billion (fig. B-1). The amount of packaging per dollar of consumer expenditures on Baked Goods has increased over the period studied (fig. B-2). If this trend continues, the 1980 ratio will be 11.4 kilograms per $100 of expenditure and the total quantity of packaging will be 1.28 million tons (table B-5).

Because Baked Goods (especially fresh Baked Goods) are perishable, protection of product quality is the dominant packaging consideration. This requirement is primarily related to the need to provide a moisture barrier. The degree of protection needed from packaging materials depends on the particular product and the amount of preservatives added to the product. Thus, there is the opportunity to substitute between preservatives and packaging. For most Baked Goods (e.g., bread and rolls, and sweet goods), the need is to
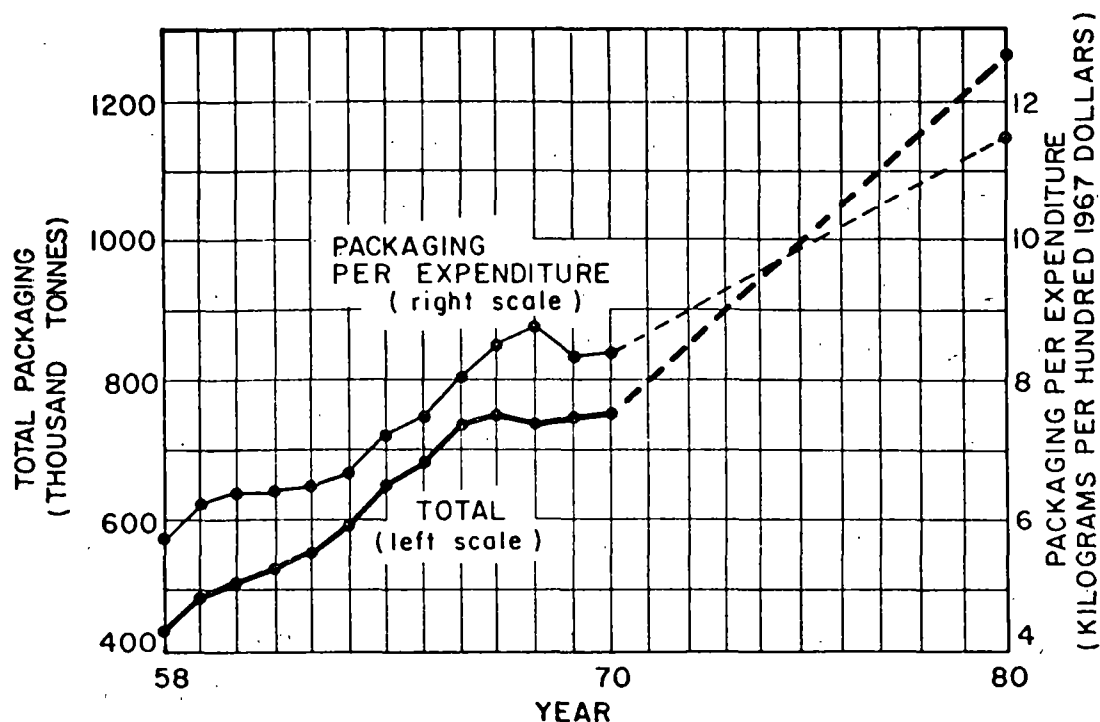
Figure B-2. Baked Goods (1) packaging
(Source: Research Triangle Institute).

Table B-5. Trends in the distribution of materials used for packaging Baked Goods (1) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging 1980 (thousand tonnes)
	1958	1970	1980	
Paper	81.03	80.71	80.7	1030.4
Plastics	14.62	13.59	13.6	173.6
Glass	0.00	0.00	0.0	0.0
Steel	1.55	1.07	1.1	14.1
Aluminum	2.80	4.63	4.6	58.7
Total packaging	100.00	100.00	100.0	1276.8*

*Based on projections of 11.41 kilograms of packaging per $100 of consumer expenditures of $11.2 billion for consumer expenditures on Baked Goods (1).

Source: Research Triangle Institute.

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provide a package that will retain moisture within the package.
Indeed, it is interesting to note that modern packaging has altered
the character of bread. Packaging designed to retain moisture
traps the moisture in the crust leaving it soft rather than the
traditional hard crust associated with European-style breads.
For other Baked Goods (e.g., crackers, cookies, popcorn, potato
chips, and pretzels), the need is to provide a package that will not
permit moisture to enter the package, which would cause crispness to
be reduced.

The ability to provide moisture protection with modern flexible
packaging materials has increased product shelf life and quality
maintenance once the bakery product reaches the consumer. The
importance of protection is illustrated by the current shift from
plastic wraps to plastic (polyethylene) bags. This shift has
apparently increased materials costs and damage rates, necessitated
more careful handling, and decreased the amount of salvage from
stale returns. However, longer product life also results, offsetting
the negative aspects of bags (ref. 1). Modern packaging makes
available to consumers a greater variety of Baked Goods than would exist
in the absence of packaging. Modern packaging materials have also
contributed to the demise of the local baker as an important factor
in Baked Goods production and distribution. Today, probably well
over 80 percent of all Baked Goods are sold through supermarkets
supplied by major corporations (e.g., ITT Continental Baking Co.,
National Biscuit Co., Ward Foods, American Bakers Co.), co-op bakers,
and supermarket chain bakeries (ref. 2).

The major Baked Goods packaging material, in terms of weight,
is paper. Cellophane and plastics are also important materials in
part due to the trends toward self-service merchandising where product
visibility is important. They are used either alone or with paper.
Waxed paper, cellophane wrapping paper, aluminum foil laminated
papers, and polyethylene sheet wrappers and bags are used for
bread packaging. For other fresh Baked Goods as well as for biscuits
and cookies, paperboard (folding boxboard) is frequently used, often
lined with wax paper to provide a moisture barrier, and sometimes

the entire box is inserted in a polyethylene bag. When products
have a high shortening content and are therefore likely to become
stale quickly, the paperboard may be laminated and coated in order
to make it moistureproof and greaseproof. Trays of treated paper
or foam plastic are frequently used when cakes and pies are sold in
paperboard boxes. Since the frosting on cakes provides a moisture
barrier, it is important that the trays provide a similar barrier
in order to have constant distribution of moisture throughout
the cake.

Less perishable and nonperishable Baked Goods are frequently
packaged in waxed paper bags inside paperboard containers which may
be wrapped in cellophane or just in bags made of laminated paper.

B.3 Dairy Products (2)

In 1970, consumers spent $12.7 billion on Dairy Products which
include milk, cheese, yogurt, cream, butter, and eggs. Purchases of
fluid milk accounted for approximately one-half of total dairy expenditures.

The total of consumer expenditures on Dairy Products as a share of
the total food budget has fallen from 16.9 percent in 1958 to 12.3
percent in 1970. This trend is attributed primarily to the decline
in per capita milk consumption associated with the fall in the birth
rate. In addition, the demand for butter and eggs has fallen as
consumer concern over cholesterol content has increased. If these
trends continue to 1980, purchases of Dairy Products as a share of the
total food budget is projected to be 8.3 percent and total expenditures
on Dairy Products to be $11.1 billion (fig. B-3).

Despite the shift to lighter weight materials, the weight of
packaging per dollar of expenditure on Dairy Products increased 3
percent over the period studied (fig. B-4). The trend toward portion
packaging of certain Dairy Products such as yogurt and cheeses, and the
rapid growth in the market share of these products, is responsible
for the increased packaging weight per dollar of expenditure. If
trends in packaging Dairy Products continue, consumption of packaging
materials is expected to reach 1.33 million tonnes in 1980 (table B-6).

Milk and related Dairy Products are often mild flavored, delicate,
and perishable products that require high quality containers to protect
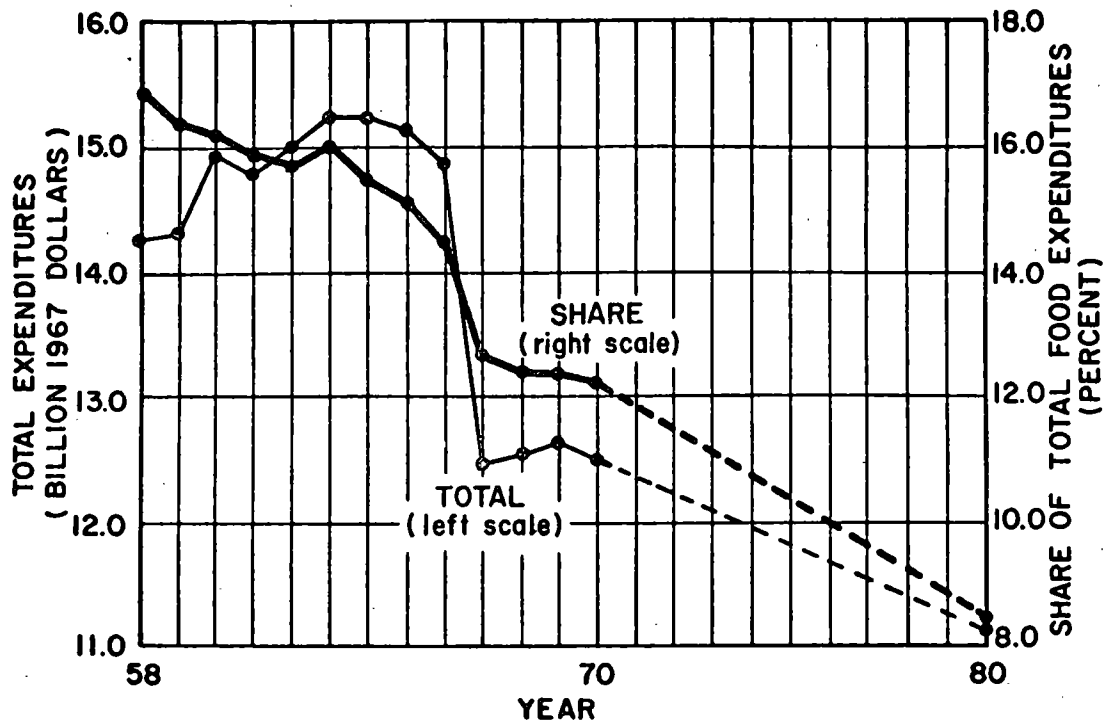
Figure B-3. Dairy Products (2) consumption (Source:
Supermarketing and Research Triangle Institute).
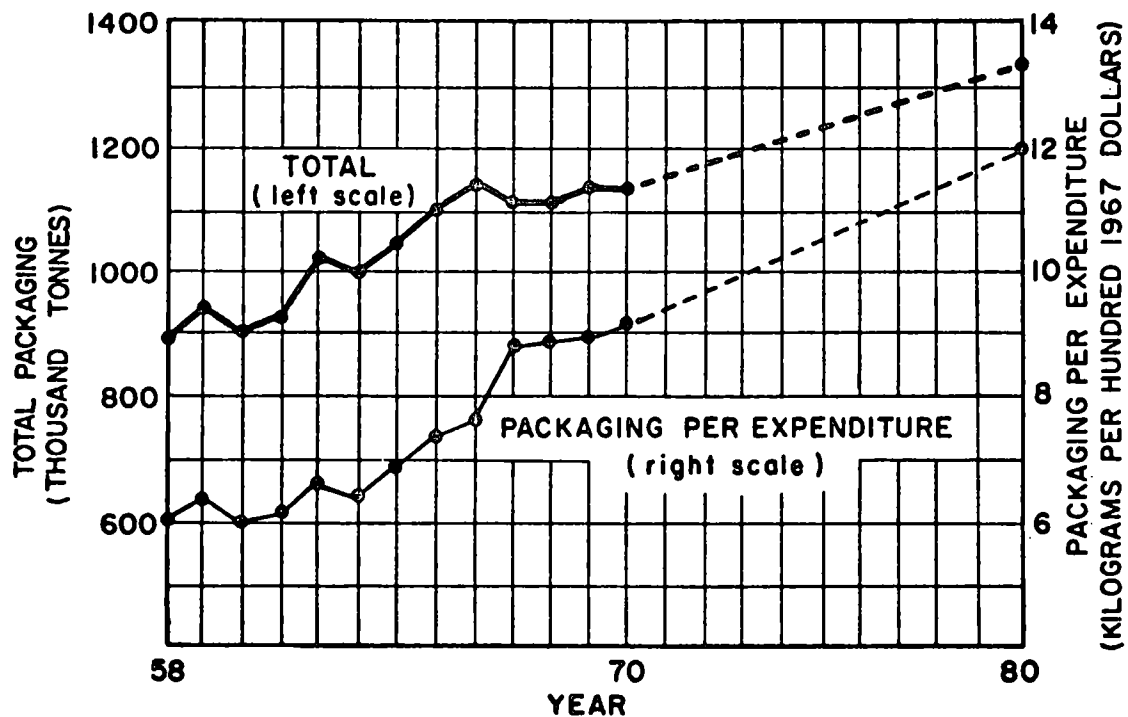
Figure B-4. Dairy Products (2) packaging (Source:
Research Triangle Institute).

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Table B-6. Trends in the distribution of materials used for packaging Dairy Products (2) and projections of 1980 packaging

| Packaging material | Percentage share of weight | | | Projected packaging, 1980 (thousand tonnes) |
	1958	1970	1980	
Paper	86.06	89.74	88.00	1,170.8
Plastics	1.38	5.50	9.80	130.5
Glass	6.99	1.28	0.20	2.6
Steel	5.08	3.00	1.50	19.9
Aluminum	0.49	0.48	0.50	6.7
Total packaging	100.00	100.00	100.00	1,330.5*

*Based on projections of 11.99 kilograms of packaging per $100 of consumer expenditures on $11.10 billion for consumer expenditures on Dairy Products (2).

Source: Research Triangle Institute.

them from spoilage and flavor changes. For many years, glass maintained a monopoly as a milk container. Glass is chemically inert and clear, and it is easily formed into a variety of shapes. The glass bottle guarantees the amount of the contents; therefore, the container is a legal measure of volume.

The decline of the glass milk bottle in favor of the paper carton may be attributed to the change in consumer buying habits that shifted the distribution of Dairy Products from home delivery to chain stores. Supermarkets disliked handling the returnable glass bottle and promoted nonreturnable containers, and consumers readily accepted the lightweight, nonbreakable paperboard carton. In addition, the paper carton allows less light penetration than do glass or plastic bottles. Under dairy case lighting, oxidizing of flavor begins in 5 hours with glass, 7 hours with plastics and 20-27 hours with plastic-coated paper containers (ref. 3). Now the dominant container for milk, the common paper carton has five layers of paper and a layer of polyethylene laminate (as a barrier against leakage) between the inner board stock and the outside layer.

Recently, the plastic bottle has entered the competition for the milk container market. A wide range of polymers has been used: polyethylene, PVC, polypropylene, PVDC, and nylon. Plastic bottles are more expensive than paper cartons or returnable glass bottles, but consumers have been willing to pay a premium for the plastic bottle.

Several new dairy packages that have gained acceptance in European countries have been introduced into the United States. One is the plastic pack pouch, a bag that fits into a plastic (reusable) pitcher. The consumer snips off the corner of the pouch and pours the contents into the pitcher. The pouch is the most economical nonreturnable packaging concept because of the smaller quantity of material and weight of the container.

A second new system is a plastic bottle that is blow-molded, filled, and hermetically sealed on a single piece of equipment (ref. 4). This technique makes possible asceptic bottling of milk; with asceptic bottling, very few bacteria are present and no refrigeration is required. Asceptic packaging has been widely adopted in countries having little refrigeration and low turnover. In the United States, where refrigerated distribution of dairy products is expensive, asceptic packaging has created some interest.

Another new form of milk packaging is a modification of the Swedish Tetra Pak. The new package, called Tetra Brik, is rectangular, eliminating the stacking and handling problems of the tetrahedron shape of the Tetra Pak (ref. 4). The Tetra Brik incorporates the Tetra Pak principle in which the container is completely filled. This affords two distinct advantages: (1) the elimination of air which could be injurious to milk and (2) good stacking strength because it has no head space.

Nonmilk Dairy Products are usually packaged in paper or plastics. Butter is usually wrapped in vegetable parchment and placed in a paper-board carton. Some butter, yogurt, cottage cheese, and soft cheeses are packaged in paper tubs coated with wax or plastic. The tub combines the rigidity necessary for protection against leakage with a convenient closure for resealing the container. Egg packages are made of paperboard

molded pulp or foam plastic. As eggs are subject to breakage, protection against crushing is the major requirement of the egg package.

B.4. Frozen Foods (3)

For the past decade, Frozen Foods have been the fastest growing item in the consumers' food budget. Between 1958 and 1970, expenditures on Frozen Foods increased at an average annual rate of 7.5 percent (fig. B-5). The impetus for the trend in Frozen Foods may be traced to the growing demand for convenience foods that eliminate one or more preparatory operations that otherwise would be performed by the consumer. Complete dinners account for the largest share of prepared food sales, but snack foods, frozen dairy products, international items, and specialty vegetables have attracted much attention in recent years.

Although there is still consumer resistance to marketing frozen meats, frozen meat sales should increase substantially in the next 10 years. The encouragement for this growth is expected to come from the distributors and retailers rather than the consumer. Centralized cutting and freezing of meats is viewed as an opportunity to stabilize meat
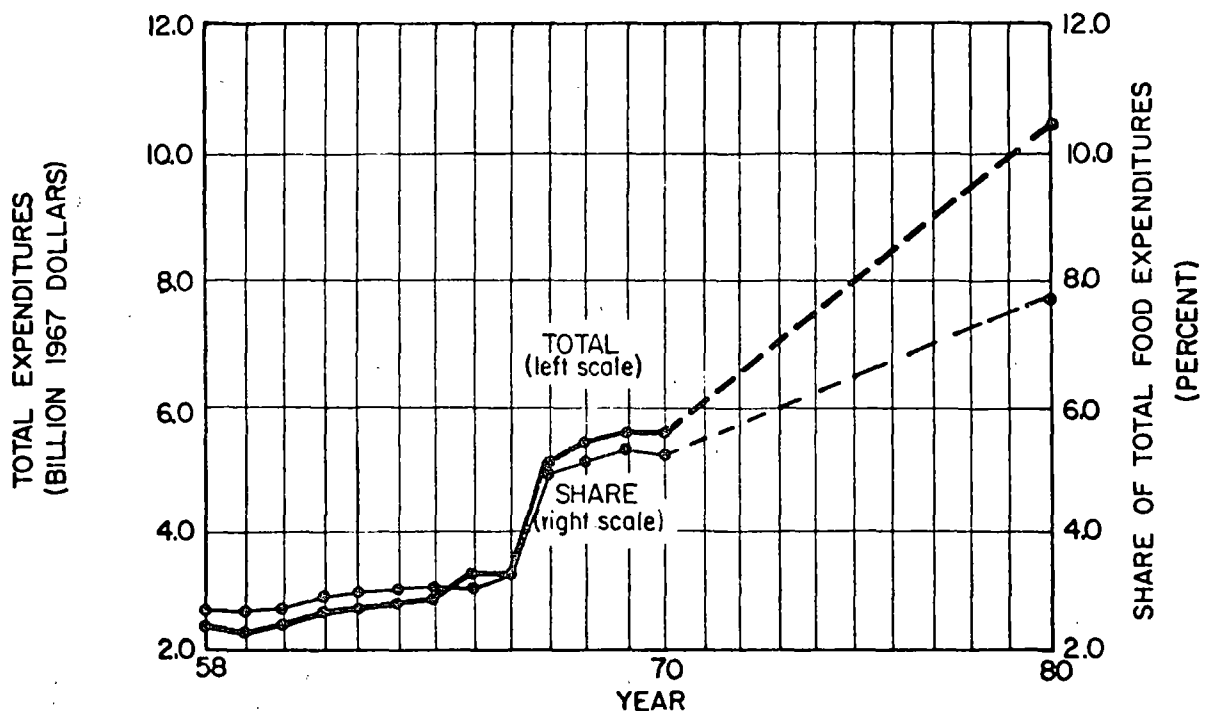
Figure B-5. Frozen Foods (3) consumption (Source: Supermarketing and Research Triangle Institute).
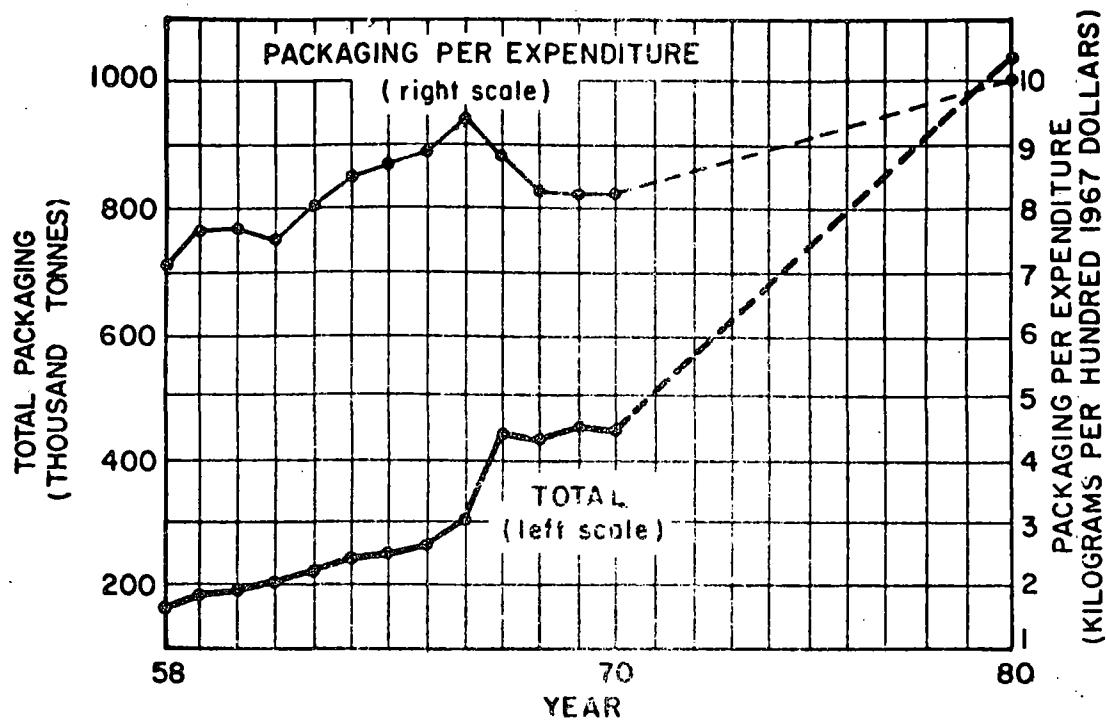
Figure B-6. Frozen Foods (3) packaging
(Source: Research Triangle Institute).

Table B-7. Trends in the distribution of materials used for
packaging Frozen Foods (3) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	79.21	78.87	78.00	801.4
Plastics	9.35	8.50	9.00	92.5
Glass	0.00	0.00	0.00	0.0
Steel	1.49	1.04	1.00	10.3
Aluminum	9.95	11.59	12.00	123.3
Total packaging	100.00	100.00	100.00	1,027.5*

*Based on projections of 9.83 kilograms of packaging per $100
of consumer expenditures on $10.45 billion for consumer expenditures
on Frozen Foods (3).

Source: Research Triangle Institute.

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prices by reducing the increasing labor cost of cutting and packaging at the store level (ref. 5).

Growth in the consumption of Frozen Foods is likely to continue at a high rate. The continuing desire for convenience among consumers and the Frozen Foods industry's proven ability to capitalize on new opportunities will encourage growth. By 1980, Frozen Foods are projected to account for 7.8 percent of the total food budget, representing total expenditures of $10.4 billion.

A slight trend toward greater packaging consumption per dollar of expenditure on Frozen Foods occurred during the period from 1958 to 1970 (fig. B-6). This primarily reflects the growing market share of prepared foods which require more packaging than traditional items. For example, a TV dinner requires a tray in which to heat the food, a barrier material covering the tray, and a carton to protect the contents and to insure easy stacking. If the trends continue, packaging of Frozen Foods is expected to reach 1.0 million tonnes by 1980 (table B-7).

A good Frozen Foods package possesses certain characteristics. It must be resistant to the passage of moisture vapor from the product to the freezer. "Freezer burn" and loss of flavor and nutrition result from improper protection. The container must also protect against oxidation which results in rancidity. Aluminum and most plastics provide the required barrier properties. Paper that is waxed or is laminated to barrier materials is also extensively used in packaging Frozen Foods. Aluminum foil has received increasing usage in packaging Frozen Foods. This growth is predicated on the consumer's desire for convenience. Aluminum is an excellent conductor of heat, and its application as a heat-and-serve container was a prime force in the success of prepared foods.

B.5 <u>Fresh and Cured Meat (4), Fresh and Cured Fish and Seafood (5),</u>
<u>and Fresh and Cured Poultry (6)</u>

The meat, fish, and poultry category is the largest item in the consumer's food budget, accounting for 26 percent of food expenditures
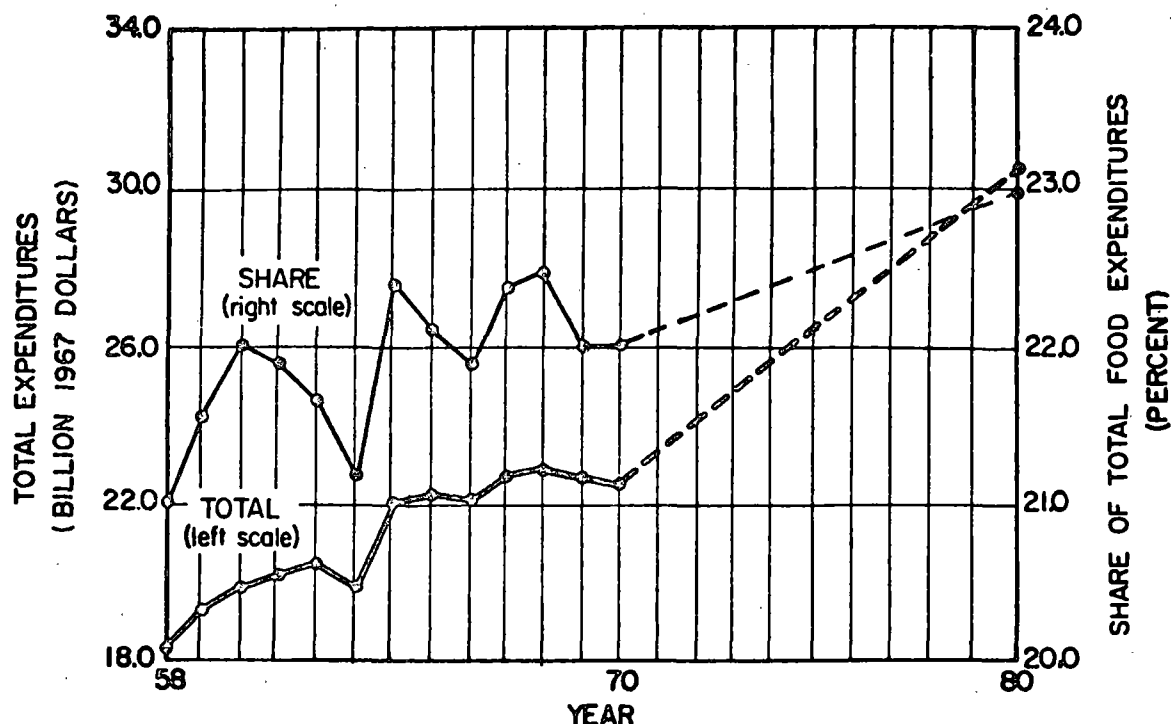
Figure B-7. Fresh and Cured Meat (4) consumption
(Source: Supermarketing and Research Triangle Institute).

in 1970. Fresh and Cured Meat purchases, representing 85 percent of this
category, grew slowly over the 1958-1970 period at an average annual rate
of 1.8 percent (fig. B-7). Although per capita beef consumption has been
rising rapidly from 85 pounds in 1960 to 113 pounds in 1971 (ref. 5), declines
in per capita consumption of pork, lamb, and provisions offset the
growth in beef. Purchases of fresh fish, which grew at an average annual
rate of 4.7 percent from 1958 to 1965, declined during the latter part
of the 1960's due to limited supplies and subsequent higher prices
(fig. B-8). Poultry consumption increased about 3 percent per year
from 1958 to 1970 (fig. B-9). Based on the trends of the 1958 to
1970 period, 1980 expenditures on meat, fish, and poultry together
are projected to be $36.5 billion (tables B-8 through B-10).

The quantity of packaging consumed per dollar of expenditure on
meats, fish, and poultry exhibited some increase between 1958 and 1970,
particularly in meat packaging (figs. B-10 through B-12). The increased
packaging requirements are probably attributable to the spread of the

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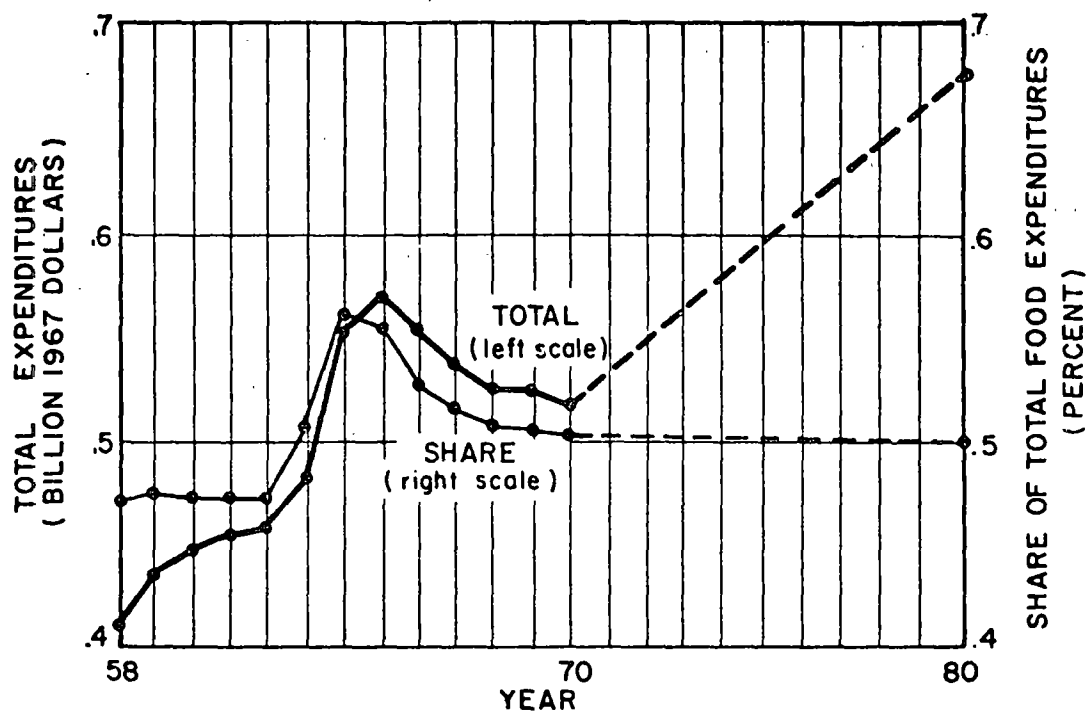
Figure B-8. Fresh and Cured Fish and Seafood (5) consumption
(Source: <u>Supermarketing</u> and Research Triangle Institute).
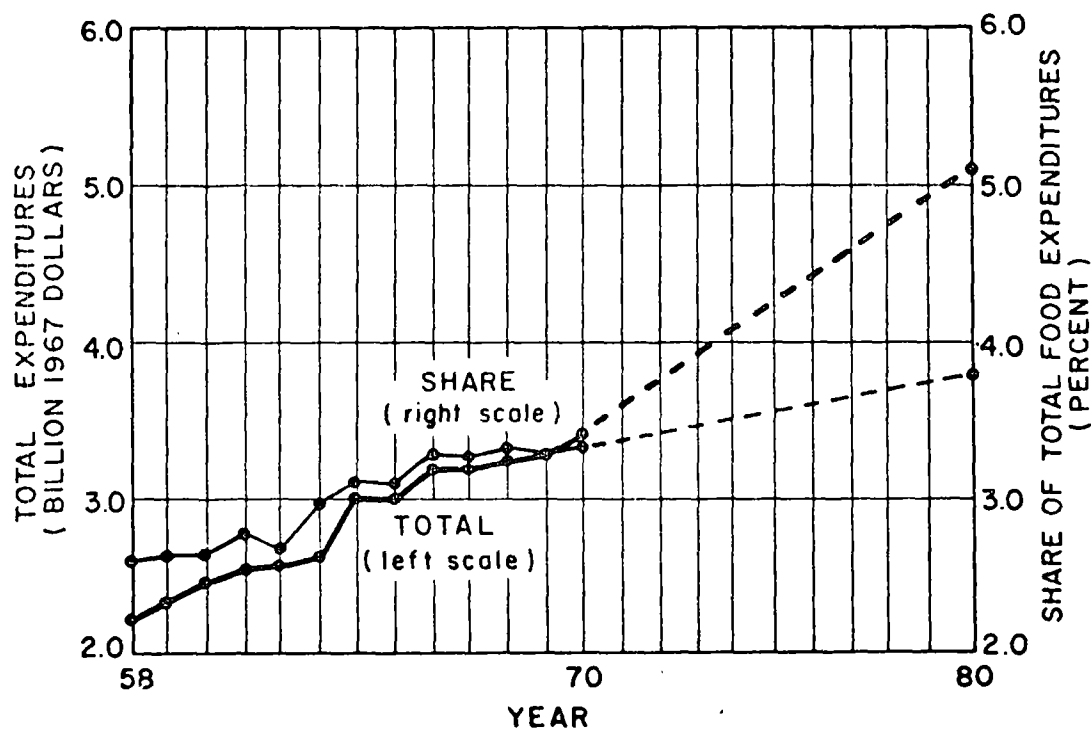
Figure B-9. Fresh and Cured Poultry (6) consumption
(Source: <u>Supermarketing</u> and Research Triangle Institute).

Table B-8. Trends in the distribution of materials used for
packaging Fresh and Cured Meat (4) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	96.02	95.21	92.00	2,376.8
Plastics	2.64	3.79	7.00	180.8
Glass	0.00	0.00	0.00	0.0
Steel	1.30	0.96	0.96	24.8
Aluminum	0.04	0.04	0.04	1.1
Total packaging	100.00	100.00	100.00	2,583.5*

*Based on projections of 8.40 kilograms of packaging per $100
of consumer expenditures on $30.76 billion for consumer expenditures
on Fresh and Cured Meat (4).

Source: Research Triangle Institute.

Table B-9. Trends in the distribution of materials used for packaging
Fresh and Cured Fish and Seafood (5) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	95.58	95.08	93.90	53.5
Plastics	2.83	3.82	5.00	2.9
Glass	0.00	0.00	0.00	0.0
Steel	1.54	1.05	1.05	0.6
Aluminum	0.05	0.05	0.05	0.0
Total packaging	100.00	100.00	100.00	57.0*

*Based on projections of 8.51 kilograms of packaging per $100
of consumer expenditures on $0.67 billion for consumer expenditures
on Fresh and Cured Fish and Seafood (5).

Source: Research Triangle Institute.

Table B-10. Trends in the distribution of materials used for packaging Fresh and Cured Poultry (6) and projection of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	96.01	95.18	92.98	287.7
Plastics	2.65	3.80	6.00	18.6
Glass	0.00	0.00	0.00	0.0
Steel	1.28	0.98	0.98	3.0
Aluminum	.06	0.04	0.04	0.1
Total packaging	100.00	100.00	100.00	309.4*

*Based on projections of 6.06 kilograms of packaging per $100 of consumer expenditures on $5.11 billion for consumer expenditures on Fresh and Cured Poultry (6).

Source: Research Triangle Institute.
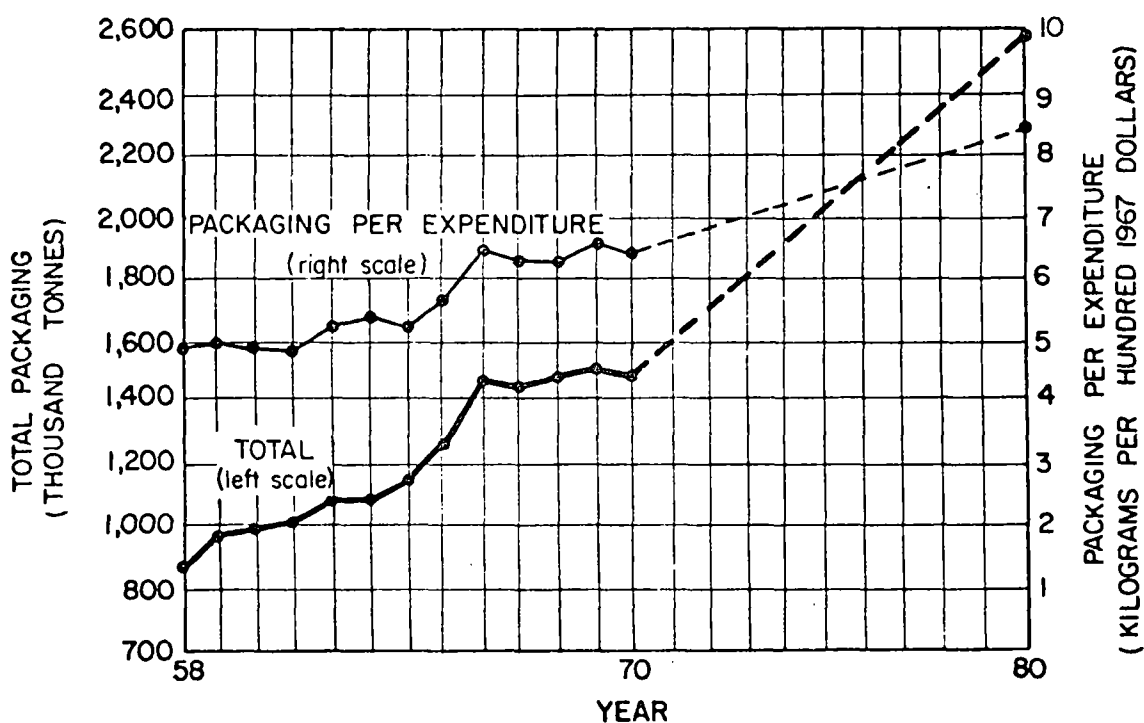
Figure B-10. Fresh and Cured Meat (4) packaging (Source: Research Triangle Institute).
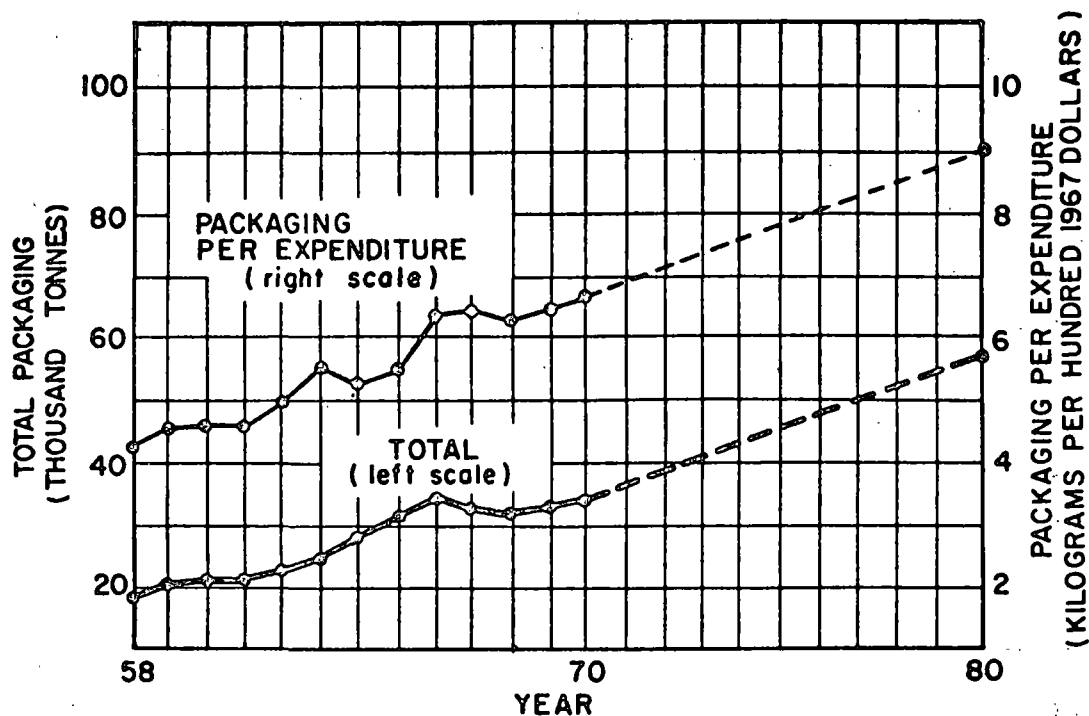
Figure B-11. Fresh and Cured Fish and Seafood (5)
packaging (Source: Research Triangle Institute).
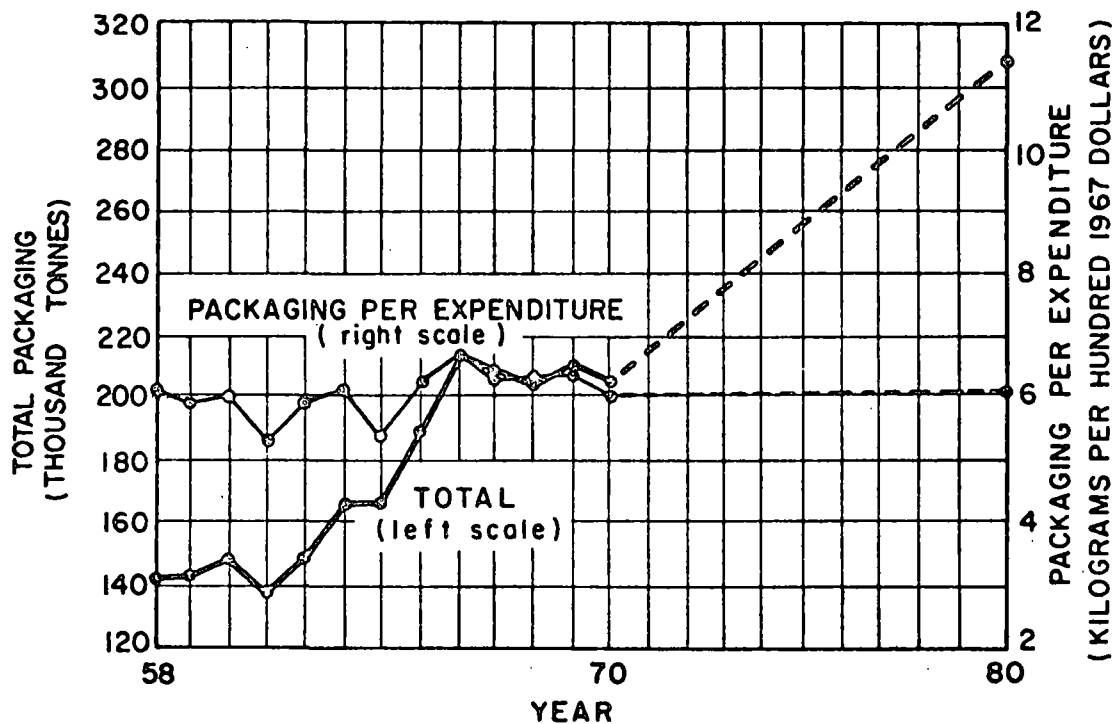
Figure B-12. Fresh and Cured Poultry (6) packaging
(Source: Research Triangle Institute).

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self-service meat counter. The trend in meat packaging has been toward portion control and preunitizing. Most noticeable has been the advances in mechanization for packaging meat that reduces the high labor costs of customer butcher service (ref. 6). The majority of meat is packaged at the retail level. Industry observers predict that poultry packaging will lead the way toward the development of central wrapping facilities for meats. The growing acceptance of the chill-pack system for broilers, developed by Holly Farms Poultry of Wilkesboro, North Carolina, is cited as evidence of this trend (ref. 7). Many package suppliers view the meat market as the most promising area for growth; if the trends continue, the materials used to package meat, fish, and poultry are projected to be 2.9 million tonnes in 1980.

Meat, fish, and poultry items require packaging materials that have low water vapor transmission, protection against leakage, tensile strength, and good handling characteristics.

Meats that are prepackaged for display are usually placed in a tray that is overwrapped with plastic or cellophane. Trays are made of molded pulp, foamed plastic, or polystyrene sheet. The molded pulp food trays are treated to control absorption. Polystyrene foam trays have an advantage in that the tray is completely nonabsorbent and therefore will not become soggy from juices soaking into the material. The nonabsorbent property of the foam tray posed a problem until the "ribbed" construction was designed, utilizing indentions to trap juices, thus keeping the meat from resting in its own juices. Polystyrene sheet trays afford nearly complete transparency, which is an important merchandising feature since the consumer can view the meat from all sides. These clear plastic trays are also said to be stronger than either the molded pulp or plastic foam tray.

A packaging consideration important for cured meats is the problem of discoloration. The interaction of light, oxygen, and moisture causes

fading or discoloration in cured meat products. Ham slices and luncheon meats often have a paper and cardboard tray on one side to shield the contents from the light.

B.6 Produce (7)

Consumer expenditures on fresh fruits and vegetables totaled $10.3 billion in 1970. Total purchases of fresh Produce increased 10 percent from 1958 to 1970 (fig. B-13); however, per capita consumption of fresh Produce has continually declined over the decade. Among the reasons for the decrease in per capita consumption is the increasing preference for convenience items. In 1962, consumption of processed vegetables (frozen or canned) equaled fresh vegetable consumption for the first time. By 1967, 54 percent of all vegetables purchased were processed (ref. 8). A second factor in the shift to processed Produce has been the relative price movements. During the last 10 years, the price of fresh Produce increased 31 percent while prices of processed
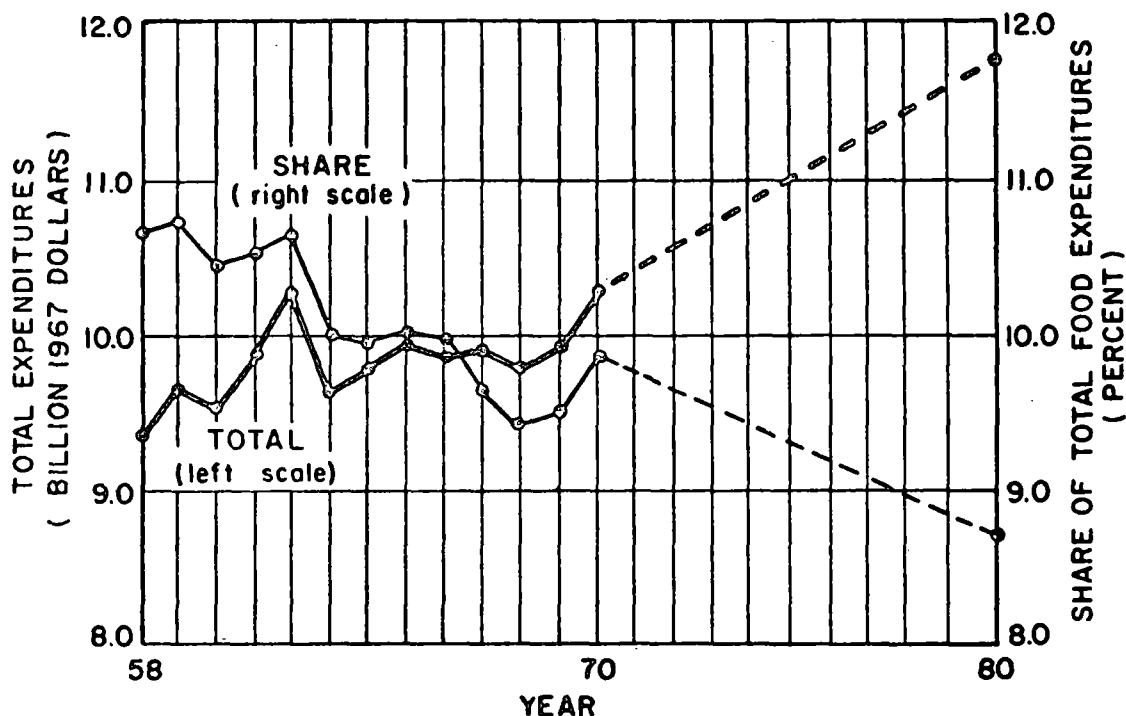
Figure B-13. Produce (7) consumption (Source: Supermarketing and Research Triangle Institute).
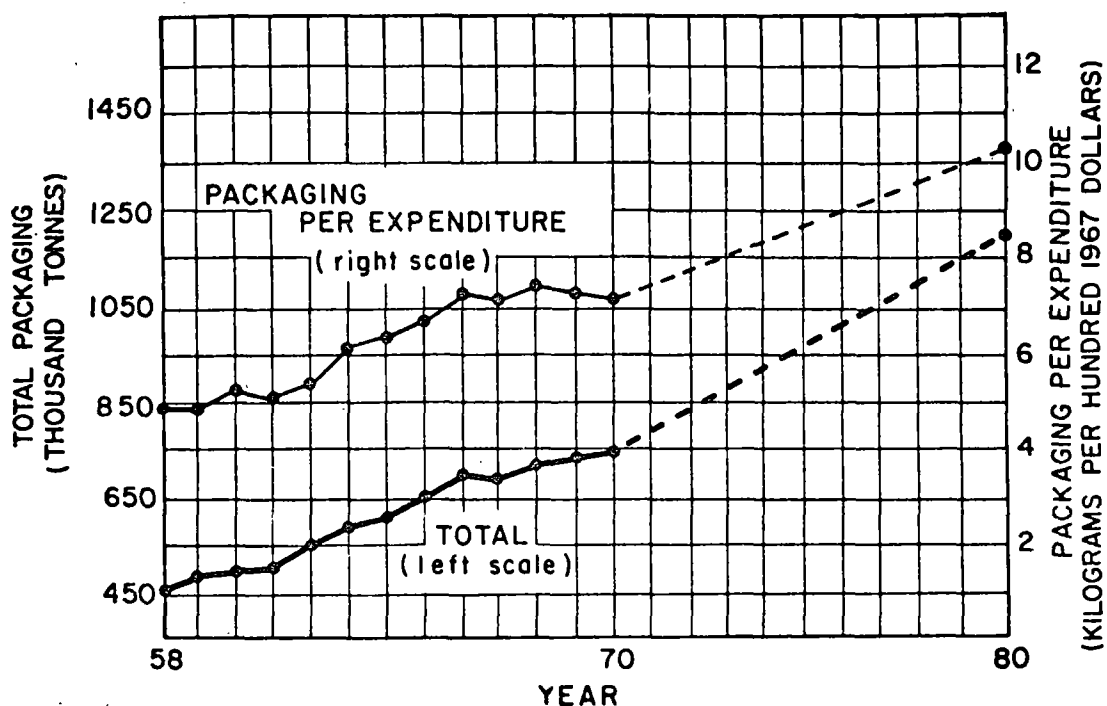
Figure B-14. Produce (7) packaging (Source: Research Triangle Institute).

Table B-11. Trends in the distribution of materials used for packaging Produce (7) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	91.75	87.05	82.00	985.7
Plastics	8.25	12.95	18.00	216.4
Glass	0.00	0.00	0.00	0.0
Steel	0.00	0.00	0.00	0.0
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	1,202.1*

*Based on projections of 10.24 kilograms of packaging per $100 of consumer expenditures on $11.74 billion for consumer expenditures on Produce (7).

Source: Research Triangle Institute.

Produce rose only 17 percent (ref. 8). If the trends continue, 1980 expenditures on fresh fruits and vegetables are projected to be $11.7 billion.

Traditionally, Produce was displayed in bulk, unpackaged. However, fresh Produce is easily bruised and damaged from handling; to afford protection for the product, the recent trend has been to prepackage Produce. Twenty years ago, 40 percent of Produce arriving in the retail outlets was damaged prior to sale; prepackaging has reduced damages to 25 percent. Application of packaging to protect the quality is illustrated with lettuce. Recently, a plastic film developed specifically for packaging lettuce was announced. This film is said to provide the correct moisture level without fogging and yet allow the transfer of oxygen and carbon dioxide necessary to keep the lettuce from wilting. The costs are about one cent per head of lettuce (ref. 9). Significant opportunities remain for increasing Produce packaging and the 1980 usage of materials is projected to be 1.2 million tonnes (fig. B-14, table B-11).

A food tray overwrapped with cellophane or other plastic is the most common container for prepackaged Produce. Molded pulp or polystyrene are the usual tray materials. They are primarily used for soft, fleshy fruits and vegetables such as grapes, peaches, and eggplants.

Paper and plastic wrap are also used for other Produce to prepackage and preprice at regional distribution centers. Centralized packaging and pricing reduces the labor cost of weighing and pricing at the retail level. The tray may be overwrapped with polyethelene or with a paper tape that carries the price.

Paper bags, polyethelene bags, and plastic netting are used to prepackage and protect less fragile vegetables such as carrots, onions, and potatoes. Paper or plastic bags are also provided for the consumer to contain vegetables and fruits chosen from bulk display.

B.7 Beverages (8-12)

Beverages, as defined for this study include alcoholic beverages (Distilled Spirits, Wine, Beer), Soft Drinks, and Prepared Beverages (coffee, tea, prepared food drinks, breakfast drinks).

Overall beverage consumption is physiologically limited; therefore, per capita growth for any one beverage must come mainly at the expense of other beverages.

Table B-12. Beverage preference by age

Age group	Beverage preferred		
	First	Second	Third
Under 5 years	Milk	Soft drinks	Fruit juice
5-19	Soft drinks	Milk	Fruit juice
20-34	Beer	Soft drinks	Coffee
35-64	Distilled spirits	Coffee	Soft drinks
65 and over	Coffee	Distilled spirits	Soft drinks

Source: K.C. Shih and C.Y. Shih, "American Soft Drink Industry and Carbonated Beverage Market - A Statistical Analysis and Graphic Presentation," Studies of American Industries, Series number 2, W.A. Krueger Co., Brookfield, Wis., 1965, p. 20.

Beverage preference is strongly influenced by age (table B-12). The growth in Soft Drink consumption during the 1960's and the stagnation in sales of hot beverages (particularly coffee) may be at least partially attributed to shifts in the age distribution of the population.

Beverage choice also depends upon family income. Income growth during the past decade was particularly favorable to the growth in sales of Wine and Distilled Spirits.

Personal consumption expenditures on beverages were $20.5 billion in 1970. Per capita expenditure on beverages increased slightly from 1958 to 1970, reflecting a shift to higher priced beverages (Wine, Distilled Spirits) from prepared beverages; during the 13-year period, expenditures on Wine and Distilled Spirits increased at an annual rate of 56 percent and 26 percent, respectively, while sales of Prepared Beverages grew less than 1 percent per year. If current trends in beverage consumption continue, 1980 consumer expenditures on beverages are projected to be $28.2 billion. Shifts in the composition of these expenditures may also be expected to continue. Population shifts in favor of the 20- to 35-year-old group, combined with increasing affluence, should favor the markets for Wine and Distilled Spirits. Prepared Beverage sales (particularly coffee) are expected to be adversely affected by the decline in the number of people in their 40's. Figures B-15 through B-19 depict the trends in the composition of beverage expenditures and the 1980 projections.
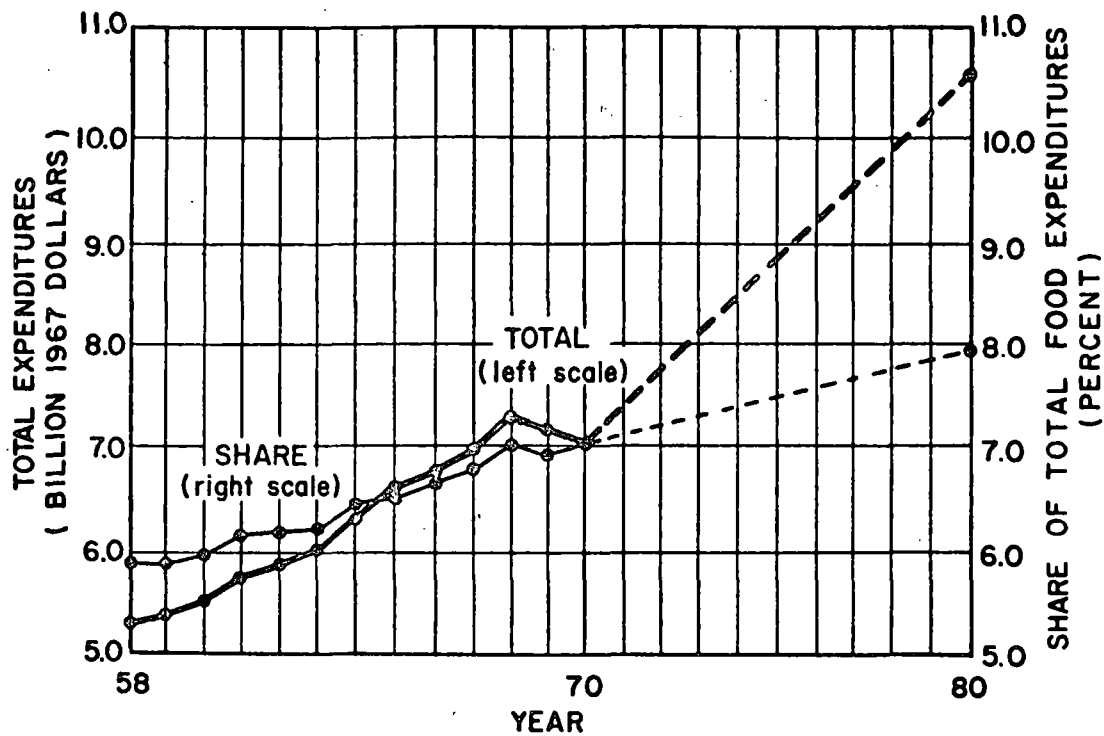
Figure B-15. Distilled Spirits (8) consumption (Source: Supermarketing and Research Triangle Institute).
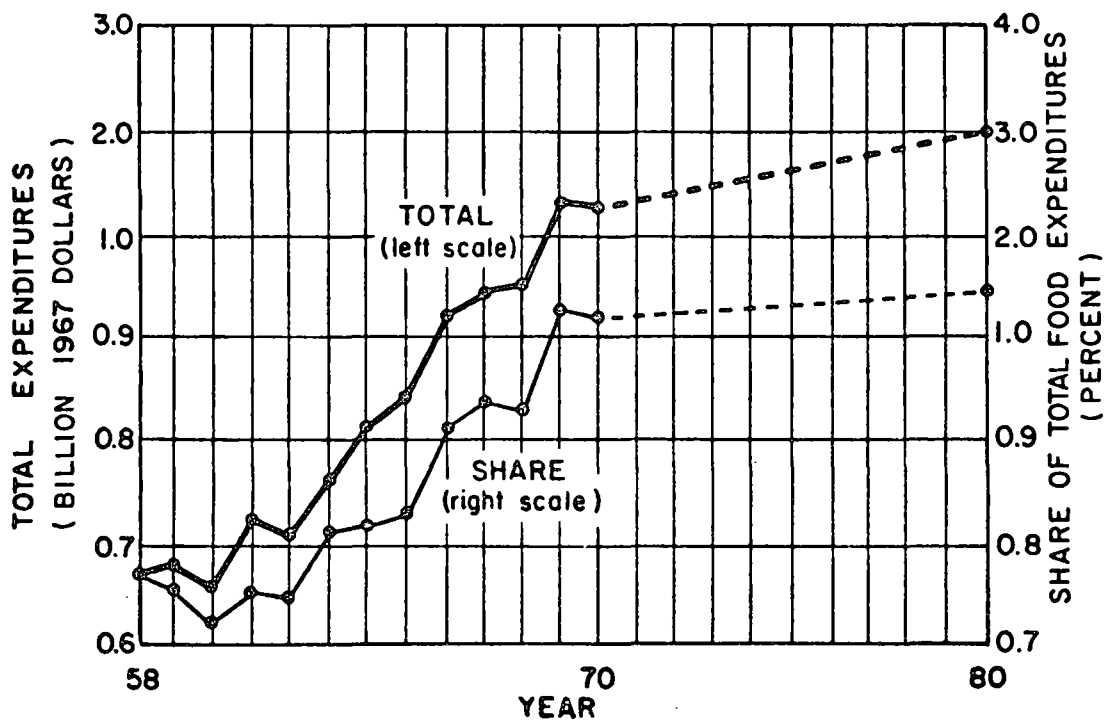
Figure B-16. Wine (9) consumption (Source: Supermarketing and Research Triangle Institute).
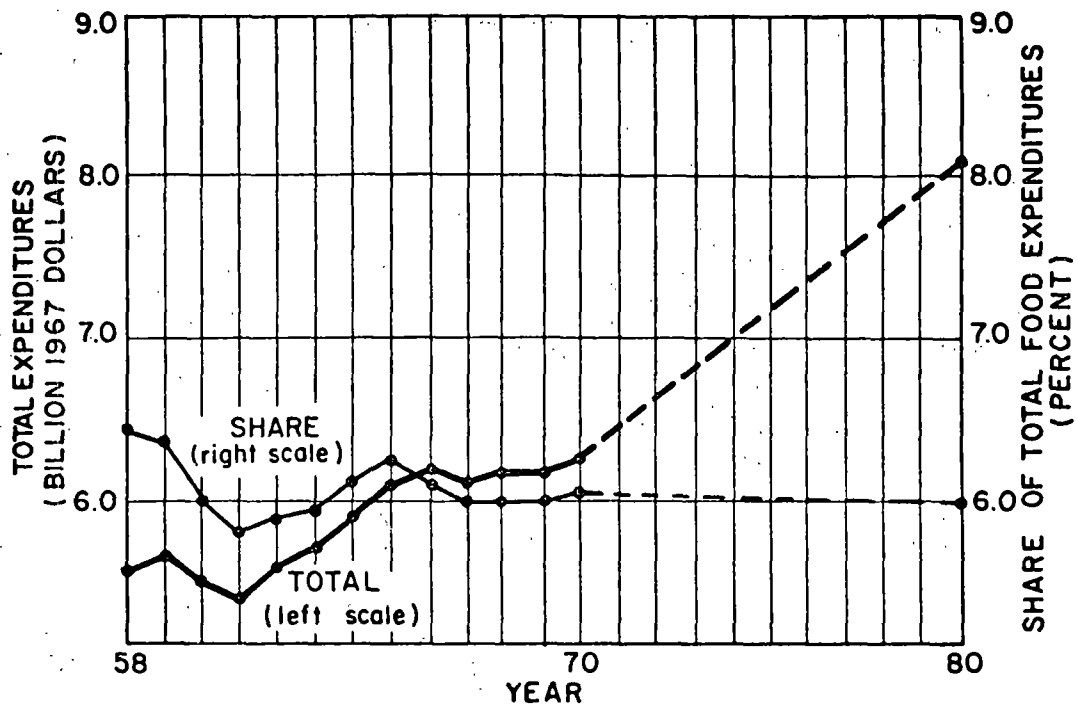
Figure B-17. Beer (10) consumption (Source: Supermarketing and Research Triangle Institute).
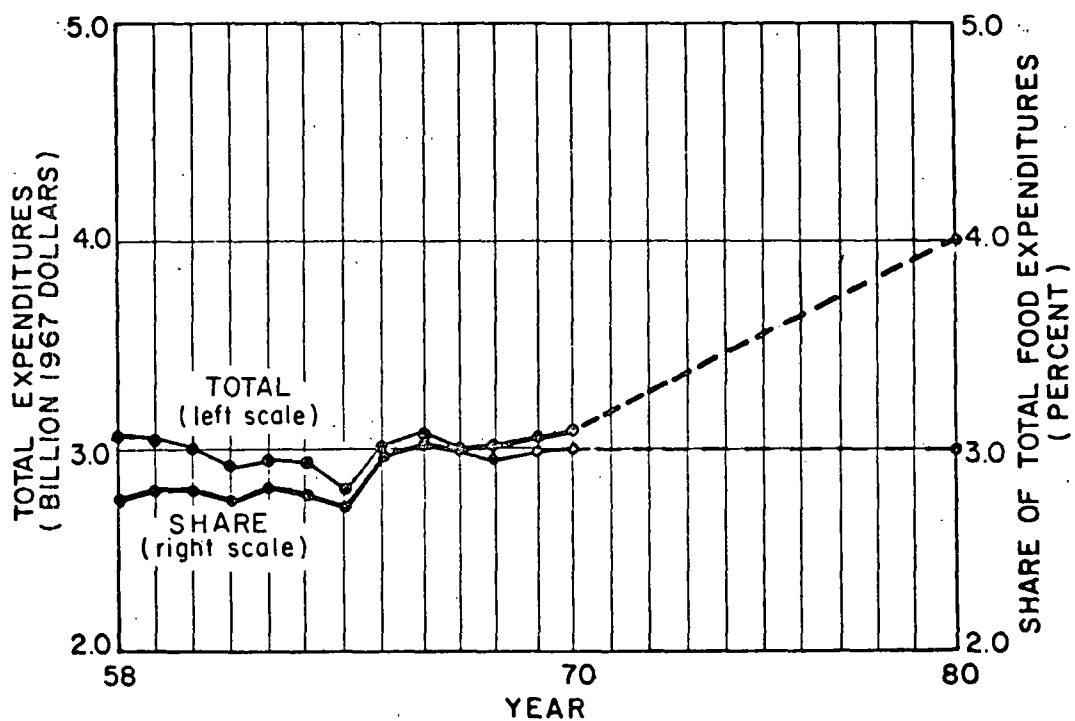
Figure B-18. Soft Drinks (11) consumption (Source: Supermarketing and Research Triangle Institute).

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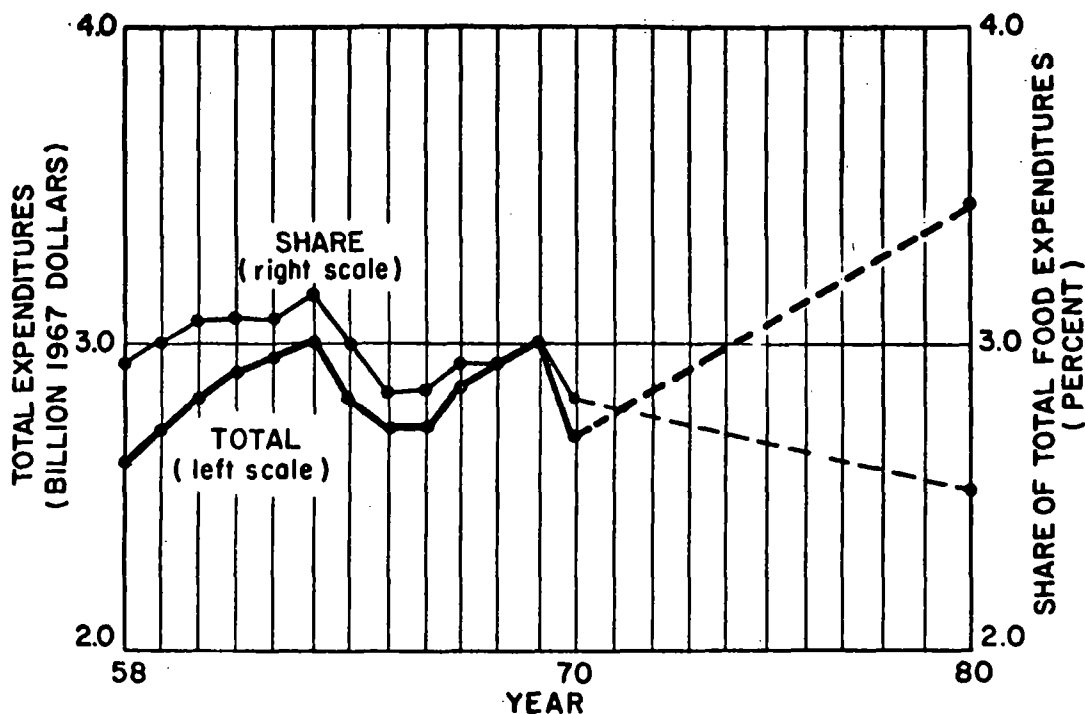
Figure B-19. Prepared Beverages (12) packaging
(Source: Supermarketing and Research Triangle Institute).

The packaging solid waste associated with beverage consumption
increased at an average annual rate of 8 percent from 1958 to 1970,
6 percent more rapidly than the overall growth in beverage consumption.
The increase in the amount of packaging consumed per dollar of expendi-
ture on beverages has been caused by the substantial shifts in the type
of beverage packaging (particularly Beer and Soft Drink containers).
Shifts in the structure of beverage packaging are discussed in further
detail below.

B.7.1. Distilled Spirits (8) and Wine (9) Packaging

Almost all Distilled Spirits and Wine are packaged in nonrefillable
glass bottles. Tradition and custom have played a major role in the use
of glass; Distilled Spirits bottles, for example, have tended to be slender
and round for ease of handling and to have tall labels to give the appearance
of a large bottle.

The amount of glass consumed in packaging Distilled Spirits increased
slightly between 1958 and 1970, and a further increase is projected to
1980 (table B-13). A slight trend toward greater packaging consumption per

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Table B-13. Trends in the distribution of materials used for
packaging Distilled Spirits (8) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	37.73	37.60	37.60	520.2
Plastics	0.00	0.00	0.00	0.0
Glass	62.27	62.40	62.40	863.4
Steel	0.00	0.00	0.00	0.0
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	1,383.6*

*Based on projections of 12.97 kilograms of packaging per $100
of consumer expenditures on $10.67 billion for consumer expenditures
on Distilled Spirits (8).

Source: Research Triangle Institute.

dollar of expenditure on Distilled Spirits occurred during the period
1958-1970 (fig. B-20). The average size container for Distilled Spirits
increased from 18 ounces in 1959/61 to 20 ounces in 1969, and is expected
to reach 22 ounces by 1980. Half-gallon and quart sizes will continue to
be the major gainers.

In the latter part of the 1960's, plastic began to enter the market
for packaging Distilled Spirits. Plastics enjoy a great weight advantage
over glass bottles in the half-gallon size: 3.5 ounces versus 2.5 pounds.
In addition, plastic bottles are unbreakable. Recently, however, the FDA
banned the use of PVC bottles for Distilled Spirits. The alcohol extracts
vinyl chloride monomer from PVC which has not been proved harmless.

Trends in the amount of glass used to package Wine are depicted in
figure B-21 and table B-14. Although the average size of the Wine bottle
has been relatively constant, a small decrease in the amount of glass
consumed per dollar of expenditure was evidenced. This is probably due
to the use of lighter weight glass.

The share of imported Wine consumed has been increasing and is
expected to be 15 percent of total Wine sales in 1980. In order to reflect
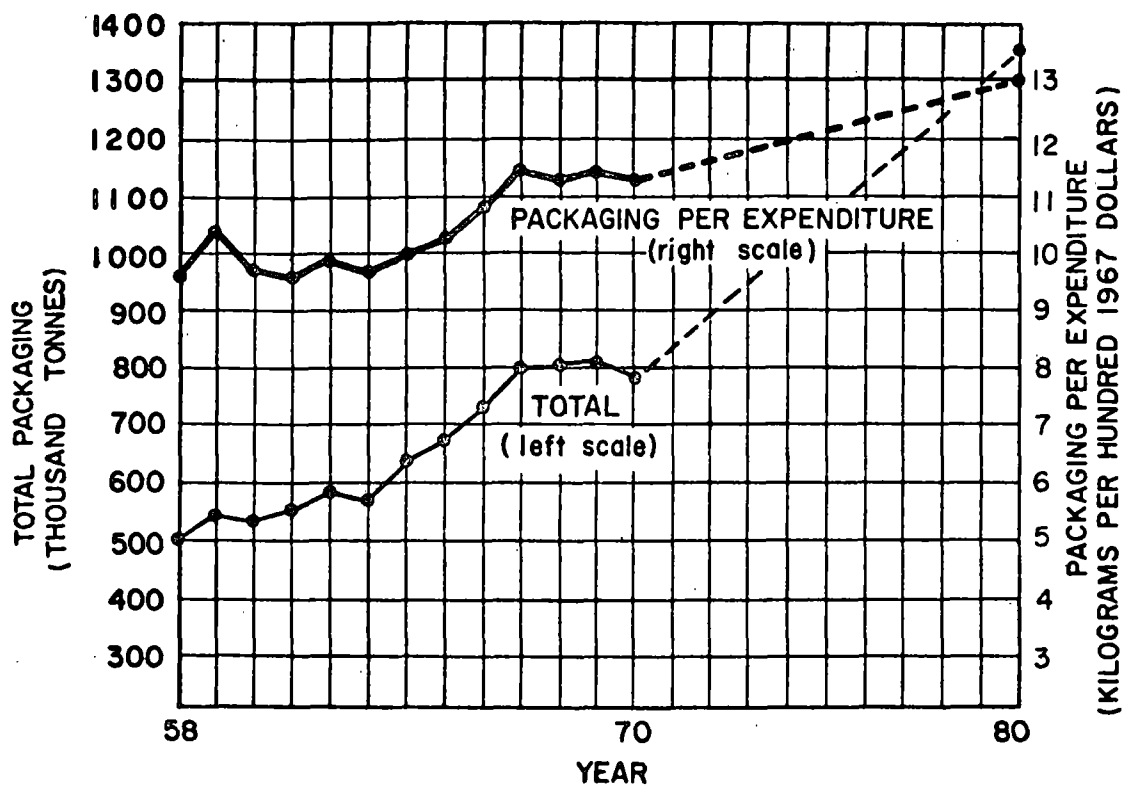
Figure B-20. Distilled Spirits (8) packaging
(Source: Research Triangle Institute).
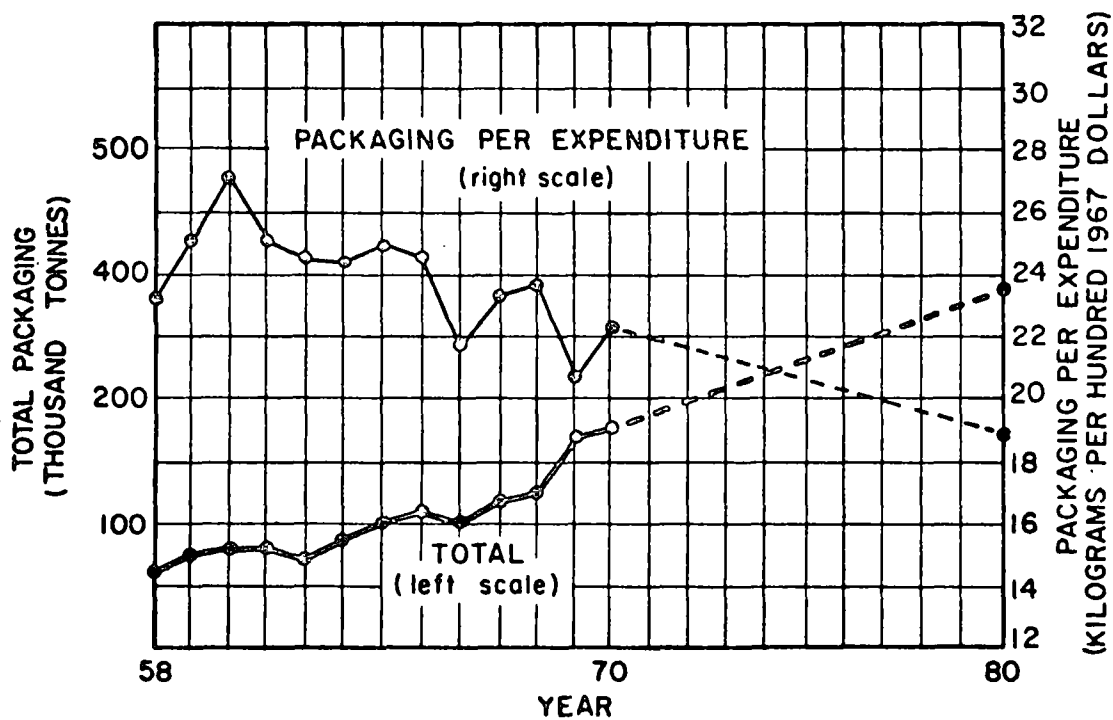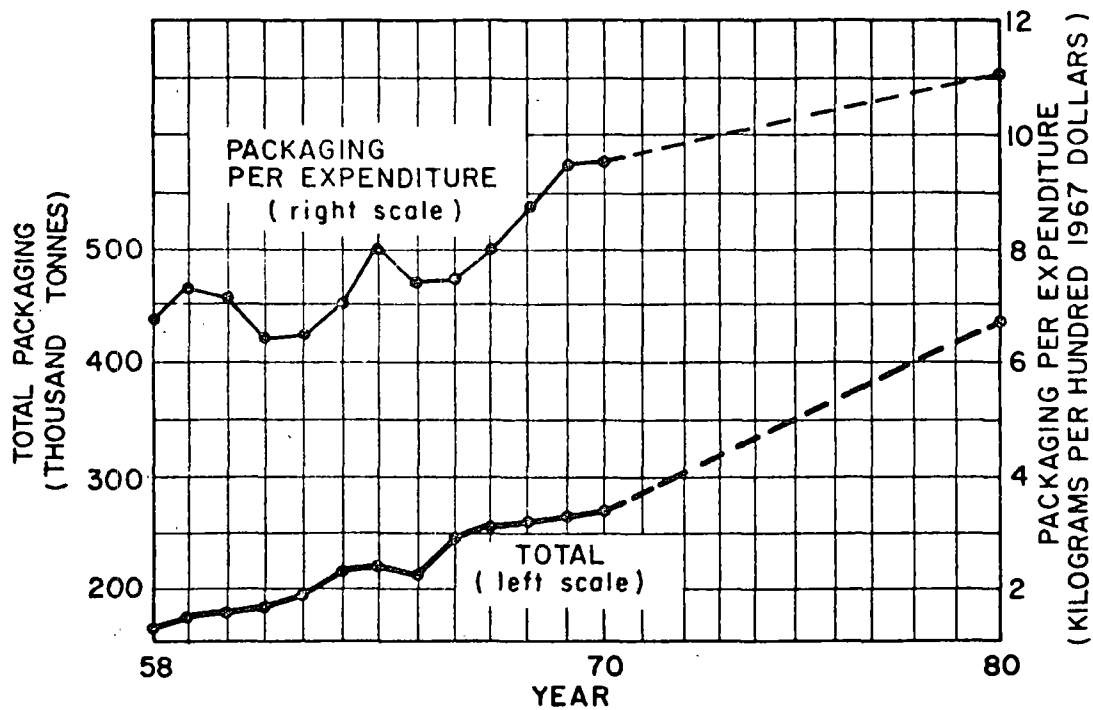

Figure B-21. Wine (9) packaging (Source:
Research Triangle Institute).

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Table B-14. Trends in the distribution of materials used for packaging Wine (9) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	0.00	0.00	0.00	0.0
Plastics	0.00	0.00	0.00	0.0
Glass	100.00	100.00	100.00	392.4
Steel	0.00	0.00	0.00	0.0
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	392.4*

*Based on projections of 19.14 kilograms of packaging per $100 of consumer expenditures on $2.05 billion for consumer expenditures on Wine (9).

Source: Research Triangle Institute.

solid waste associated with Wine consumption, domestic production of glass Wine bottles was inflated by a percentage equal to the share of imported Wines consumed.

Despite the growth of the plastic Wine bottle in Europe, plastics have not yet entered the Wine market in the United States. However, the plastics industry may aggressively encourage this market in the face of the ban on the promising Distilled Spirits container. Wine, with a lower alcohol content than Distilled Spirits, should not be incompatible with PVC.

B.7.2. Beer (10) and Soft Drink (11) Packaging

Beer and Soft Drinks were traditionally packaged in bulk for on-premise (bars, taverns, drug stores) sale and consumption. The earliest container used for packaging Beer and Soft Drinks for off-premise consumption was the refillable glass bottle. This container offered an economical means of protecting and preunitizing the product. Today, however, the trend is toward the nonrefillable container, especially cans, and away from refillable bottles (figs. B-22 and B-23) due to a variety of factors. First, economies of scale have encouraged consolidation of breweries and Soft Drink bottling plants. Secondly, reductions in the number of breweries and bottling plants have lengthened distribution distances, thereby placing more importance
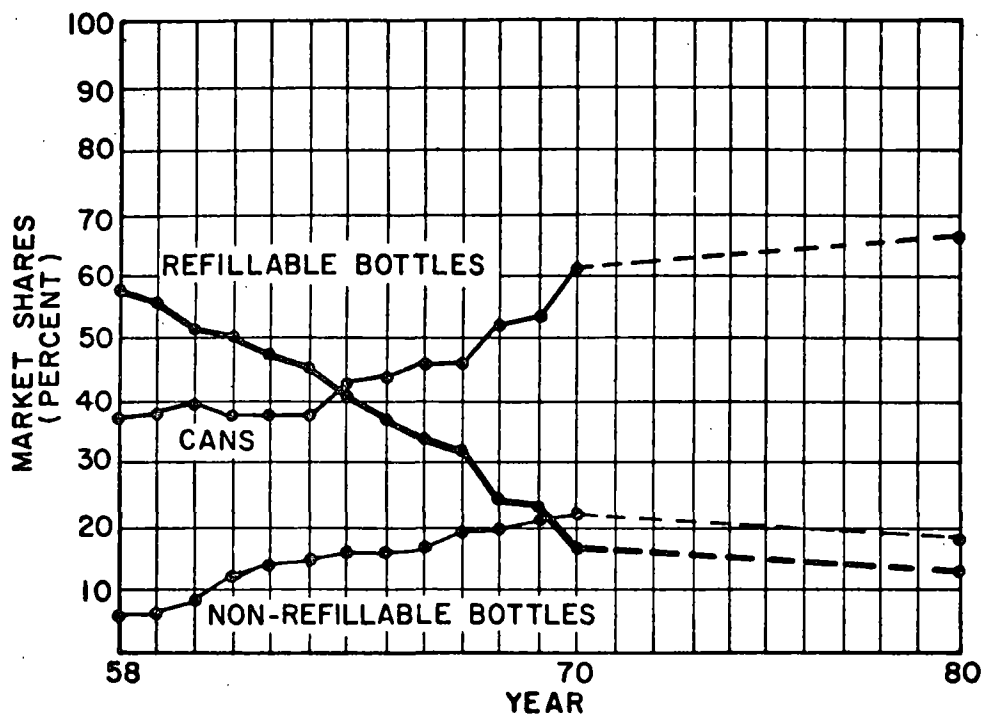
Figure B-22. Beer (10) bottles, market shares
(Source: Research Triangle institute).
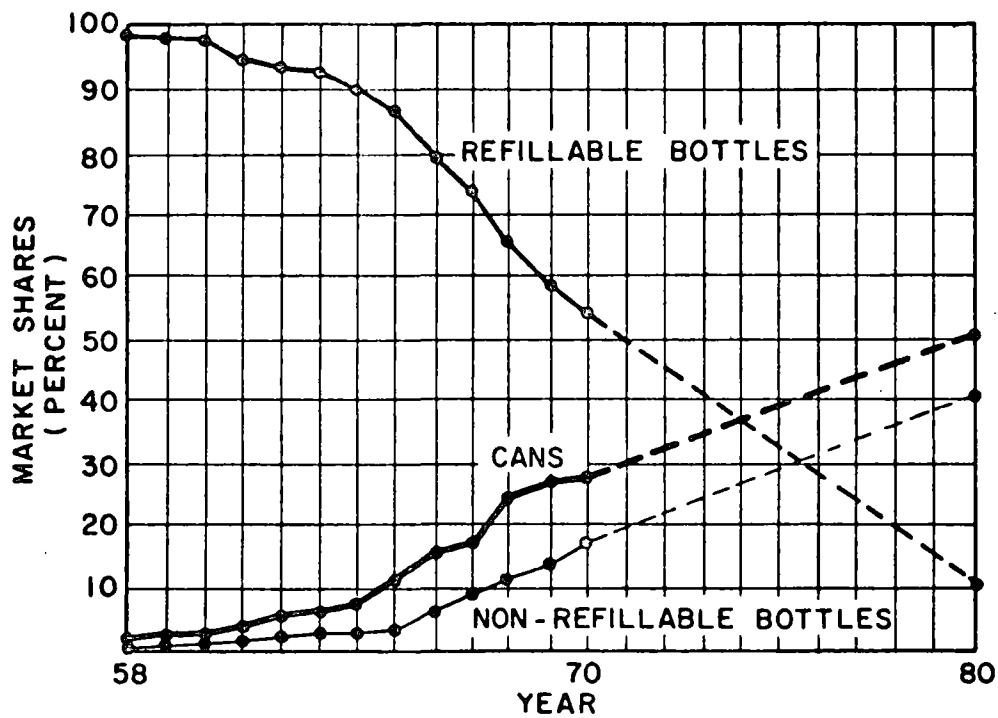
Figure B-23. Soft Drink (11) bottles, market shares
(Source: Research Triangle Institute).

on transportation costs. These costs have been increasing, thereby reducing the traditional cost advantage of the refillable bottle vis-a-vis one-way containers. There have also been improvements in the manufacture of nonrefillable bottles and cans that have resulted in prices for these containers being low enough to permit their substitution for refillable bottles. Finally, there is apparently the substantial consumer desire for the convenience of a beverage container that does not have to be returned for a deposit.

Metal cans were first introduced for Beer packaging in 1935. The can was made of tinplate with a cone top and it could be run on the then-existing bottling lines. Soon it was replaced by the flat top can which was used during World War II for overseas shipment. Servicemen returning from the war provided a ready domestic market for Beer packaged in cans. Since that time, cans have made steady inroads into the Beer container market, accounting for 60 percent of all fillings in 1970. The acceptance of metal cans by the Soft Drink industry did not gain momentum until the early 1960's when private label brands in nonrefillable containers were introduced by several major supermarket chains. The national franchise companies and independent regional firms, observing the popularity of private label brands, followed with nonrefillable bottles and cans.

The reduction in the price of aluminum sheets for canmaking in 1964 resulted in the entry of a new competitor to tin plated steel in the metal can market. First used for beer, more recently aluminum has been used for making soft drink cans.

In order to meet this competition, the steel industry introduced the tin-free steel (TFS) can 1 year later. This can is not dependent on foreign sources of tin and is thinner and cheaper than the traditional tinplate can. This competition between the steel and aluminum industries for the beer can fabricating industries has been cited by breweries as an important source of stability in beer can cost and, hence, beer prices over the last few years.

Aluminum is competitive with steel for applications where thin gages of metal can be used, such as for beer and soft drinks because (a) the internal pressure of carbonation helps support the container, and (b) the cost (on a weight basis) increases with decreases in thickness due to the economies of production. The cost of aluminum cans (on a weight basis)

is not sensitive to thickness.

Aluminum cans may be more attractive to consumers than steel cans because of their image of being made of a modern metal. Since most aluminum cans used for beverage packaging are of two-piece construction, quality control problems due to leakage along the side or bottom seams are eliminated. Aluminum cans are adaptable to wrap-around lithography whereas steel cans, and those made of tinplate, have a side seam that cannot be decorated. Finally, since aluminum cans are lighter than steel cans, their shipping costs are less. For example, aluminum cans weigh 39-45 pounds per base box versus 55 pounds for the lightest steel cans.

On the negative side, some modification of can-filling lines originally designed to handle three-piece steel cans is necessary due to the nonmagnetic, high coefficient of friction and lightness of aluminum.

The glass bottle share of the Beer and Soft Drink packaging market has been declining steadily, and would have declined still further had not the nonrefillable bottle been introduced in 1959. This bottle is lighter in weight than the conventional bottle but incorporates design features that permit it to withstand the pressure of carbonated beverages. Bottles cannot be filled at the speeds of cans, and bottle-filling lines must also have additional manpower. Unless there are substantial increases in bottle-filling speeds and reductions in weight without increases in costs, it is difficult to see how the glass bottle share of the Beer and Soft Drink market can reverse its continuing decline.

Two possibilities exist that may alter the current trend in the glass share. First, Owens-Illinois is developing a lightweight (3-ounce), bulb-shaped bottle, set in a polyethylene base, with a ring-pull cap. This bottle has been run at speeds of over 1,000 bottles per minute in a prototype plant. Secondly, legislation proposed in virtually every State to ban or require deposits on nonrefillable containers would, if enacted, leave the refillable glass container as the only currently viable beverage package.

In addition to the usage of glass and metal for beverage containers, smaller amounts of paper and plastics are used for labeling and multi-container packaging.

Table B-15. Beer (10) and Soft Drink (11) containerization
and solid waste generation

	Beer	Soft Drink	Total
Containerization			
Total consumption:			
Million 1967 dollars	8,094.5	4,020.4	12,114.9
Billion oz	647.56	1,005.10	1,652.66
Packaged consumption:			
Billion oz	537.47[a]	804.08[b]	1,341.55
Fillings (million 12-oz units):			
Total	44,789.2	67,006.6	111,795.8
Refillable bottles	6,360.1	6,533.1	12,893.2
Nonrefillable bottles	8,509.9	27,171.2	35,681.1
Cans	29,919.2	33,302.3	63,221.5
Solid waste generation:			
(thousand tonnes)			
Refillable bottles	112.57[c]	176.23[d]	288.80
Nonrefillable bottles	1,422.52[e]	8,233.70[f]	9,656.22
Cans:			
Aluminum	628.28[g]	584.25[h]	1,212.53
Steel	2,521.75[i]	2,960.20[j]	5,481.95
Metal closures	178.44	40.44	218.88
Paperboard	179.16	134.01	313.17

[a]Based on 17 percent bulk sales.

[b]Based on 20 percent bulk sales.

[c]Based on 16 trips per bottle and an average of 3.53 thousand units per tonne.

[d]Based on 16 trips per bottle and an average of 2.3 thousand units per tonne.

[e]Based on 4.5 thousand units per tonne.

[f]Based on 3.3 thousand units per tonne.

[g]Based on 24 percent market share of cans and 11.4 thousand units per tonne.

[h]Based on 20 percent market share of cans and 11.4 thousand units per tonne.

[i]Based on 76 percent market share of cans and 9.0 thousand units per tonne.

[j]Based on 80 percent market share of cans and 9.0 thousand units per tonne.

Since the flavor of Beer is affected by sunlight (ultraviolet) and by the fluorescent light in retail outlets, brewers continue to favor the more protective paper carrier for bottled Beer.* Shrink-wrap bottle carriers will probably, therefore, be more quickly adapted by the Soft Drink rather than Beer market. For canned Beer and Soft Drinks, the Hi-cone carrier dominates although shrink wrapping appears to be making inroads.

Projections of the quantity of materials used to package Beer and Soft Drinks are presented in table B-15. Constant dollar expenditure projections were converted to ounces of consumption on the basis of the historical relationship. Consumption was converted to fillings and then to the types of containers, based on trends in the proportions of the various containers (figs. B-22 and B-23). The 1970 average weight of each of the three containers and the average number of trips for refillable bottles were used to convert containerization to a measure of the weight of packaging materials consumed. The usage of closures was estimated from the 1970 relationship between number of bottle fillings and the weight of closures. Paperboard consumed was similarly estimated, based on the 1970 ratio of paperboard weight and total fillings.

B.7.3 Prepared Beverage Packaging (12)

Prepared Beverages include coffee, tea, cocoa, and other dry beverage mixes. Coffee is the major component, accounting for two-thirds of expenditures on prepared beverages.

The considerations that dictate the type of package for prepared beverages are protection from spoilage and length of shelf life. Coffee sold in the form of coffee beans does not readily become stale and is therefore usually packaged in an economical paper bag. After the coffee is ground, it begins to deteriorate and requires greater protection. Most regular coffee is packaged in a vacuum-packed metal can. The trend in the regular roasted coffee market has been toward the larger size 2- or 3-pound can.

Soluble coffee, which has been increasing its share of the market

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*Dark glass bottles eliminate the light problem for Beer; however, these bottles are more expensive than amber bottles.
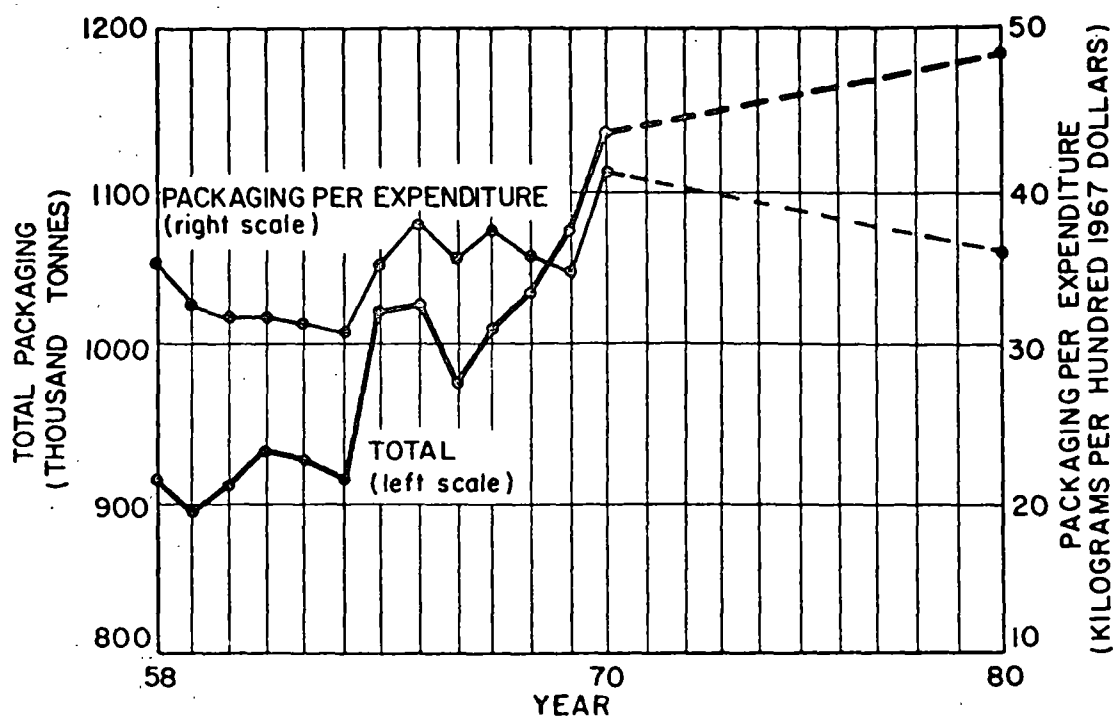
Figure B-24. Prepared Beverages (12) packaging
(Source: Research Triangle Institute).

Table B-16. Trends in the distribution of materials used for packaging Prepared Beverages (12) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	11.85	12.02	12.00	142.6
Plastics	0.00	0.00	1.00	11.9
Glass	67.14	74.22	74.80	889.3
Steel	20.89	13.14	12.00	142.6
Aluminum	0.12	0.16	0.20	2.4
Total packaging	100.00	100.00	100.00	1,188.8*

*Based on projections of 35.20 kilograms of packaging per $100 of consumer expenditures on $3.38 billion for consumer expenditures on Prepared Beverages (12).

Source: Research Triangle Institute.

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spurred by the new freeze-dried varieties, is packaged in a glass container. Instant coffee usually has longer shelf life than regular roasted, and although glass containers are a more expensive package than metal cans, they are easily and tightly resealable. The fastest growing sizes are the 4- and 8-ounce jars, the package sizes of the popular freeze-dried coffees.

Plastics have been introduced as a packaging material for coffee in the form of a polyethylene bag-in-box. The limitation of this package is the shelf life after opening, although at least one packer has resolved this problem by preportioned servings.

Instant tea and breakfast drinks are usually sold in vacuum packed glass jars to insure long shelf life. Drink powders that are to be mixed with milk for a full meal serving and some instant teas are preportioned into single servings and sold in foil-lined paper.

Cocoa is packaged in composite cans. This is an economical package which is sufficiently rigid and resealable to protect the contents.

Trends in packaging Prepared Beverages and projections of the quantity of materials consumed in 1980 are shown in figure B-24 and in table B-16.

B.8 Candy and Chewing Gum (13)

Personal consumption expenditures on Candy and Chewing Gum were $2.8 billion in 1970. During the first half of the last decade, sales of Candy and Chewing Gum kept pace with the growth in population. However, since 1966, confectionery sales have declined; in 1970, expenditures were 15 percent below sales recorded in 1966 (fig. B-25). Per capita consumption is expected to stabilize for the next 10-year period, and total expenditures are predicted to be $3.9 billion in 1980.

The amount of packaging per dollar of expenditure on confectionery increased 3 percent during the 12-year period 1958-1970 (fig. B-26). This trend reflects the decline in sales of bulk candy in preference for prepackaged bars. In addition, the growing volume of 6-bar packs and bags of junior bars requires more packaging per pound of candy than the single bar. This packaging trend is expected to continue, with total packaging projected to be 433 thousand tonnes in 1980 (table B-17), or 11 kilograms per $100 expenditures.

The prime requisite in packaging Candy and Chewing Gum is a material that forms a barrier to moisture escaping from the product.
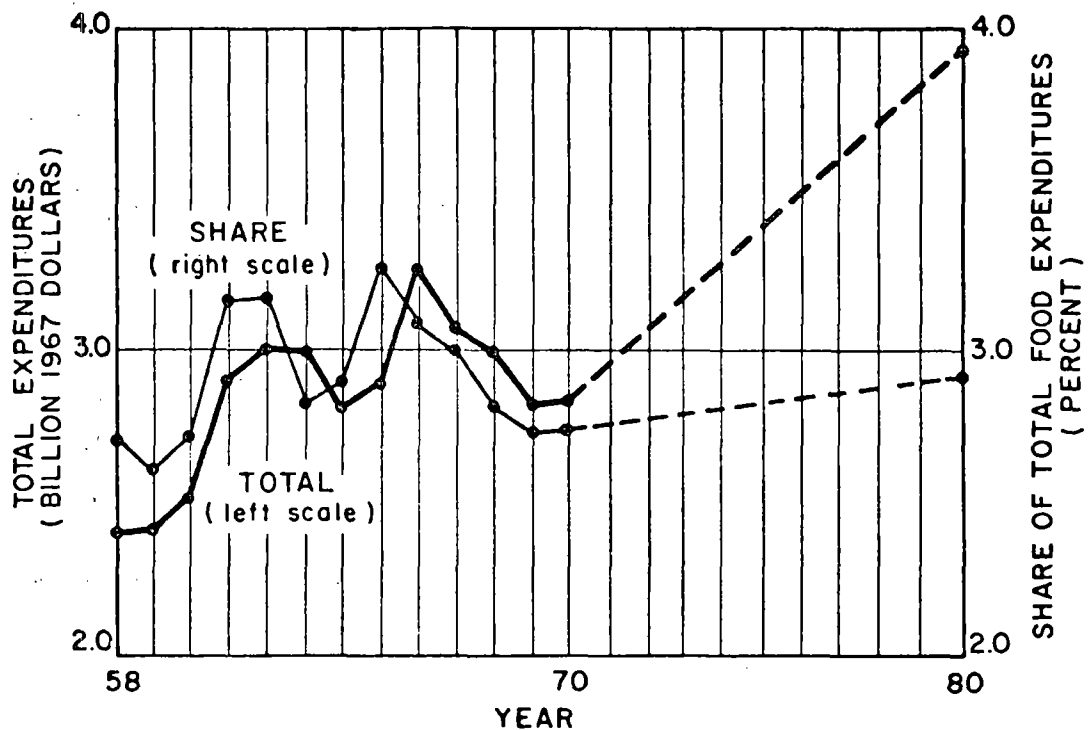
Figure B-25. Candy and Chewing Gum (13) consumption
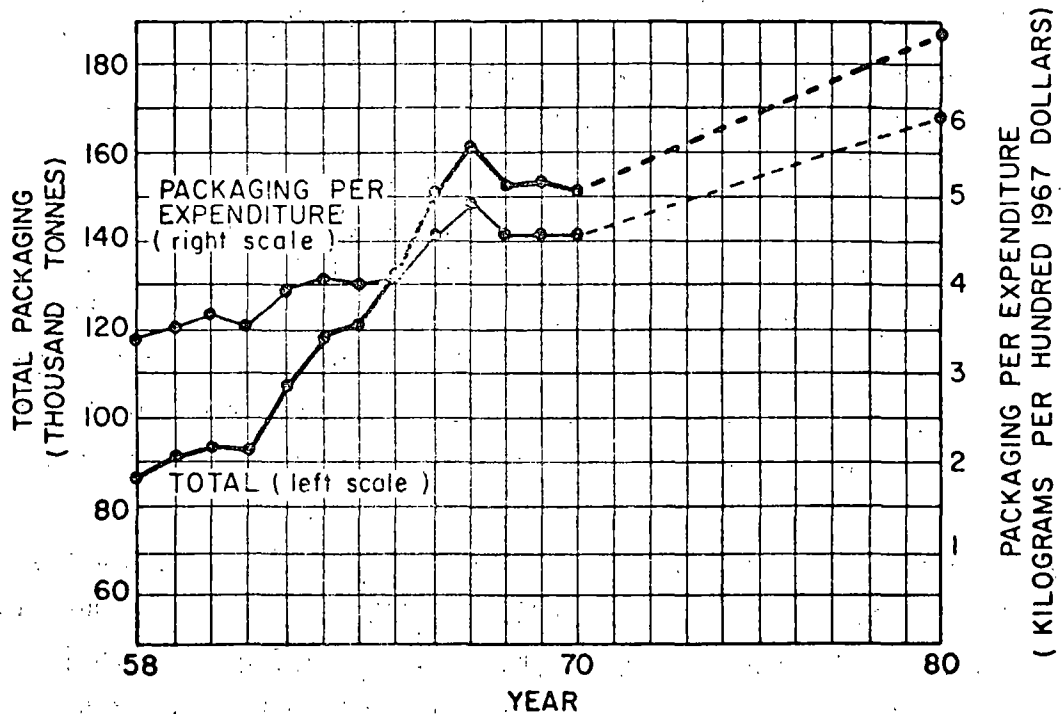(Source: *Supermarketing* and Research Triangle Institute).

Figure B-26. Candy and Chewing Gum (13) packaging
(Source: Research Triangle Institute).

Table B-17. Trends in the distribution of materials used for packaging Candy and Chewing Gum (13) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	76.54	73.68	69.50	300.8
Plastics	20.92	23.91	28.00	121.3
Glass	0.00	0.00	0.00	0.0
Steel	0.00	0.00	0.00	0.0
Aluminum	2.55	2.41	2.50	10.8
Total packaging	100.00	100.00	100.00	432.9*

*Based on projections of 11.14 kilograms of packaging per $100 of consumer expenditures on $3.88 billion for consumer expenditures on Candy and Chewing Gum (13).

Source: Research Triangle Institute.

Both Candy and Chewing Gum become stale if not properly protected. Additionally, the package should protect the contents in normal handling, and, for many Candy bars, the material must be greaseproof.

Glassine paper is the usual material used to wrap Candy bars. Plastics are often used to bag several bars or other types of Candy. Chewing Gum is wrapped in aluminum.

B.9 Canned Foods (14)

Consumer expenditures on Canned Foods were $6.1 billion in 1970, representing about 5 percent of the total food budget. Per capita consumption of canned baby foods and milk declined from 1958 to 1970 as the birth rate fell. Somewhat higher per capita consumption of canned fruits and vegetables was evidenced toward the end of the historical period. The gains in canned fruits and vegetables came at the expense of fresh produce. Per capita consumption of canned vegetables grew at an annual rate of 17 percent from 1960 to 1971 while fresh vegetable consumption fell 81 percent during the period. A similar situation was true for fruits. Consumer preference for convenience foods explains the shift from fresh produce; and while the major beneficiary has been the frozen food industry, some benefit has accrued to Canned Foods. Expendi-

tures on Canned Foods are expected to reach $7.8 billion in 1980 (fig. B-27).

"Canned" refers to the method of packaging rather than to the package itself. The method of canning involves preservation of the food by sterilization in a rigid container, either metal or glass. The canned product has a shelf life that is measured in years rather than in days or months as with most other food items.

The amount of packaging per dollar of consumer expenditure decreased slightly between 1958 and 1970 (fig. B-28). This decline reflects the introduction of the lightweight aluminum can for some applications, and a trend toward thinner gage steel cans. Shifts in the size distribution of cans have been insignificant (for example, see table B-18). Table B-19 provides a list of container dimensions. A further decrease in the amount of packaging consumed per dollar of expenditure is projected for 1980, and the total 1980 packaging requirements of the canned food industry are estimated at 4.3 million tonnes (table B-20).

Steel is the primary material used for canning, accounting for 67.5 percent of the total weight of materials used in canning in 1970. Steel excels in various characteristics including the many ways it can be formed and shaped into packages. Its most important properties, however, are strength, total impermeability, and resistance to temperature extremes. Steel maintains advantages over glass jars in that it will not break or allow light to penetrate, thus damaging the contents.

Prior to 1965, tinplate was practically the only canmaking material in commercial use. Since 1965, however, the introduction of tin-free metal has created a transformation in the canmaking industry. The use of tin-free steel (TFS) has involved not only the introduction of a new material, but also the development of completely new can fabrication techniques. TFS cannot be soldered with reliability at high speeds nor can it be effectively drawn and ironed, the processes used for tinplate. Cementing and welding fabricating processes for TFS have been developed and proved successful. Industry observers predict that an almost complete conversion to TFS for most food applications will occur within the next 5 to 10 years (ref. 10).

The impetus for the development of tin-free steel was due to the competition to traditional tinplate from aluminum. Tin-free steel, which costs 15 to 20 percent less than tinplate, offered the steel industry an
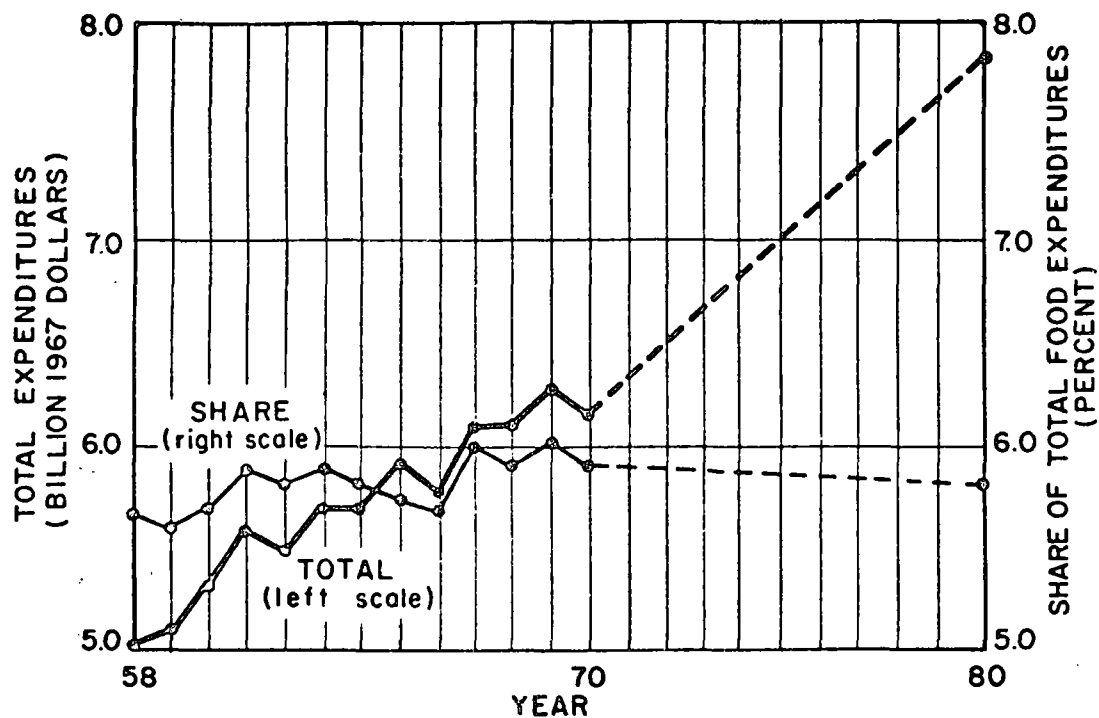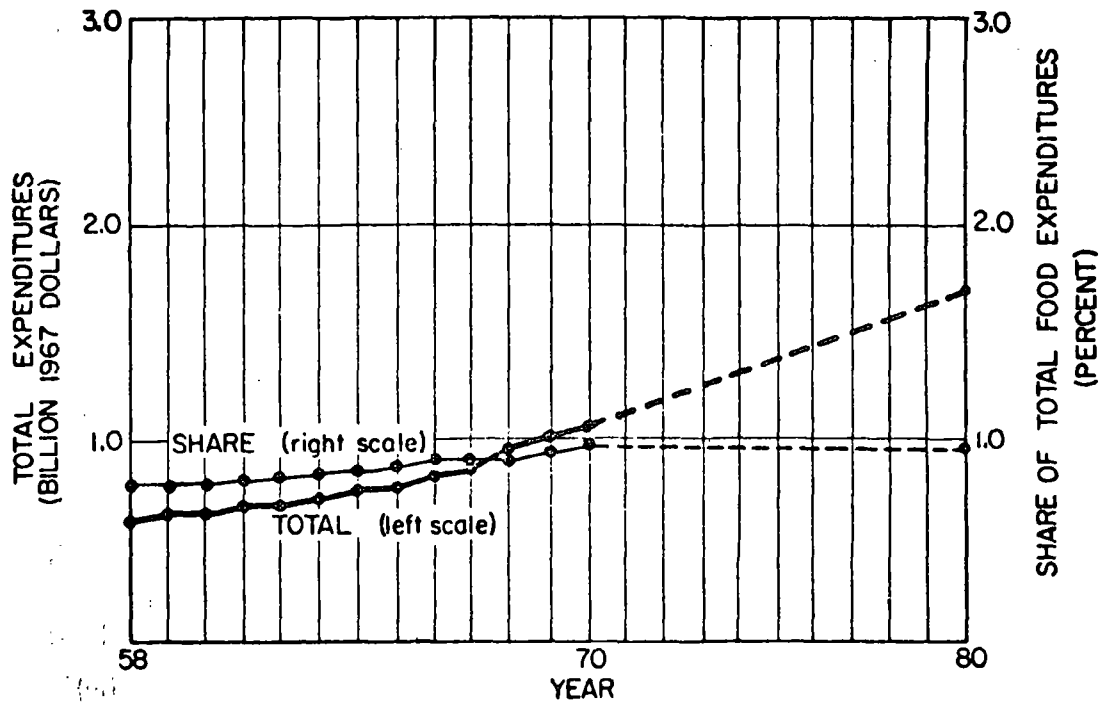
Figure B-27. Canned Food (14) consumption (Source: Supermarketing and Research Triangle Institute).
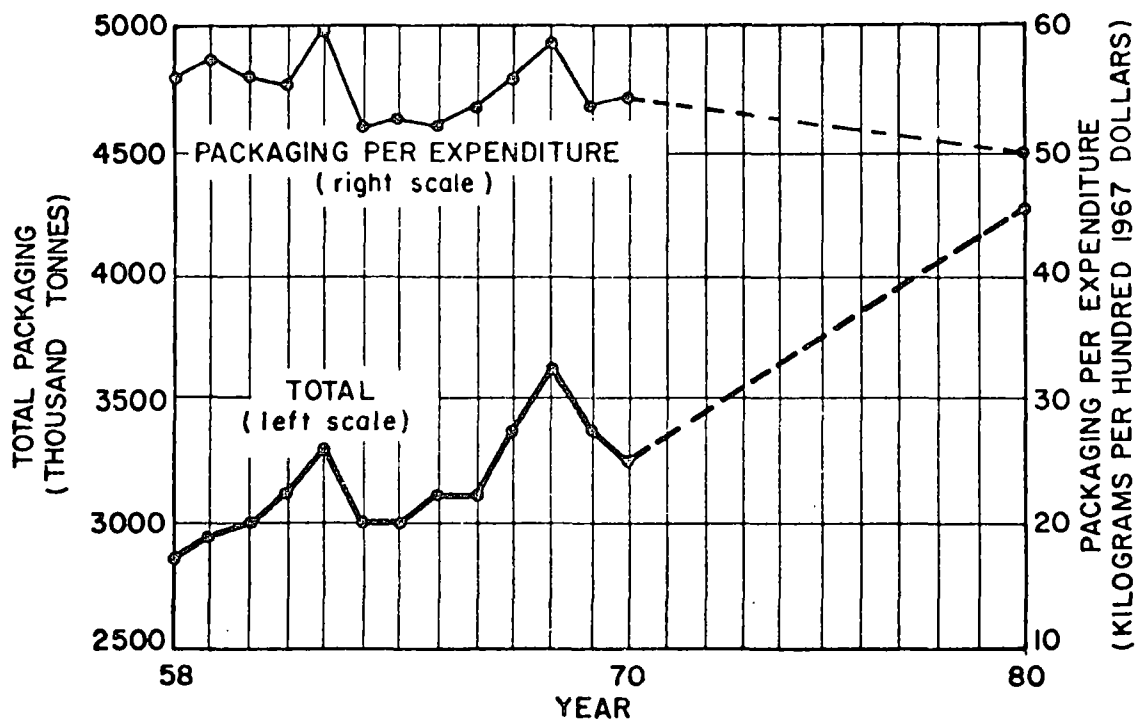
Figure B-28. Canned Food (14) packaging (Source: Research Triangle Institute).

Table B-18. Comparison of the size distribution of canned vegetable packs, 1962 and 1970

Vegetable	No. 8Z	No. 8Z Tall	No. 1 Picnic	Nos. 300 & 303	No. 2 Vac. (12Z Vac.)	No. 2	No. 2-1/2	No. 3	No. 10	Misc.	Total
Asparagus											
Thousand containers											
1962	-	2,217.6	4,627.2	12,285.6	-	1,480.8	-	-	299.4	2,236.2	23,146.8
1970	-	1,953.6	2,688.0	9,307.2	-	86.4	-	-	157.8	1,726.8	15,919.8
Percent distribution											
1962	-	9.6	19.9	53.1	-	6.4	-	-	1.3	9.7	100.0
1970	-	12.3	16.9	58.5	-	0.5	-	-	1.0	10.8	100.0
Green beans											
Thousand containers											
1962	9,360.0	-	-	45,830.4	-	-	1,024.8	-	3,872.4	686.4	60,774.0
1970	11,016.0	-	-	64,850.4	-	-	2,272.8	-	4,362.6	837.6	83,339.4
Percent distribution											
1962	15.4	-	-	75.4	-	-	1.7	-	6.4	1.1	100.0
1970	13.3	-	-	77.8	-	-	2.7	-	5.2	1.0	100.0
Wax beans											
Thousand containers											
1962	2,016.0	-	-	6,782.4	-	-	-	-	371.4	9.6	9,179.4
1970	1,488.0	-	-	6,364.8	-	-	-	-	521.4	7.2	8,381.4
Percent distribution											
1962	22.0	-	-	73.9	-	-	-	-	4.0	0.1	100.0
1970	17.8	-	-	75.9	-	-	-	-	6.2	0.1	100.0
Lima beans, green											
Thousand containers											
1962	1,948.8	-	-	5,541.6	-	-	-	-	328.2	7.2	7,825.8
1970	1,675.2	-	-	4,183.2	-	-	-	-	243.0	40.8	6,142.2
Percent distribution											
1962	24.9	-	-	70.8	-	-	-	-	4.2	0.1	100.0
1970	27.3	-	-	68.1	-	-	-	-	4.0	0.6	100:0
Beets											
Thousand containers											
1962	5,491.2	-	-	17,894.4	-	-	-	-	1,449.6	108.0	24,943.2
1970	3,571.2	-	-	17,340.0	-	-	-	-	1,227.0	16.8	22,155.0
Percent distribution											
1962	22.0	-	-	71.7	-	-	-	-	5.9	0.4	100.0
1970	16.1	-	-	78.3	-	-	-	-	5.5	0.1	100.0
Carrots											
Thousand containers											
1962	1,670.4	-	-	4,564.8	-	-	-	-	1,044.6	9.6	7,289.4
1970	1,728.0	-	-	5,606.4	-	-	-	-	992.4	2.4	8,329.2
Percent distribution											
1962	22.9	-	-	62.7	-	-	-	-	14.3	0.1	100.0
1970	20.8	-	-	67.3	-	-	-	-	11.9	‡	100.0
Corn											
Thousand containers											
1962	17,404.8*	-	-	69,225.6	17,870.4	-	-	-	2,352.6	804.0	107,657.4
1970	15,345.6*	-	-	73,200.0	17,616.0	-	-	-	2,509.2	98.4	108,769.2
Percent distribution											
1962	16.2	-	-	64.3	16.6	-	-	-	2.2	0.7	100.0
1970	14.1	-	-	67.3	16.2	-	-	-	2.3	0.1	100.0
Peas											
Thousand containers											
1962	21,652.8	-	-	53,119.2	-	-	-	-	2,521.2	331.2	77,624.4
1970	16,195.2	-	-	47,152.8	-	-	-	-	2,041.8	148.8	65,538.6
Percent distribution											
1962	27.9	-	-	68.5	-	-	-	-	3.2	0.4	100.0
1970	24.7	-	-	72.0	-	-	-	-	3.1	0.2	100.0

Table B-18. Comparison of the size distribution of canned vegetable packs, 1962 and 1970 (con.)

Vegetable	No. 8Z	No. 8Z Tall	No. 1 Picnic	Nos. 300 & 303	No. 2 Vac. (12Z Vac.)	No. 2	No. 2-1/2	No. 3	No. 10	Misc.	Total
Pumpkin, squash											
Thousand containers											
1962	-	-	-	3,364.8†	-	†	2,534.4	-	568.8	-	6,468.0
1970	-	-	-	3,000.0†	-	†	2,328.0	-	373.2	36.0	5,737.2
Percent distribution											
1962	-	-	-	52.0	-	-	39.2	-	8.8	-	100.0
1970	-	-	-	52.3	-	-	40.6	-	6.5	0.6	100.0
Sauerkraut											
Thousand containers											
1962	1,449.6	-	-	8,008.8	-	-	-	-	507.6	6,897.6	16,863.6
1970	4,944.0	-	-	8,347.2	-	-	-	-	764.4	5,541.6	19,597.2
Percent distribution											
1962	8.6	-	-	47.5	-	-	-	-	3.0	40.9	100.0
1970	25.2	-	-	42.6	-	-	-	-	3.9	28.3	100.0
Spinach											
Thousand containers											
1962	1,982.4	-	523.2	9,492.0	-	-	2,004.0	-	468.6	-	14,470.2
1970	1,857.6	-	264.0	9,045.6	-	-	1,936.8	-	594.0	-	13,698.0
Percent distribution											
1962	13.7	-	3.6	65.6	-	-	13.9	-	3.2	-	100.0
1970	13.6	-	1.9	66.0	-	-	14.1	-	4.4	-	100.0
Tomatoes											
Thousand containers											
1962	-	-	2,692.8	37,113.6	-	456.0	11,066.4	-	3,918.0	902.4	56,149.2
1970	-	-	1,185.6	38,198.4	-	134.4	16,334.4	-	3,693.6	1,632.0	61,178.4
Percent distribution											
1962	-	-	4.8	66.1	-	0.8	19.7	-	7.0	1.6	100.0
1970	-	-	1.9	62.4	-	0.2	26.7	-	6.1	2.7	100.0
Turnip greens and other leafy greens											
Thousand containers											
1962	-	-	-	3,024.0	-	-	333.6	-	246.6	-	3,604.2
1970	-	-	-	4,492.8	-	-	657.6	-	438.0	-	5,588.4
Percent distribution											
1962	-	-	-	83.9	-	-	9.3	-	6.8	-	100.0
1970	-	-	-	80.4	-	-	11.8	-	7.8	-	100.0
Sweet potatoes											
Thousand containers											
1962	1,636.8	-	-	3,794.4	290.4	-	3,782.4	5,546.4	848.4	582.0	16,480.8
1970	931.2	-	-	4,243.2	573.6	-	3,240.0	3,460.8	820.2	2,181.6	15,450.6
Percent distribution											
1962	9.9	-	-	23.0	1.8	-	23.0	33.7	5.1	3.5	100.0
1970	6.0	-	-	27.5	3.7	-	21.0	22.4	5.3	14.1	100.0
TOTALS											
Thousand containers											
1962	64,612.8	2,217.6	7,843.2	280,041.6	18,160.8	1,936.8	20,745.6	5,546.4	18,797.4	12,574.2	432,476.4
1970	58,752.0	1,953.6	4,137.6	295,332.0	18,189.6	220.8	26,769.6	3,460.8	18,738.6	12,270.0	439,824.6
Percent distribution											
1962	14.9	0.5	1.8	64.8	4.2	0.4	4.8	1.4	4.3	2.9	100.0
1970	13.4	0.4	0.9	67.2	4.1	0.1	6.1	0.7	4.3	2.8	100.0

*Includes 8Z short and tall.
†No. 2 included with Nos. 300 and 303.
‡Less than 0.05%

Source: The Almanac of the Canning, Freezing, Preserving Industries 1972, Edward E. Judge & Sons, Inc. Westminster, Md., 1972.

Table B-19. Container sizes for common vegetable packs

Name of container	Diameter x height*	Min. vol. fil. (cu. in.)	Total capac. (avoir oz., water at 68°F)
8Z	211 x 300	12.34	7.90
8Z Tall	211 x 304	13.48	8.65
No. 1 Picnic	211 x 400	17.06	10.90
No. 300	300 x 407	23.71	15.20
No. 303	303 x 406	26.31	16.85
No. 2 Vac. (12Z Vac.)	307 x 306	22.90	14.70
No. 2	307 x 409	32.00	20.50
No. 2-1/2	401 x 411	46.45	29.75
No. 3	404 x 414	54.09	35.05
No. 10	603 x 700	170.71	109.45

*For diameter or height, first figure in each dimension number is inches and second two figures are 16ths of an inch; e.g., 303 x 406 = 3-3/16" diameter x 4-6/16" height.

Source: The Almanac of the Canning, Freezing, Preserving Industries 1972, Edward E. Judge & Sons, Inc., Westminster, Md., 1972.

Table B-20. Trends in the distribution of materials used for packaging Canned Foods (14) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	2.77	3.36	3.40	147.8
Plastics	0.00	0.00	0.00	0.0
Glass	17.54	27.36	25.90	1,125.7
Steel	79.69*	67.51	65.70	2,855.6
Aluminum	0.00*	1.77	5.00	217.3
Total packaging	100.00	100.00	100.00	4,346.4†

*Aluminum and steel cans combined in 1958.

†Based on projections of 55.63 kilograms of packaging per $100 of consumer expenditures on $7.81 billion for consumer expenditures on Canned Foods (14).

Source: Research Triangle Institute.

opportunity to improve the competitive advantage of steel.

In recent years aluminum has been used for canning some food products. Aluminum cans, though more expensive than other metal cans, are lightweight and gain a cost advantage in transportation charges. However, aluminum cans, unlike steel, would buckle and collapse from air pressure in the vacuum filling method and are therefore unsuitable packages for many food processors.

Glass has increased its percentage share of the canning market at the expense of metals. In 1958, the weight of glass used to package canned goods was 17.5 percent; in 1970 the glass share had risen to 27 percent. Glass jars offer the consumer a convenient reclosable container. Further, transparent food containers are often preferred by consumers.

B.10 Cereals, Flour, and Macaroni (15)

Per capita consumption of Cereals, Flour, and Macaroni products has declined steadily since 1958. One reason for the stagnation in consumption has been dietary concern about starchy foods with consumer shift to higher protein, more expensive food items. Rice and macaroni products have been most affected by this concern. Cold cereals have been able to maintain their share of consumer dollars because of their convenience; however, recent attacks on the nutritional value of cold cereals and the introduction of instant breakfasts have affected the growth rate of cold cereal sales. Prepared cake mixes have been the most successful product in this market category due to increasing consumer demand for convenience foods. If the trends observed in the 1958-1970 period (fig. B-29) continue, 1980 expenditures on Cereals, Flour, and Macaroni products are projected to be $3.2 billion.

The growth rate of packaging materials consumed in this food category has exceeded the growth in expenditures (fig. B-30). This is primarily due to the shift in importance of the component foods; cold cereals and prepared cake mixes require more packaging than Macaroni products and rice. The projected quantity of materials used for packaging in 1980 is 188 thousand tonnes (Table B-21).

Cereals, Flour, and Macaroni products are dry foods and therefore do not have the stringent packaging requirements of many other food products. The package should protect the contents from excessive moisture
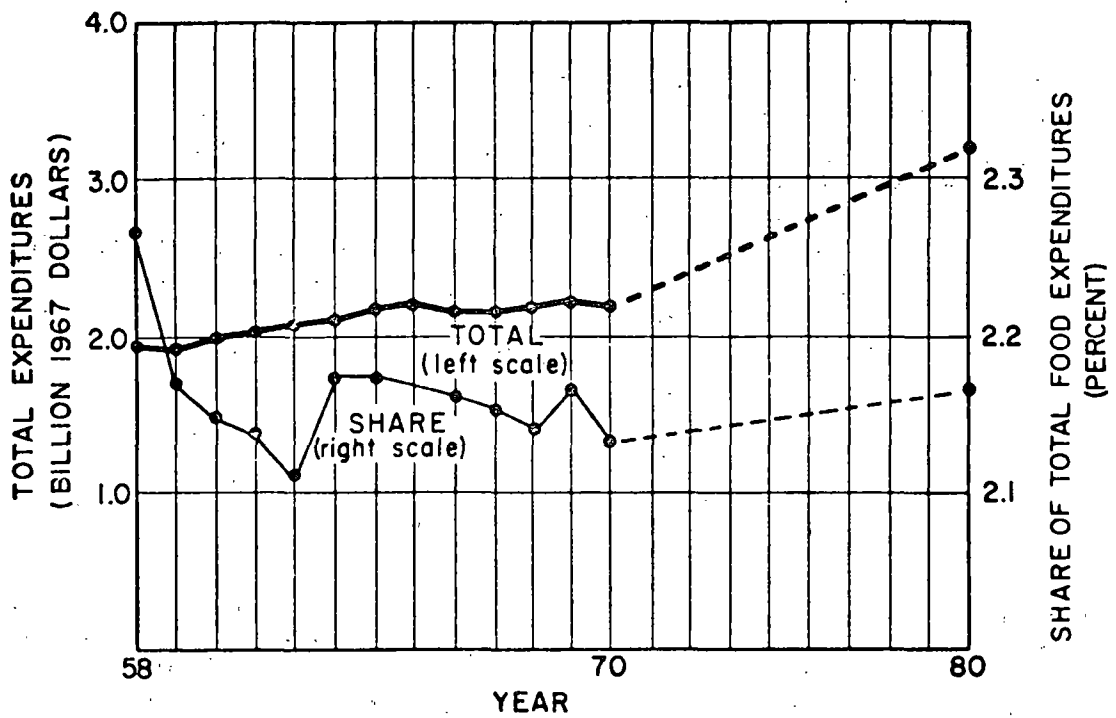
Figure B-29.   Cereals, Flour, and Macaroni (15) consumption
(Source: Supermarketing and Research Triangle Institute).

Figure B-30.   Cereals, Flour, and Macaroni (15) packaging
(Source: Research Triangle Institute).

Table B-21. Trends in the distribution of materials used for packaging Cereals (15) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	95.05	89.41	85.00	159.9
Plastics	4.95	10.59	15.00	28.2
Glass	0.00	0.00	0.00	0.0
Steel	0.00	0.00	0.00	0.0
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	188.1*

*Based on projections of 5.91 kilograms of packaging per $100 of consumer expenditures on $3.18 billion for consumer expenditures on Cereals (15).

Source: Research Triangle Institute.

and insect infestation.

Paper is the usual packaging material. Macaroni and rice are traditionally packaged in a paperboard box with a small cellophane window to display the product but plastic bags have replaced some box packaging.

Cereal is packaged in a paperboard box with a protective inner paper liner. Packaging has played a major role in marketing Cereals. Visually striking graphics and unusual designs are used to attract the consumer and sell the product. For example, the round paperboard package is the trademark of Quaker Oats and Quaker Rice; splashy cartoon packages have been used by some cereal manufacturers to attract the youth market.

B.11 Pet Foods (16)

Sales of Pet Foods topped the $1 billion mark in 1970, and industry experts feel the climate is right for continued growth. The pet population continues to grow, and owners are buying more expensive foods for their pets. Studies of owners' attitudes indicate that most people think of their pets as family members and desire to give them a balanced, varied diet (ref. 11). In an attempt to satisfy the consumers' desire to provide the the best for their pets, manufacturers recently introduced "gourmet"

Figure B-31. Pet Food (16) consumption (Source: Supermarketing and Research Triangle Institute).
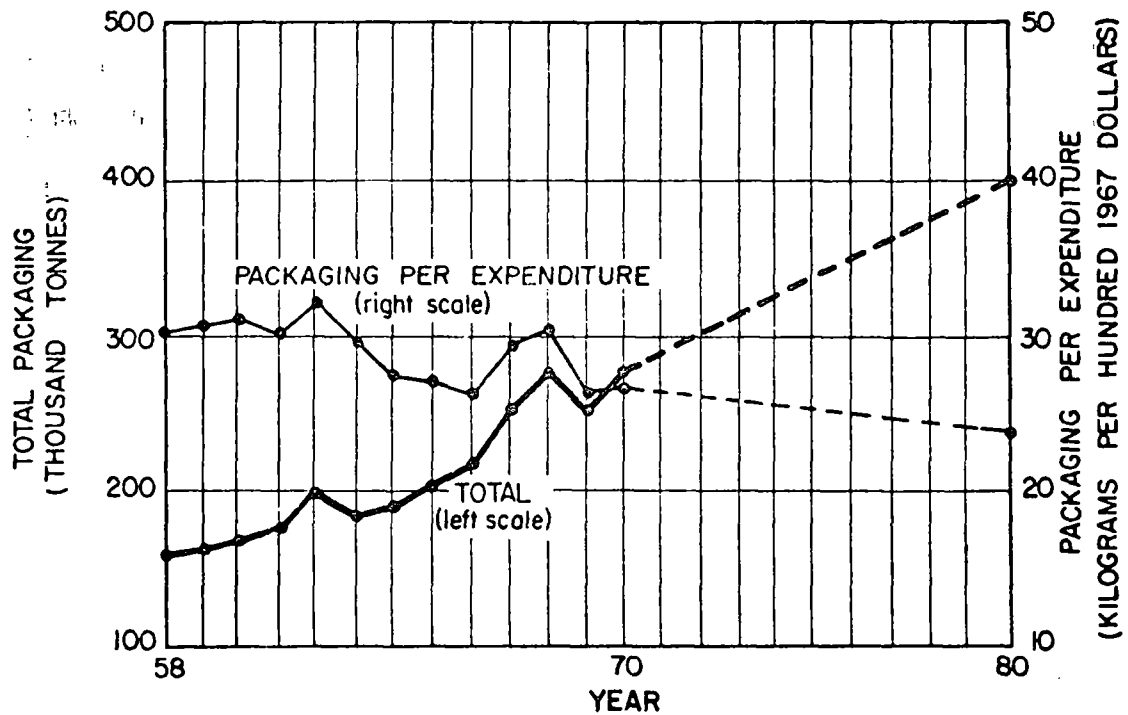
Figure B-32. Pet Food (16) packaging (Source: Research Triangle Institute).

Pet Food lines. These new variety items were successfully received
by pet owners. In addition, it is estimated that less than one-half
of the pet population eats prepared Pet Foods (ref. 11). Converting
pet owners to prepared foods offers further potential for expansion
of the Pet Food market. Sales of Pet Food in 1980 are projected to
be $1.7 billion (fig. B-31).

Pet Foods are sold in dry, semimoist, or moist form. The moist
foods are canned; the dry and semimoist foods are packaged in paper bags
and boxes. The trend in packaging Pet Foods is convenience. Some studies
show that many pet owners are reluctantly pleasing pet-loving children.
Manufacturers believe that if they wish to keep this market, they will
have to package their products to afford easy and clean opening and use.

Multipacks are being promoted with convenience in mind. The economy
8- or 10-packs save storage space and are easier to carry. A packaging
innovation, designed to make stacking and storing of Pet Foods easier,
has been introduced by Continental Can. Their "stack can" concept uses
necked-in, soldered-side-seam cans which nest one on top of the other
(ref. 12).

Trends in Pet Food packaging are shown in figure B-32 and table B-22.

Table B-22. Trends in the distribution of materials used for
packaging Pet Foods (16) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	3.03	3.47	5.00	20.2
Plastics	0.00	0.00	1.00	4.0
Glass	0.00	0.00	0.00	0.0
Steel	96.97	95.17	92.00	371.2
Aluminum	0.00	1.32	2.00	8.1
Total packaging	100.00	100.00	100.00	403.5*

*Based on projections of 23.71 kilograms of packaging per $100
of consumer expenditures on $1.70 billion for consumer expenditures
on Pet Foods (16).

Source: Research Triangle Institute.

Consumer expenditures on Tobacco Products were $9 billion in 1970; about 85 percent of expenditures were for cigarettes. Per capita consumption of cigarettes among the population 18 and over increased steadily from 1958 to 1964. The first Surgeon General's Report on Smoking and Health in 1964 caused a sharp decline in cigarette consumption, which in turn caused an increase in cigar consumption in that year. Per capita cigarette consumption attained its prereport level the following year; however, the growth in overall consumption has subsequently stabilized at the population growth rate. The recent ban on cigarette advertising over radio and television had no apparent effect on sales of cigarettes. This may be in part due to the concurrent decline in antismoking commercials on the airwaves. Trends in tobacco expenditures and the 1980 projection are depicted in figure B-33.

The market for cigarettes is mature; therefore, gains in sales of one brand must generally come at the expense of other brands. Innovative marketing techniques are a prime means available to the cigarette manu-
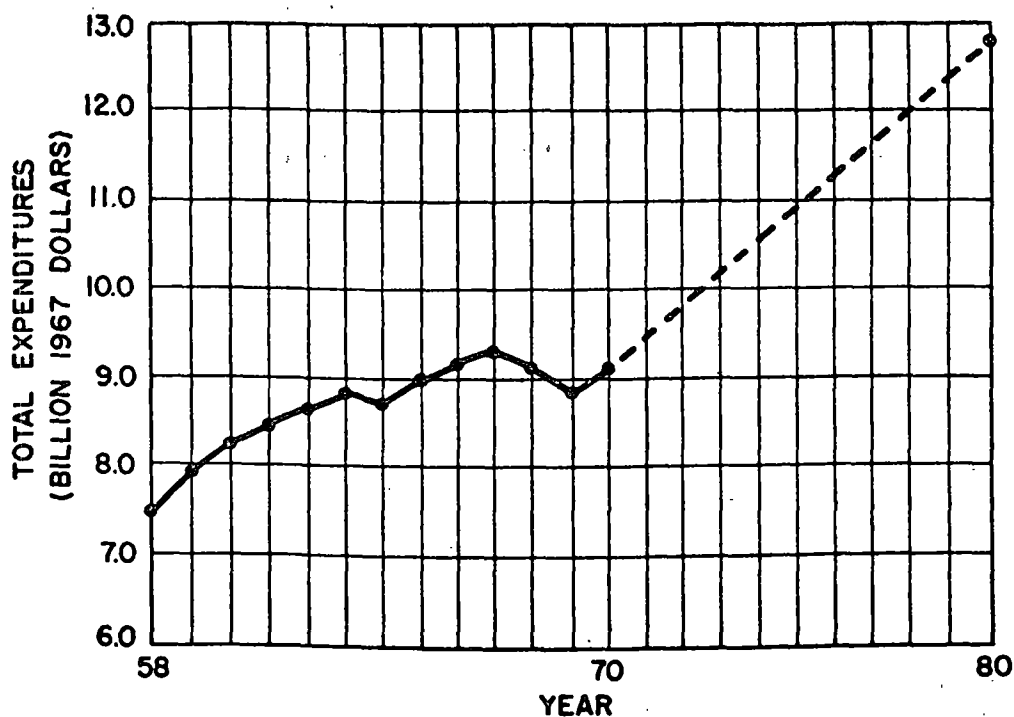
Figure B-33. Tobacco Products (17) consumption (Source: Unpublished data, Bureau of Labor Statistics).
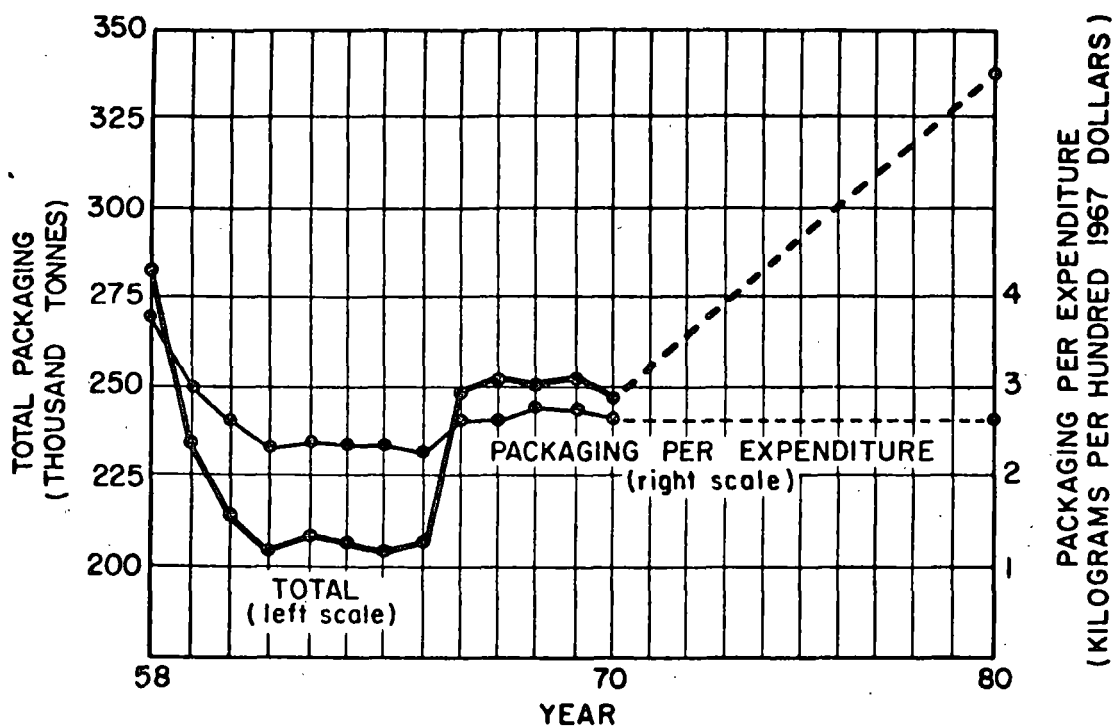
Figure B-34. Tobacco Products (17) packaging (Source: Research Triangle Institute).

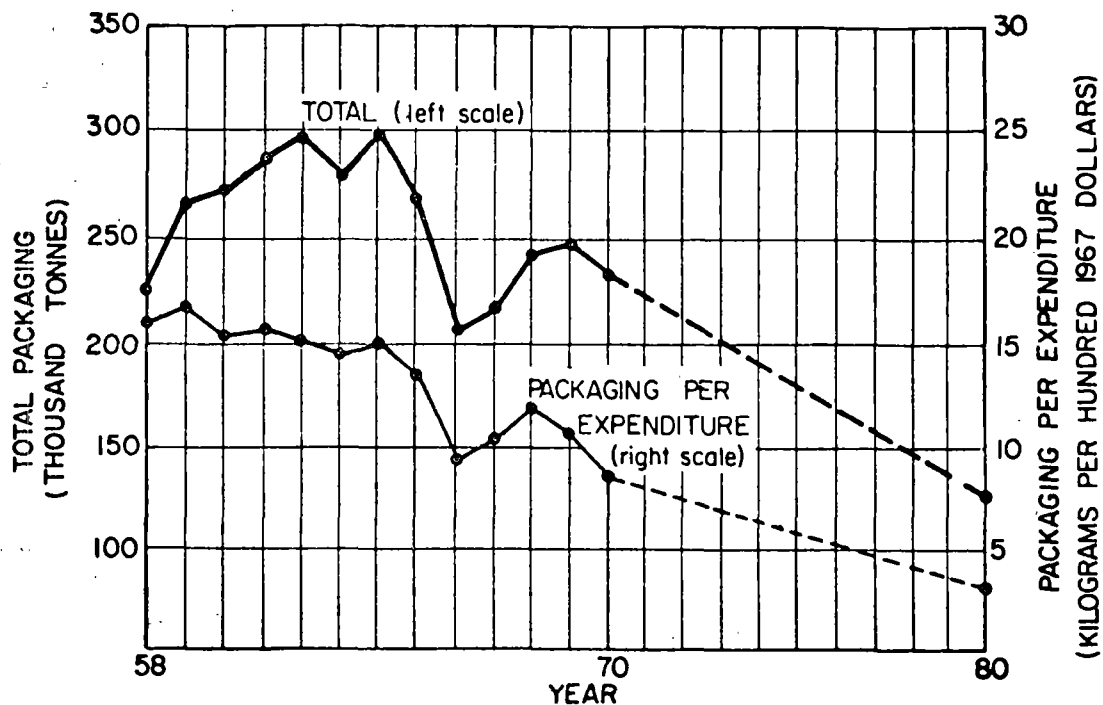Table B-23. Trends in the distribution of materials used for packaging Tobacco Products (17) and projections of 1980 packaging

| Packaging materials | Percentage share of weight | | | Projected packaging, 1980 (thousand tonnes) |
	1958	1970	1980	
Paper	90.98	86.14	86.10	291.5
Plastics	6.38	10.65	10.70	36.2
Glass	0.00	0.00	0.00	0.0
Steel	0.00	0.00	0.00	0.0
Aluminum	2.65	3.21	3.20	10.9
Total packaging	100.00	100.00	100.00	338.6*

*Based on projections of 2.67 kilograms of packaging per $100 of consumer expenditures on $12.7 billion for consumer expenditures on Tobacco Products (17).

Source: Research Triangle Institue.

facturer for maintaining and expanding his market. The Marlboro flip-top box is an example of the use of packaging to launch and market a new brand and provide product differentiation. The flip-top box was an unusual cigarette container in 1954 when it was introduced and promised the consumer additional protection of the product until the contents were consumed (ref. 13).

In the cigarette industry, which has uniform product and prices, establishing brand loyalty has been an important determinant of success. Packaging graphics, therefore, play an important role at the sales point so that the favored brand can be readily identified.

The primary materials used for packaging tobacco products are paper, plastic, and aluminum. The soft-pack cigarette container is made of plain paper, while the flip-top box and cigar box are made of heavier stock. A moisture barrier to prevent the tobacco from drying out and becoming stale is provided by glassine, paper, aluminum, or plastic. The growth in the quantity of materials consumed has mirrored the growth in consumer expenditures. Packaging trends and projections are shown in figure B-34 and table B-23.

B.13 Other Foods (18)

The remainder of consumers' food expenditures totaled $6.8 billion in 1970. Products in this category include condiments, dressings, and relishes; dried foods; fats and shortening; jams, jellies, and preserves; sweeteners and flavorers; and gelatin and pudding desserts. The fastest growing items in these market groups are convenience items such as premixed seasonings; dried, one-dish meals and potato products; and sauce and gravy mixes. Trends in consumer expenditures for this food category are shown in figure B-35.

The increased use of plastics for packaging most food products is also evidenced for products in this category. Improved plastic resins with superior chemical resistance have created opportunities for plastic bottles as packages for cooking oils, vinegar, syrups, and similar products previously packaged only in glass.

The most significant trend in packaging the foods listed above is toward portion control items. Unit-of-use packages for ketchup, mustard, seasoning mixes, sauce and gravy mixes, and sugar are currently being marketed; industry sources predict that sales of these convenience items
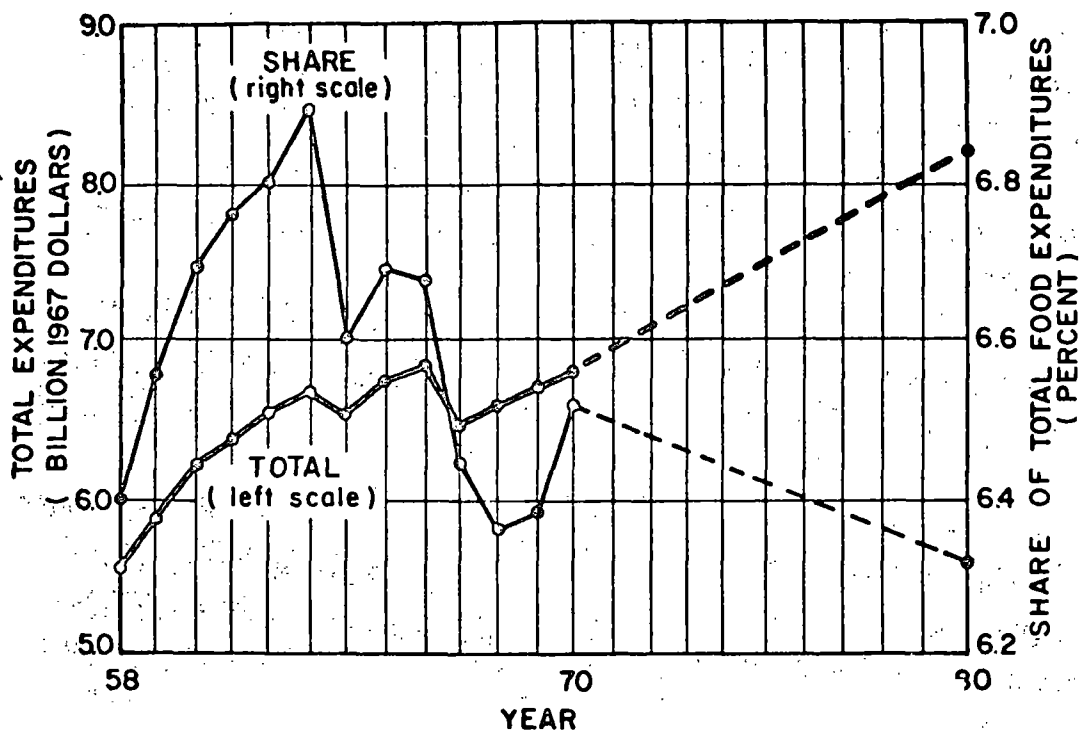
Figure B-35. Other Foods (18) consumption (Source: Supermarketing and Research Triangle Institute).
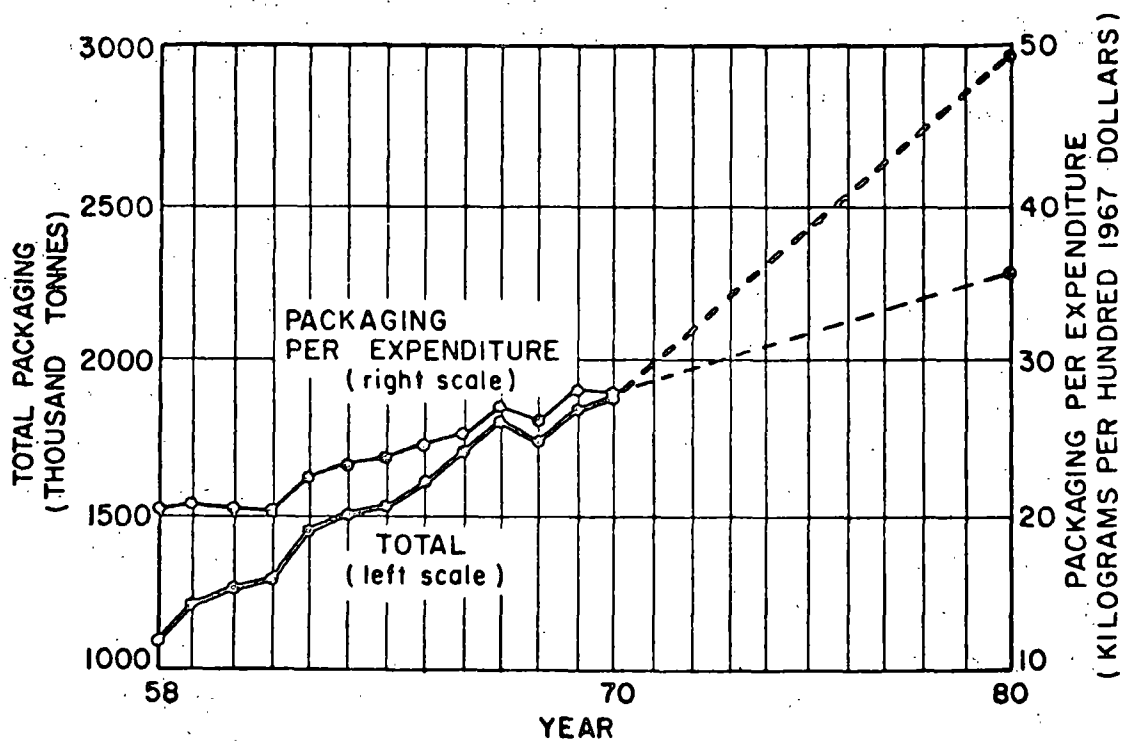
Figure B-36. Other Foods (18) packaging (Source: Research Triangle Institute).

Table B-24. Trends in the distribution of materials used for packaging Other Foods (18) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	19.47	18.76	18.00	530.8
Plastics	2.87	9.22	15.00	442.4
Glass	68.03	66.82	63.00	1,857.9
Steel	9.04	3.75	2.50	73.7
Aluminum	0.59	1.45	1.50	44.3
Total packaging	100.00	100.00	100.00	2,949.1*

*Based on projections of 35.93 kilograms of packaging per $100 of consumer expenditures on $8.21 billion for consumer expenditures on Other Foods (18).

Source: Research Triangle Institute.

will accelerate (ref. 12). Pouches to package these items, produced on form-fill-seal equipment, may be made from a wide range of materials including cellophane, aluminum foil, plastic films, and laminates (ref. 14). Therefore, packagers have a range of options in choosing materials for barrier properties, transparency, and ease of opening and closure. Many of the dried, one-dish meals and potato products use separate pouches for the components of the dish and place the several pouches in a boxboard container. Asceptic pouch packaging is believed to offer opportunities in packaging items such as prepared sauces, gravies, and dips. Methods and materials for hermetically sealed asceptic packages have been developed, but cost factors have inhibited growth (ref. 14).

Trends in the usage of packaging materials and 1980 projections are shown in figure B-36 and in table B-24.

B.14 Household Supplies (19-22)

Consumer expenditures for household supplies grew at an average annual rate of 3.5 percent between 1958 and 1970. Increasing affluence as well as the trend toward more single heads of households should maintain this growth in the future. With higher disposable income, consumers

are willing to pay for the higher-priced convenience household products. The growth in the number of households, created as children and the elderly establish single-person family units, results in increased demand for household supplies.

The trends in specific household supply products varies as consumer tastes and habits change. For example, following the almost universal use of washing machines, demand for bar laundry soap has almost disappeared; sales of home dye products, once a fading industry, were bolstered in recent years with the youth fad for tie-dyeing (ref. 12). Trends in several components are depicted in figures B-37 through B-40.

The aerosol can revolutionized the packaging of household supplies. The modern aerosol is an outgrowth of the wartime "bug bomb" developed by Goodhue and Sullivan in the 1940's (ref. 15). Surplus "bug bombs" entered the retail market immediately following the war. However, these first units were expensive and heavy, and market penetration was limited. In 1947, a lower-pressure "beer-can" type aerosol was permitted for interstate shipment, and this innovation began the era of the disposable aerosol package (ref. 15). With improvements in design, propellants, and technology, the aerosol evolved from the "bug bomb" of the 40's to today's popular package for air fresheners, furniture polish, window cleaners, and many other products.

The major types of aerosol containers include steel cans, aluminum, uncoated glass, vinyl-coated glass, and plastics. Since the aerosol is a pressurized product, the strength of the container is important.

Recent advances in the aerosol container have been designed to offer further convenience to consumers. The actuator overcap provided the consumer with a package that could be picked up and activated immediately. The actuator overcap also provided instant visual identification of the direction of spray and added protection to the valve mechanism in case of mishandling of the container unit (ref. 15).

In addition to convenience of use, the actuator overcap improved the appearance of the package. Consumer desire for convenience extends to the demand for a package that is attractively designed so that it may be stored in the open within easy reach. Manufacturers have attempted to satisfy this need by introducing tall, slender containers with colorful, decorative labels.
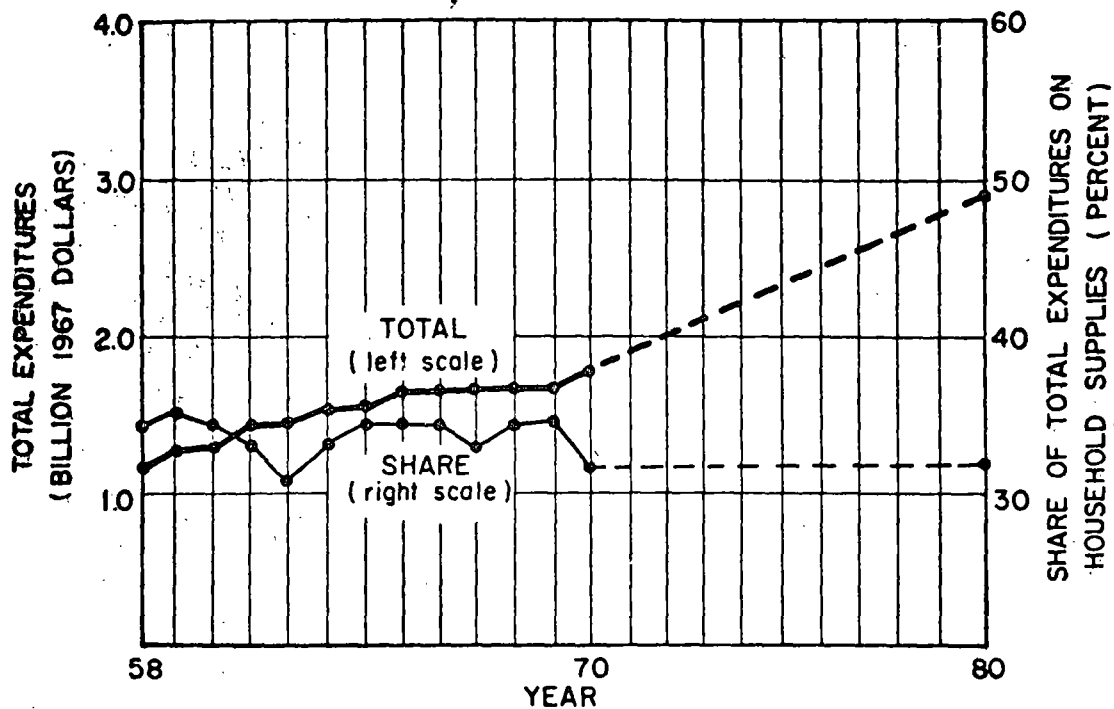
Figure B-37. Soaps and Detergents (19) consumption (Source: Supermarketing and Research Triangle Institute).
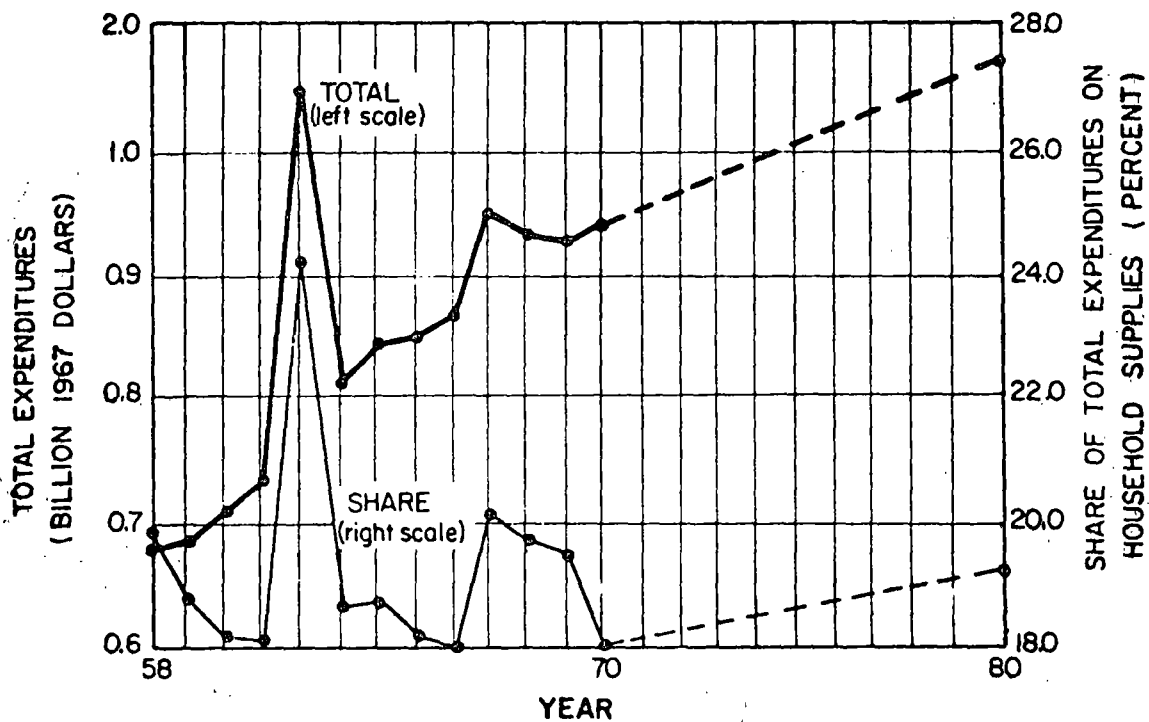
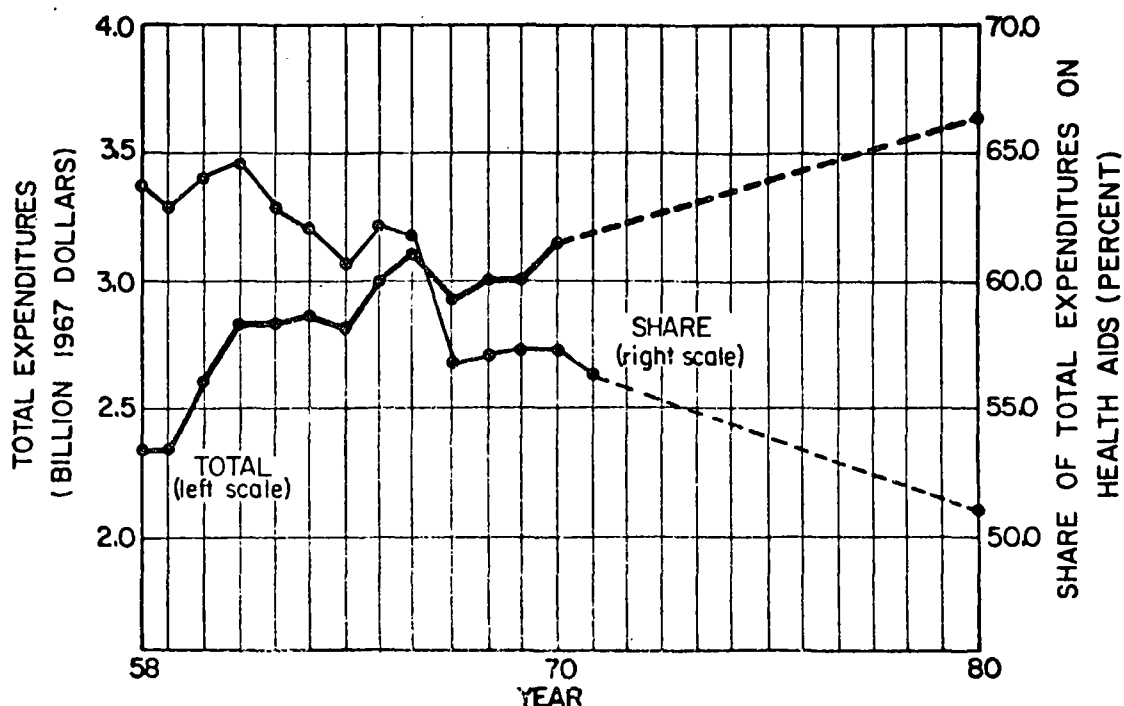Figure B-38. Other Cleaning Supplies (2') consumption (Source: Supermarketing and Research Triangle Ins itute).

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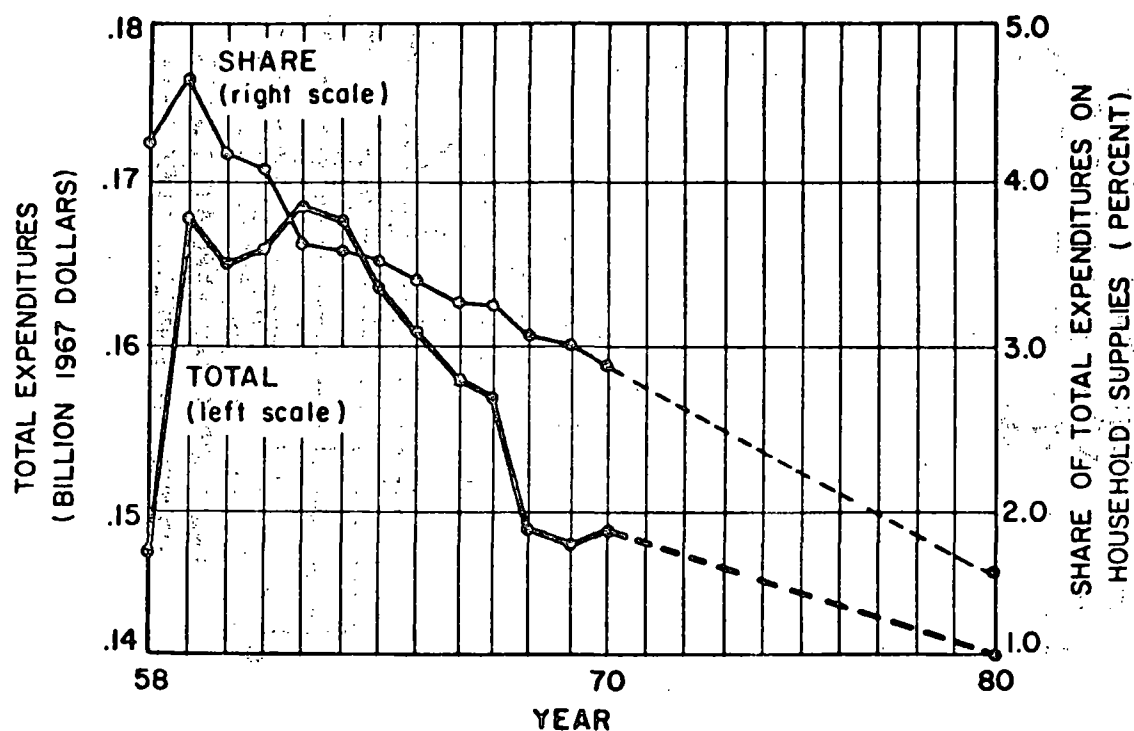
Figure B-39. Pesticides (21) consumption (Source: Supermarketing and Research Triangle Institute).
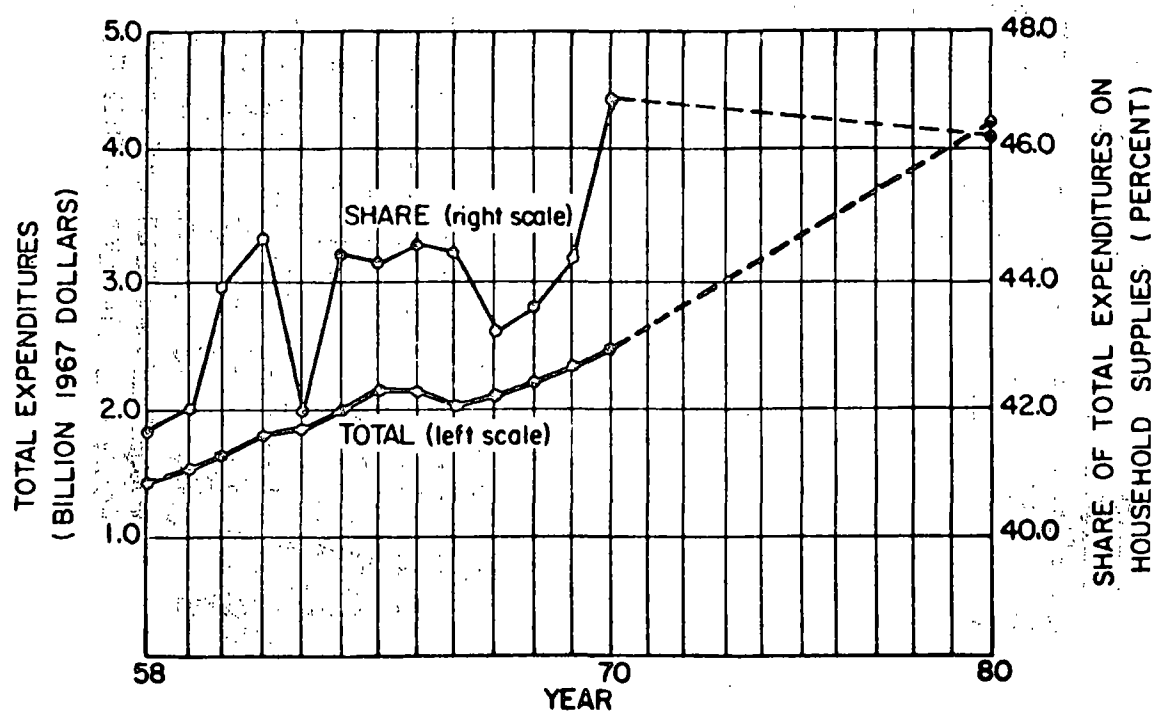
Figure B-40. Other Household Supplies (22) consumption (Source: Supermarketing and Research Triangle Institute).

Convenience packaging is also evidenced in other containers for household supplies. Unit-of-use pouches for cleansers and detergents have been introduced. Pour spouts on boxboard detergent containers, applicators for rug and spot cleaners, and the variety of closures used with liquid detergent bottles are all designed for controlled, easy dispensing of the product. Plastic bottles have been successful in capturing the liquid detergent market from glass due to their convenience and safety in handling.

Trends in the quantity of materials consumed in packaging four components of the household supply group are shown in figures B-41 through B-44. If the trends continue, the weight of packaging associated with household supplies is projected to be 1.5 million tonnes in 1980 (tables B-25 through B-28).

B.15 Health and Beauty Aids (23-29)

Benefiting from population growth and increased affluence, consumer expenditures on health and beauty aids increased at an average annual rate of 4.6 percent from 1958 to 1970. The increase in the number of women in the 14-34 age group and the successes of new toiletries and cosmetics for men have paced the growth in beauty aids at about 10 percent per year. The beauty aids industry foresees continued growth in the next decade and does not view seriously the trend away from cosmetics among some of the youth. The industry points to the fact that cosmetics are used to achieve the popular "natural" look as evidence that the use of cosmetics will not diminish. However, increased regulations on cosmetics may retard the introduction of new products in the future.

Packaged Medications (nonprescription) and Oral Hygiene Products have been the fastest growing health aids. The introduction of new mouthwash products and whitening toothpastes spurred the growth in Oral Hygiene Products. Increasing affluence and the growing appreciation for the value of self-medication have contributed to the 4.5 percent annual growth in proprietary drug sales. While growth in drug sales has remained brisk, the drug industry has always depended on the introduction of new products to maintain growth, and new drug developments have decreased. For example, in 1959, 63 new drugs were introduced, whereas, in 1969, only 11 new drugs were marketed. Part of this is due to more stringent FDA standards which have slowed down the rate of new approvals.

Expenditure trends for health and beauty aid products are exhibited
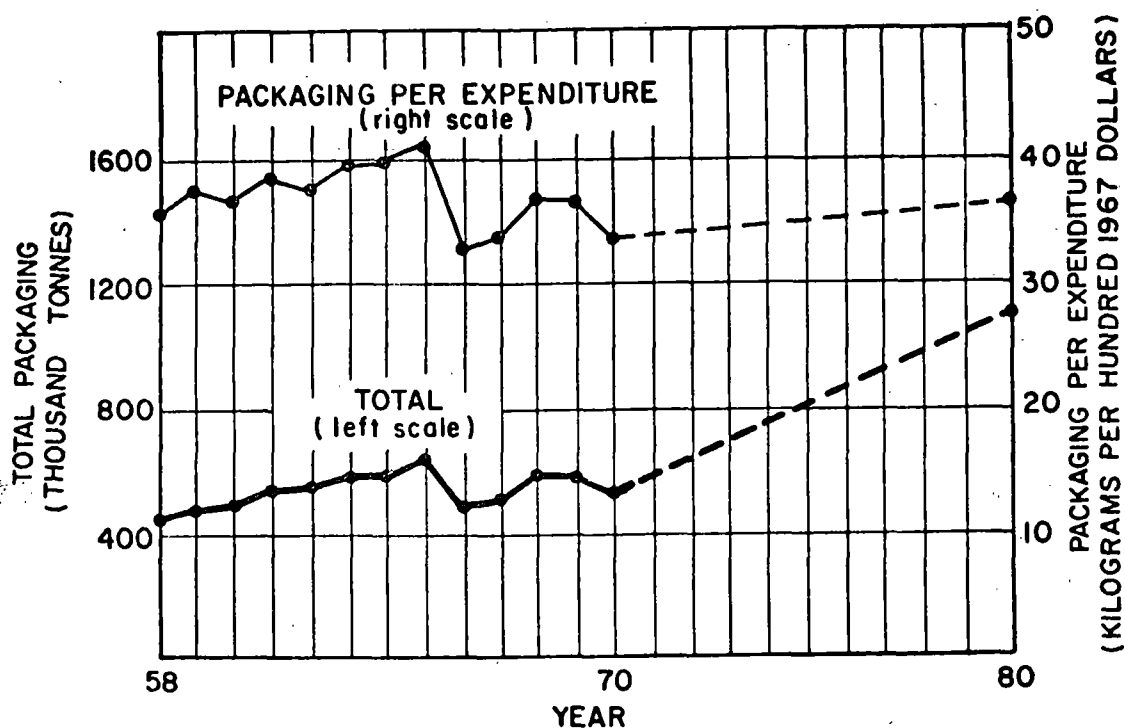
Figure B-41. Soaps and Detergents (19) packaging
(Source: Research Triangle Institute).
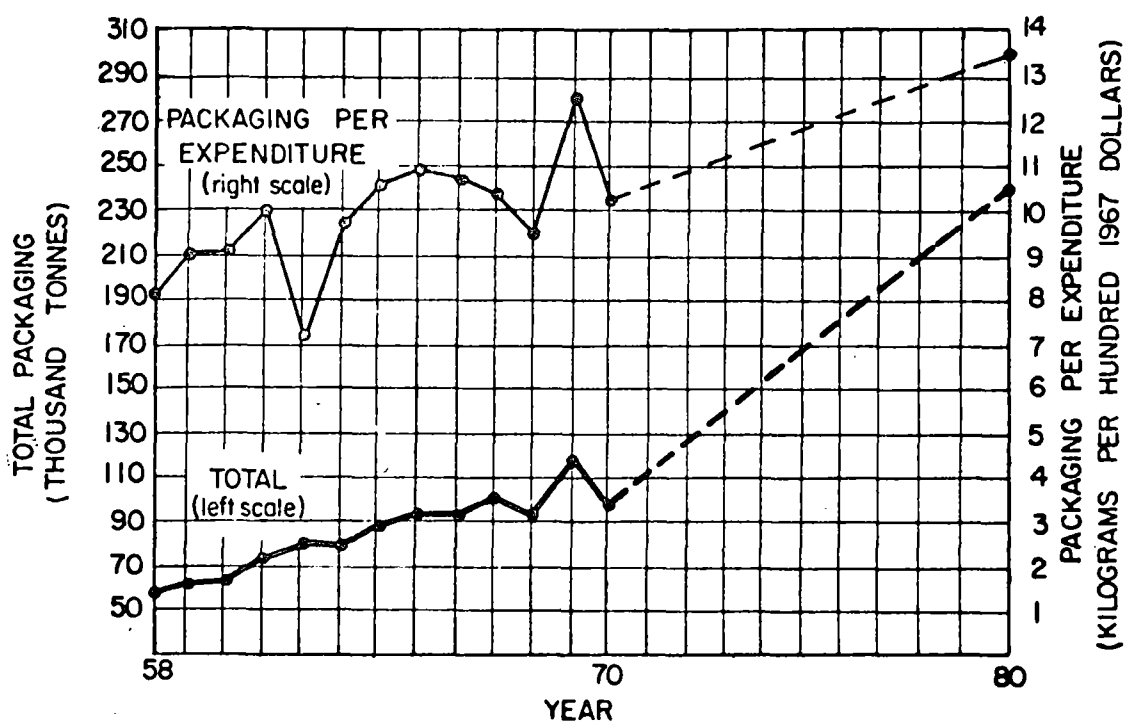
Figure B-42. Other Cleaning Supplies (20) packaging (Source:
Research Triangle Institute).
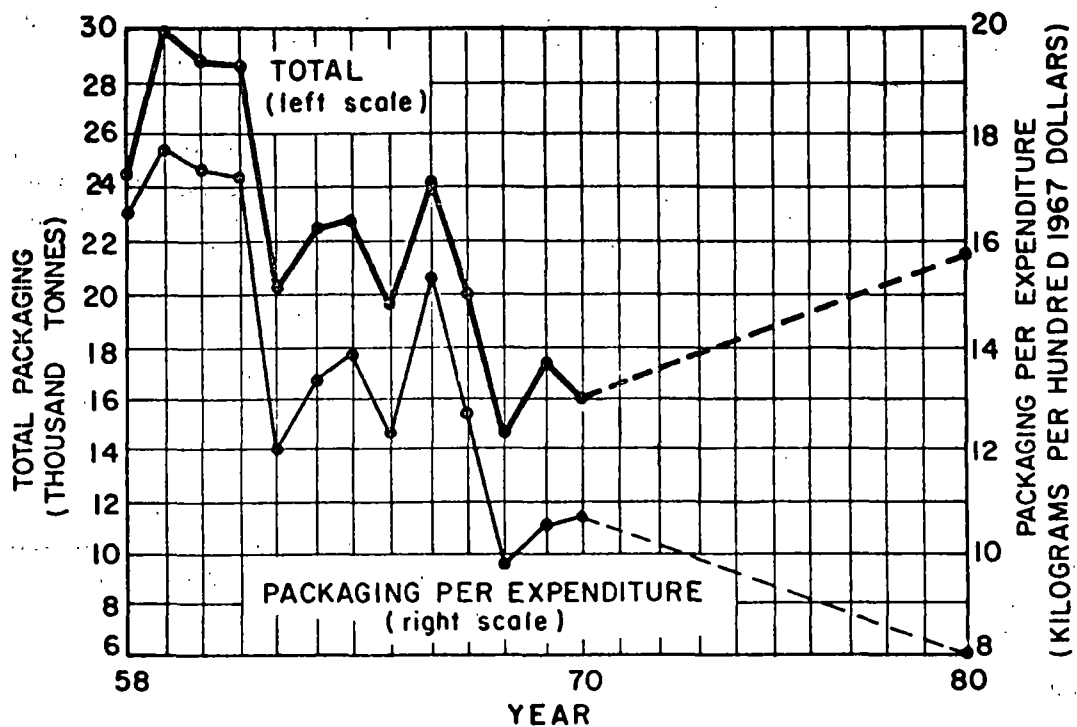
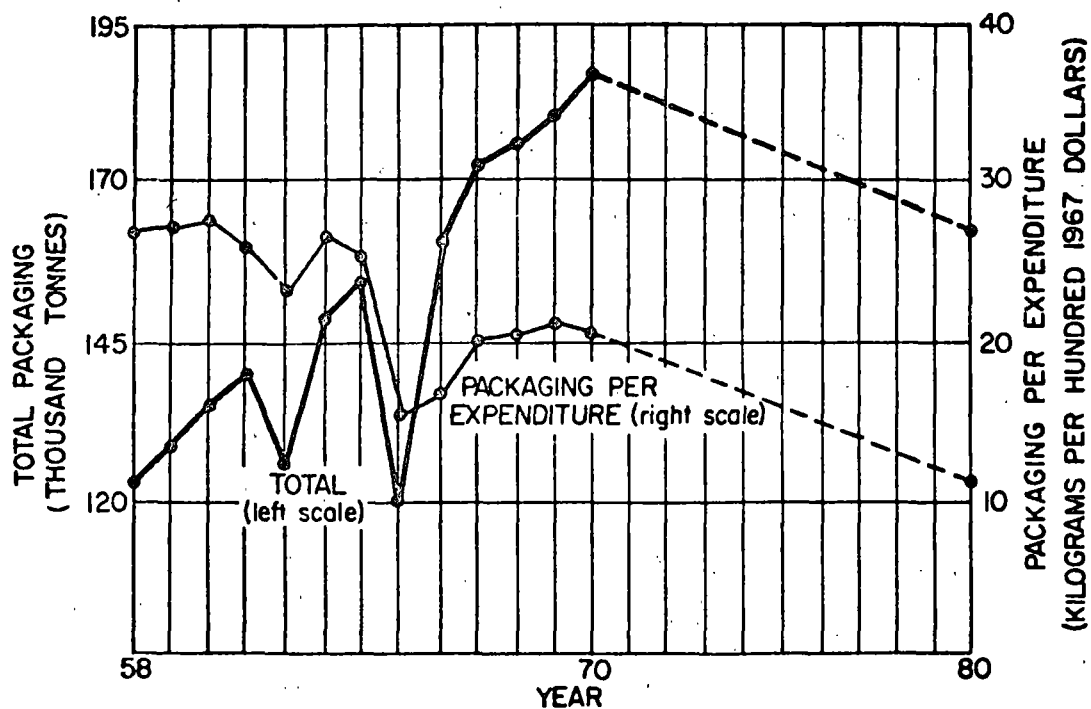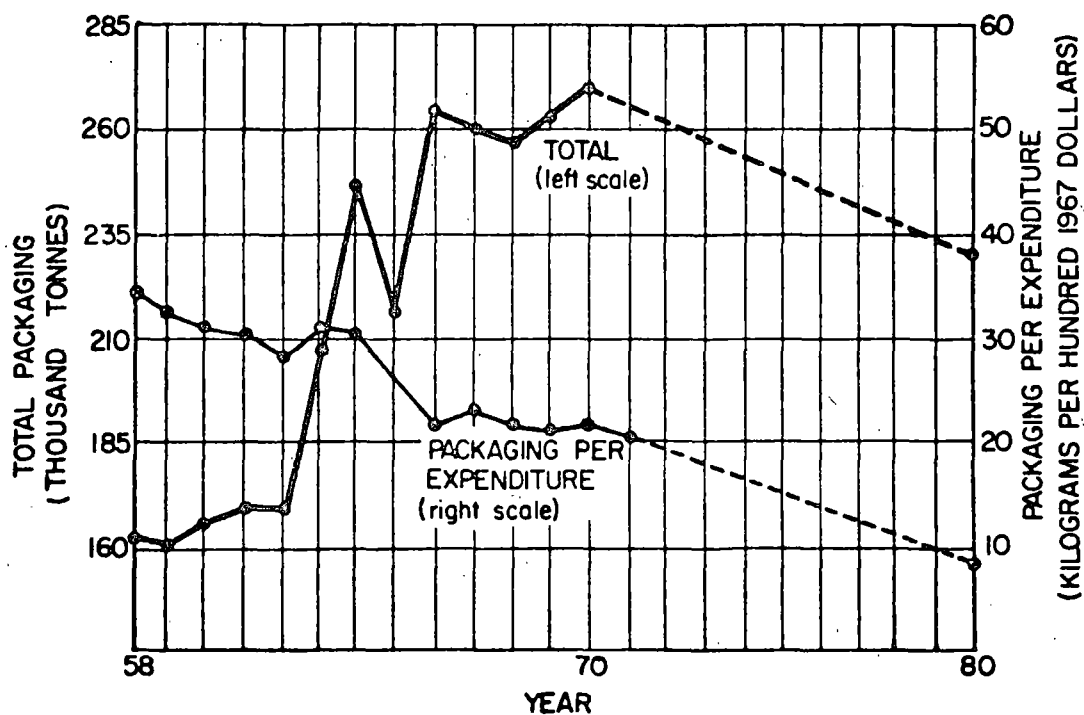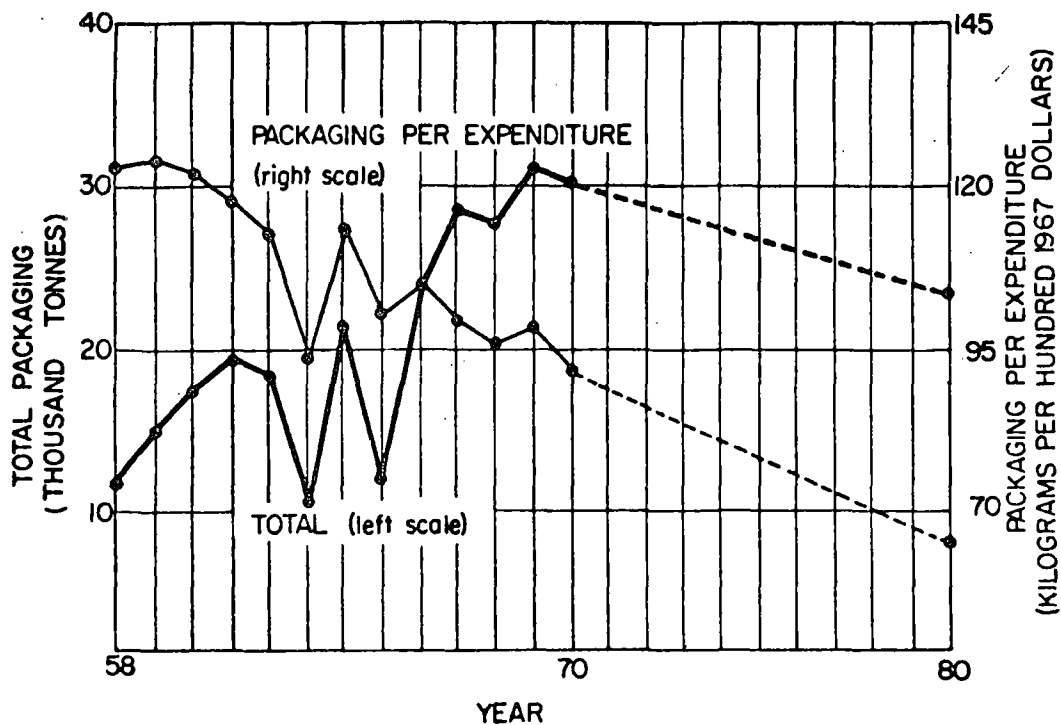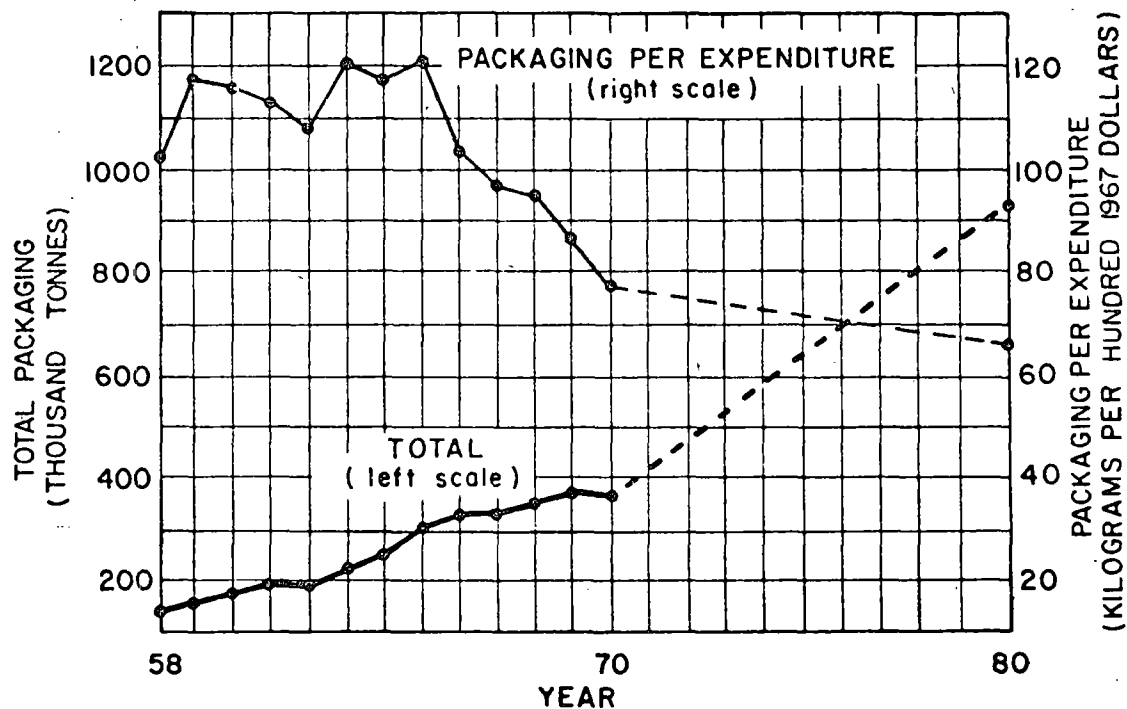Figure B-43. Pesticides (21) packaging (Source: Research Triangle Institute).
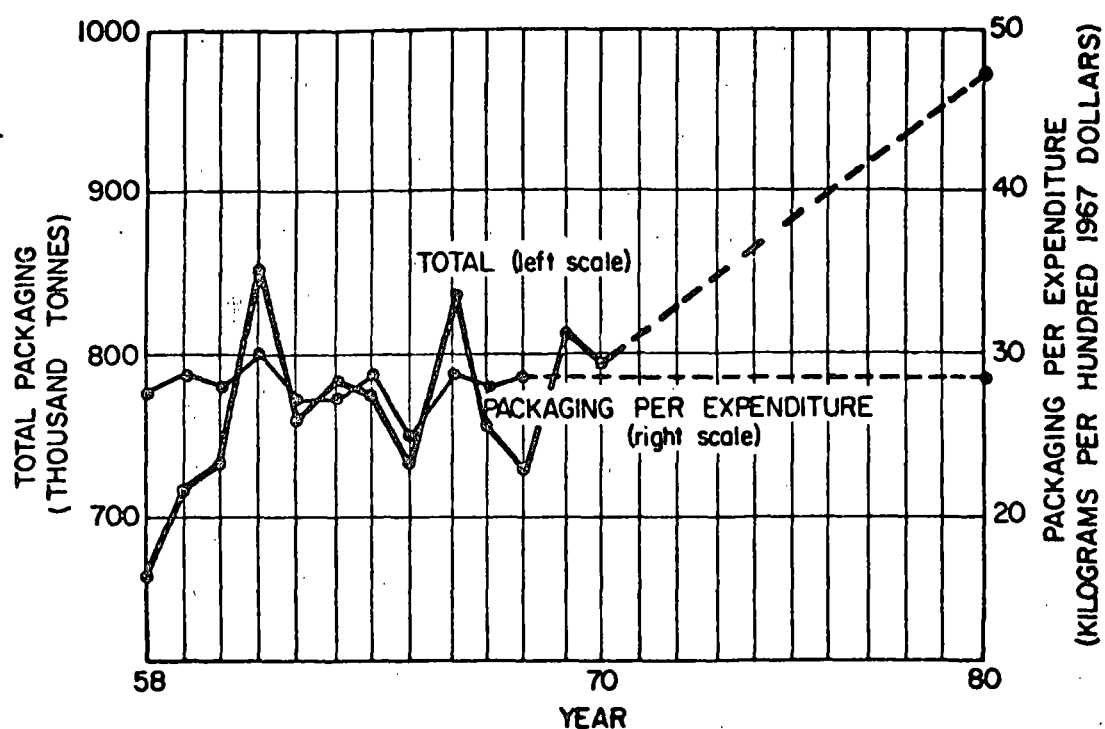

Figure B-44. Other Household Supplies (22) packaging (Source: Research Triangle Institute).

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Table B-25. Trends in the distribution of materials used for packaging
Soaps and Detergents (19) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	99.63	90.38	84.70	935.6
Plastics	0.37	9.31	15.00	165.7
Glass	0.00	0.00	0.00	0.0
Steel	0.00	0.00	0.00	0.0
Aluminum	0.00	0.32	0.30	3.3
Total packaging	100.00	100.00	100.00	1,104.6*

*Based on projections of 37.21 kilograms of packaging per $100 of consumer expenditures on $2.97 billion for consumer expenditures on Soaps and Detergents (19).

Source: Research Triangle Institute.

Table B-26. Trends in the distribution of materials used for packaging
Other Cleaning Supplies (20) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	49.78	32.51	29.00	66.7
Plastics	1.32	23.98	35.00	80.6
Glass	42.03	10.25	2.00	4.6
Steel	6.87	33.26	34.00	78.3
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	230.2*

*Based on projections of 13.47 kilograms of packaging per $100 of consumer expenditures on $1.71 billion for consumer expenditures on Other Cleaning Supplies (20).

Source: Research Triangle Institute.

Table B-27. Trends in the distribution of materials used for packaging Pesticides (21) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	0.00	0.00	0.00	0.0
Plastics	0.00	0.00	9.00	0.5
Glass	80.81	31.94	5.00	0.3
Steel	19.19	68.06	86.00	5.2
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	6.0*

*Based on projections of 4.52 kilograms of packaging per $100 of consumer expenditures on $0.14 billion for consumer expenditures on Pesticides (21).

Source: Research Triangle Institute.

Table B-28. Trends in the distribution of materials used for packaging Other Household Supplies (22) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	71.97	63.48	60.00	75.6
Plastics	0.23	10.14	18.00	22.6
Glass	23.94	10.90	4.00	5.0
Steel	3.86	15.47	18.00	22.6
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	125.8*

*Based on projections of 3.05 kilograms of packaging per $100 of consumer expenditures on $4.13 billion for consumer expenditures on Other Household Supplies (22).

Source: Research Triangle Institute.
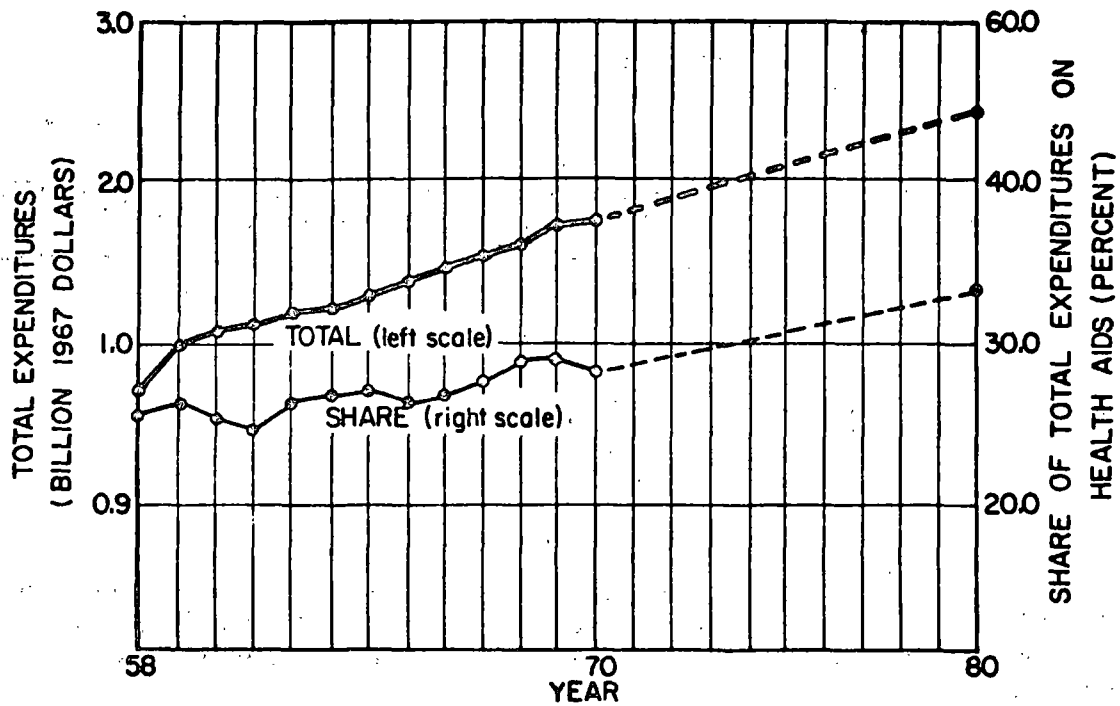
Figure B-45. Packaged Medications (23) consumption (Source: Supermarketing and Research Triangle Institute).
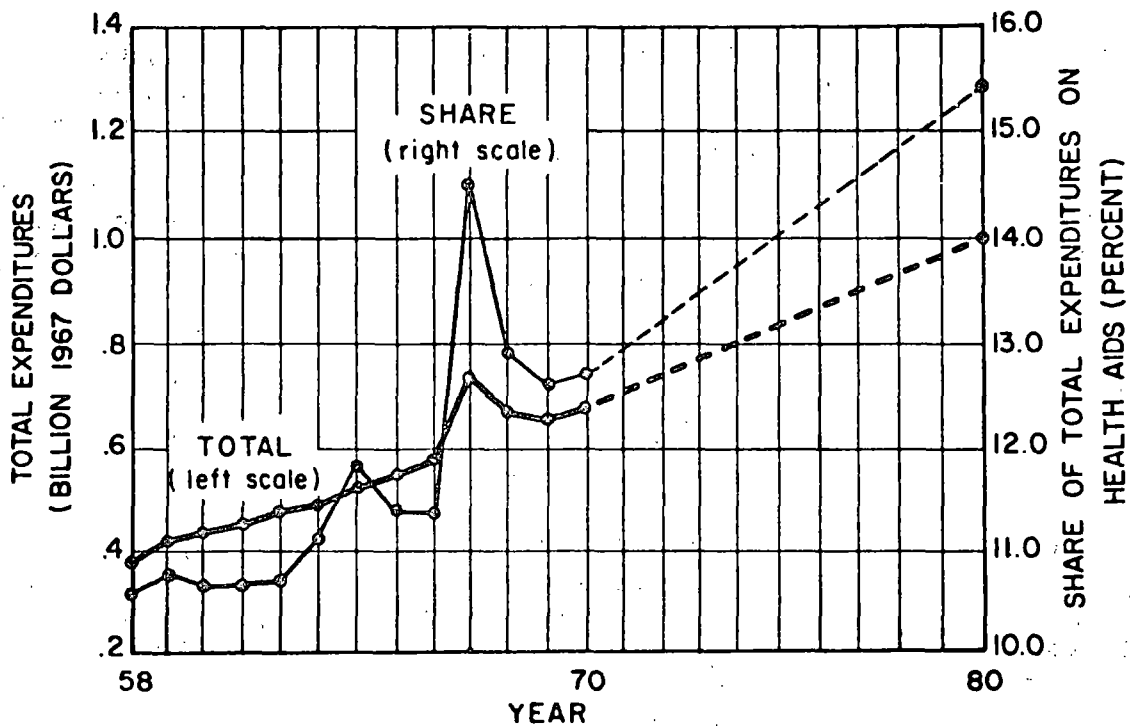
Figure B-46. Oral Hygiene Products (24) consumption (Source: Supermarketing and Research Triangle Institute).
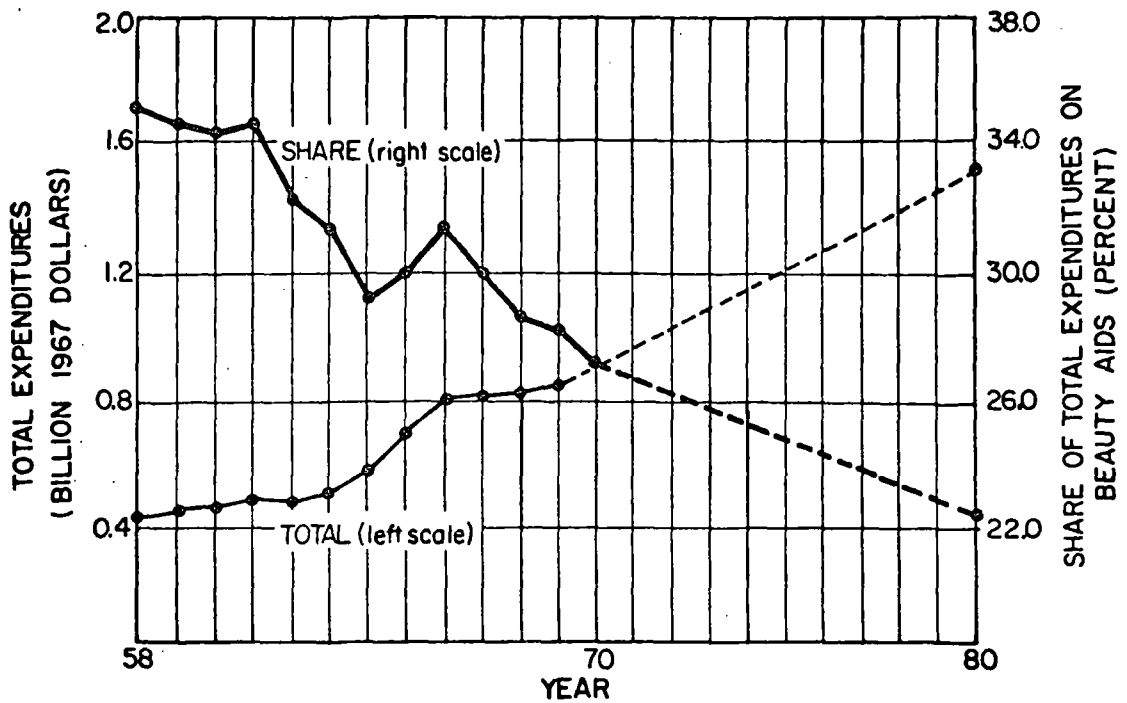
Figure B-47. Cosmetics and Hand Products (25) consumption (Source:
Supermarketing and Research Triangle Institute).
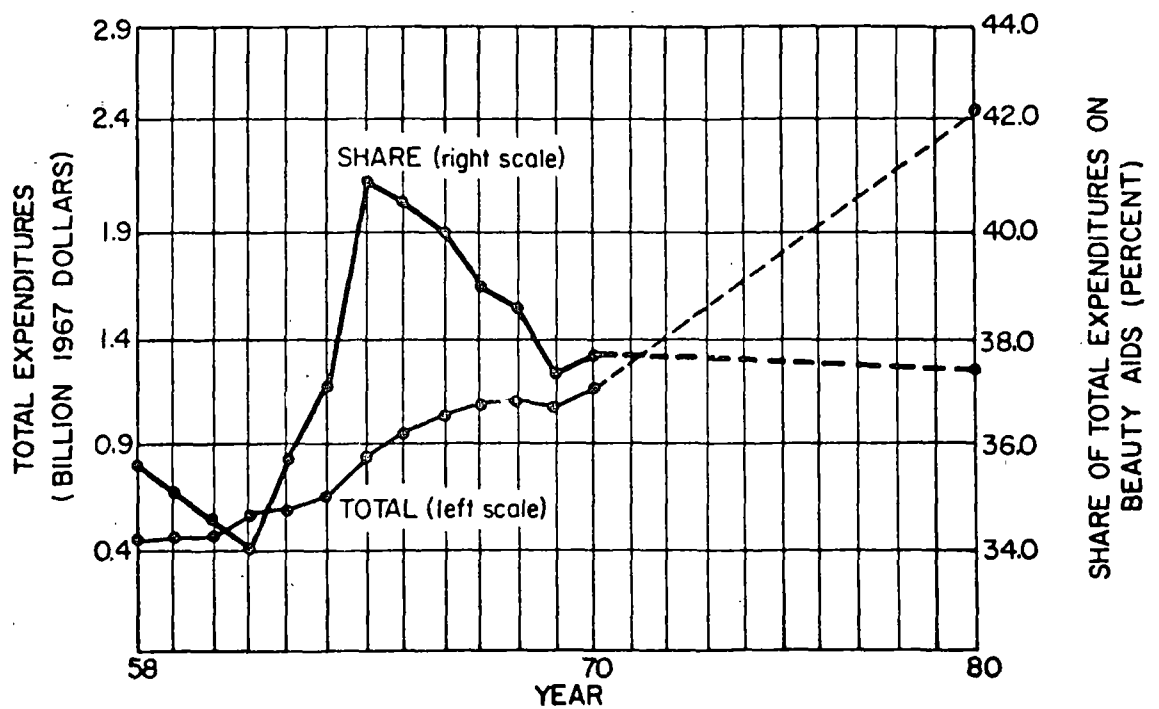
Figure B-48. Hair Products (26) consumption (Source:
Supermarketing and Research Triangle Institute).
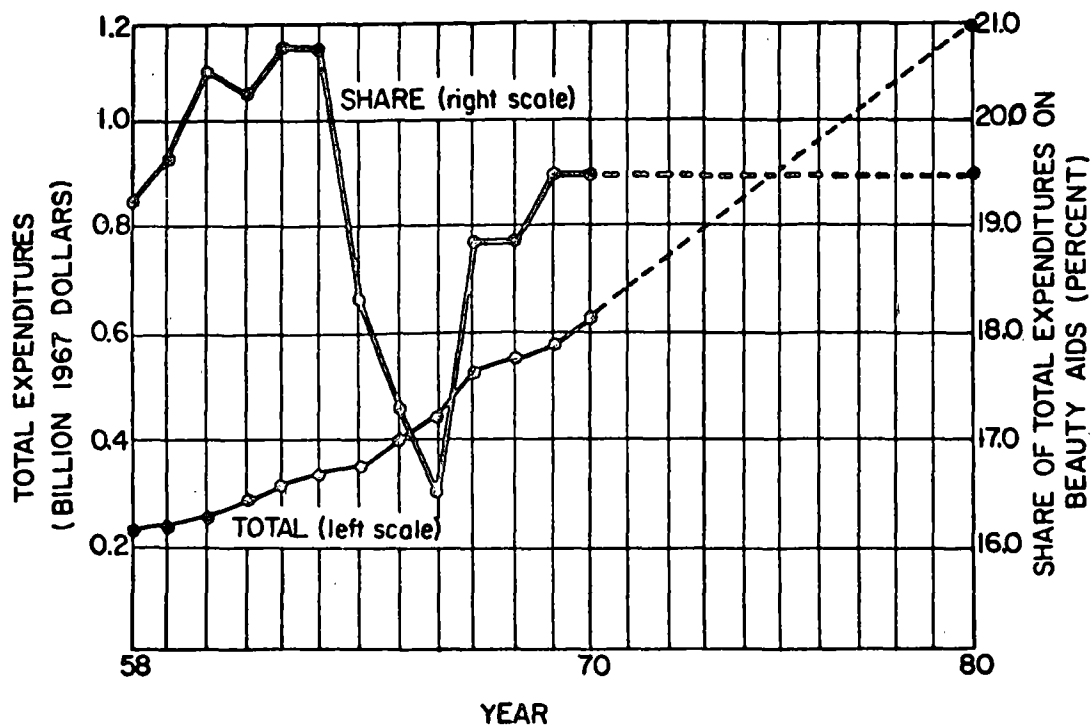
Figure B-49. Shaving Products (27) consumption (Source:
Supermarketing and Research Triangle Institute).
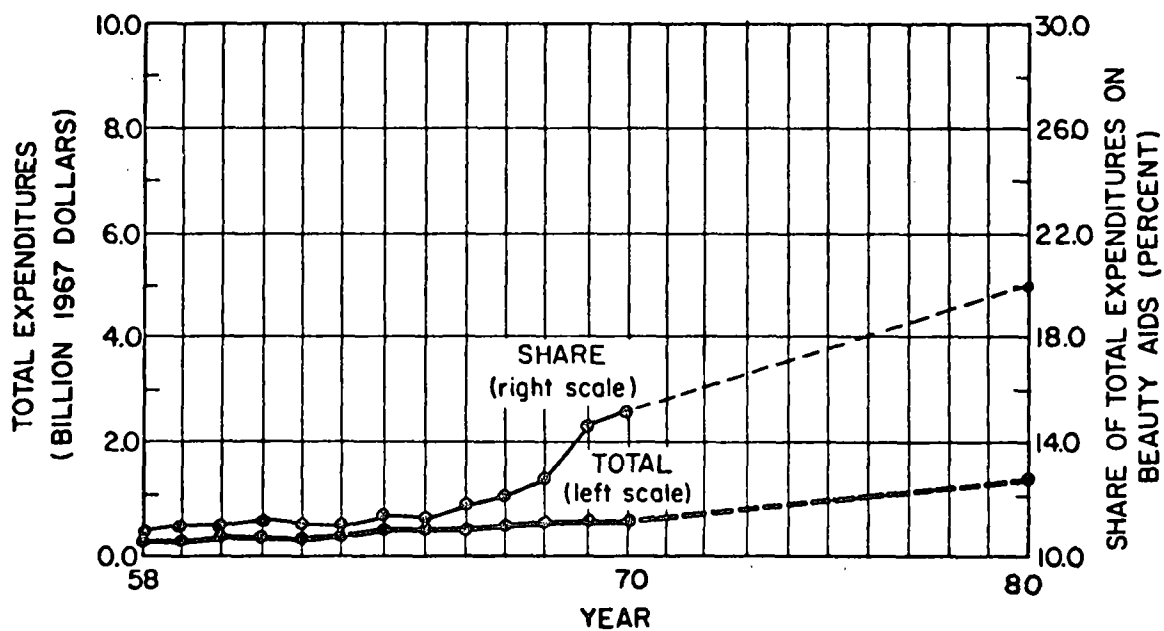
Figure B-50. Other Beauty Aids (29) consumption (Source:
Supermarketing and Research Triangle Institute).

Figure B-51. Other Health Aids (29) consumption (Source: Supermarketing and Research Triangle Institute).

in figures B-45 through B-51. The major trend in packaging these products has been the increase in the use of plastic. If the packaging trends continue, 2.7 million tons of materials are expected to be consumed in 1980; considerations in packaging health and beauty aids are discussed in more detail below.

B.15.1 Health Aids Packaging

The prime requisite of a drug package is a material that preserves the stability and functional integrity of the product. The Code of Federal Regulations, Title 21, Part 133, Drugs, requires that "closures and other component parts of drug packages are suitable for their intended use in that they are not reactive, additive, or absorptive to an extent that significantly affects the identity, strength, quality, or purity of the drug" and that they "furnish adequate protection against its deterioration or contamination".

Glass was initially the primary container material for drugs. Glass is chemically inert and provides an absolute moisture-vapor barrier. Recently, plastics have made significant inroads into the

drug packaging market. Plastics have a functional advantage in that they are lightweight and unbreakable, and the flexibility of polyethylene has allowed its use as a squeeze bottle providing the dual function of container and applicator for some preparations. However, plastics are chemically incompatible with some drug preparations and do not have the absolute barrier qualities of glass.

Plastics have almost replaced metals as a closure material for health products. The impetus for this shift was regulations requiring child-proof closures for products of possible danger to children.

Packagers have long recognized that aerosol containers have potential as drug packages. A major advantage of the aerosol is that the product is sealed in the container until the moment of use so that contact with air and contaminants is eliminated. The aerosol container preserves the product at full strength throughout its shelf life. In addition, dispensing can be carefully controlled. Aerosols have been used primarily for topical lotions and ointments.

Packages for Oral Hygiene Products have tended toward substitution of plastics for other materials. Plastic tubes have recently been used for toothpastes; the lightweight, unbreakable plastic bottle is replacing glass for mouthwash. Glass manufacturers, attempting to recapture some of the market for their package, have introduced new colors and shapes and have promoted decorator containers which may be displayed or reused when the original contents have been depleted. The apothecary-style bottle used to introduce Micrin was a distinctive package which attracted consumers and encouraged them to try the new product (ref. 13).

Trends in the packaging of various health aids are depicted in figures B-52 through B-58. If the trends continue, the quantity of packaging used in 1970 is projected to be 1.3 million tonnes (tables B-29 through B-35).

B.15.2 Beauty Aids Packaging

The most significant trend in packaging beauty aids is in the use of plastics in bottles, jars, overwraps for cartons, display packaging, and even aerosols. Consumers prefer a plastic container for shampoos, creams, lotions, and other toilet articles which will not break if dropped.

A growing use of plastics has been the blister or shrink packaging.
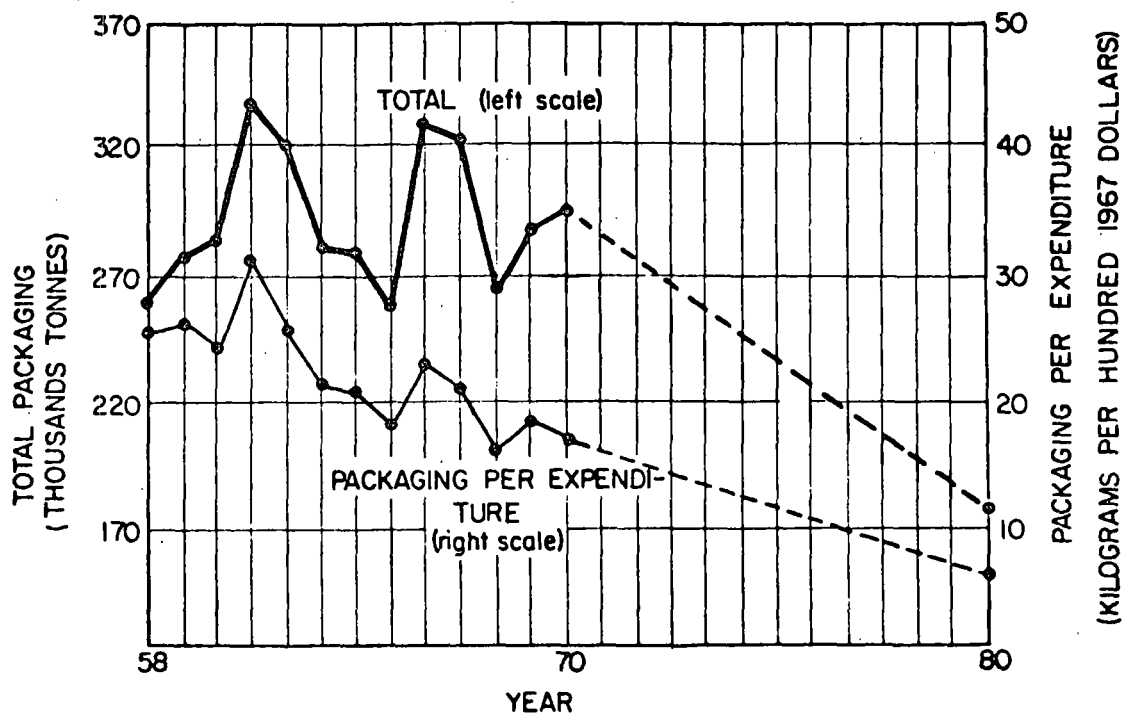
Figure B-52. Packaged Medications (23) packaging
(Source: Research Triangle Institute).
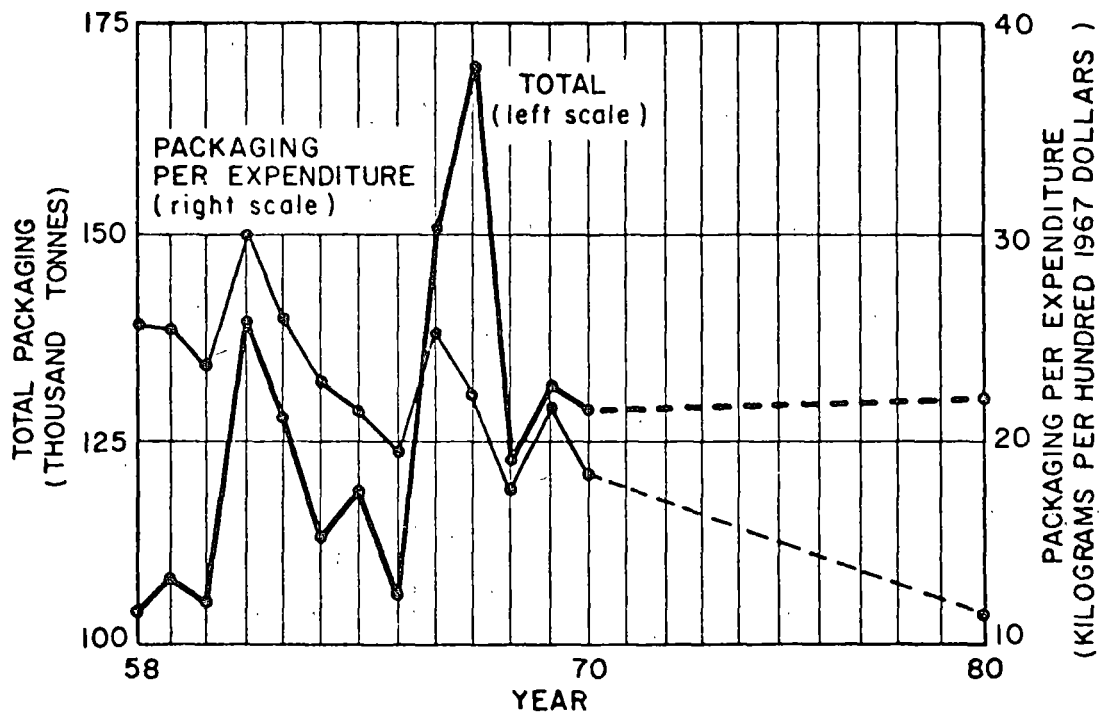
Figure B-53. Oral Hygiene Products (24) packaging
(Source: Research Triangle Institute).

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Figure B-54.   Cosmetics and Hand Products (25) packaging
(Source: Research Triangle Institute).

Figure B-55.   Hair Products (26) packaging
(Source: Research Triangle Institute).

Figure B-56. Shaving Products (27) packaging
(Source: Research Triangle Institute).

Figure B-57. Other Beauty Aids (28) packaging
(Source: Research Triangle Institute).

Figure B-58. Other Health Aids (29) packaging
(Source:/ Research Triangle Institute).

Table B-29. Trends in the distribution of materials used for
packaging Packaged Medications (23) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	10.53	12.25	12.00	20.7
Plastics	0.51	1.75	8.30	14.3
Glass	85.89	81.32	75.00	129.1
Steel	2.15	2.88	2.90	5.0
Aluminum	0.92	1.80	1.80	3.1
Total packaging	100.00	100.00	100.00	172.2*

*Based on projections of 7.26 kilograms of packaging per $100
of consumer expenditures on $2.37 billion for consumer expenditures
on Packaged Medications (23).

Source: Research Triangle Institute.

Table B-30. Trends in the distribution of materials used for packaging Oral Hygiene Products (24) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	10.23	11.70	11.80	15.5
Plastics	0.48	1.70	8.00	10.5
Glass	81.81	76.60	68.40	89.7
Steel	2.07	2.74	2.80	3.7
Aluminum	5.41	7.26	9.00	11.8
Total packaging	100.00	100.00	100.00	131.2*

*Based on projections of 12.01 kilograms of packaging per $100 of consumer expenditures on $1.09 billion for consumer expenditures on Oral Hygiene Products (24).

Source: Research Triangle Institute.

Table B-31. Trends in the distribution of materials used for packaging Cosmetics and Hand Products (25) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	9.37	11.88	11.9	19.5
Plastics	0.44	10.13	18.8	30.8
Glass	87.72	74.68	65.0	106.4
Steel	1.83	2.31	2.3	3.8
Aluminum	0.64	1.00	2.0	3.3
Total packaging	100.00	100.00	100.0	163.8*

*Based on projections of 11.32 kilograms of packaging per $100 of consumer expenditures on 1.45 billion for consumer expenditures on Cosmetics and Hand Products (25).

Source: Research Triangle Institute.

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Table B-32. Trends in the distribution of materials used for packaging
Hair Products (26) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	9.06	9.97	10.00	23.0
Plastics	0.45	8.51	20.00	46.0
Glass	83.27	62.56	45.00	103.5
Steel	7.22	18.96	25.00	57.5
Aluminum	0.00	0.00	0.00	0.0
Total packaging	100.00	100.00	100.00	230.0*

*Based on projections of 9.40 kilograms of packaging per $100 of consumer expenditures on $2.45 billion for consumer expenditures on Hair Products (26).

Source: Research Triangle Institute.

Table B-33. Trends in the distribution of materials used for packaging
Shaving Products (27) and projections of 1980 packaging

Packaging material	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	9.08	10.60	11.00	11.5
Plastics	0.47	9.01	18.00	18.9
Glass	82.46	68.67	56.80	59.6
Steel	7.38	11.57	14.00	14.7
Aluminum	0.61	0.15	0.20	0.2
Total packaging	100.00	100.00	100.00	104.9*

*Based on projections of 8.37 kilograms of packaging per $100 of consumer expenditures on $1.25 billion for consumer expenditures on Shaving Products (27).

Source: Research Triangle Institute.

Table B-34. Trends in the distribution of materials used for packaging Other Beauty Aids (28) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	73.18	59.38	55.00	508.9
Plastics	0.13	2.45	6.00	55.5
Glass	23.59	17.77	14.50	134.2
Steel	2.78	20.15	24.30	224.8
Aluminum	0.32	0.25	0.20	1.8
Total packaging	100.00	100.00	100.00	925.2*

*Based on projections of 67.86 kilograms of packaging per $100 of consumer expenditures on $1.37 billion for consumer expenditures on Other Beauty Aids (28).

Source: Research Triangle Institute.

Table B-35. Trends in the distribution of materials used for packaging Other Health Aids (29) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	30.02	36.37	37.00	362.3
Plastics	0.41	1.31	3.00	29.4
Glass	67.80	60.04	57.60	564.1
Steel	1.73	2.11	2.20	21.5
Aluminum	0.04	0.16	0.20	2.0
Total packaging	100.00	100.00	100.00	979.3*

*Based on projections of 27.20 kilograms of packaging per $100 of consumer expenditures on $3.60 billion for consumer expenditures on Other Health Aids (29).

Source: Research Triangle Institute.

Most small items, including nail polish, lipstick, and mascara, are packaged on a larger card or enclosed in a blister or shrink package (ref. 16). This trend has been encouraged by the growth of the self-service supermarket and drugstore. In the self-service retail outlet, since the product must sell itself, it must be prominently displayed and visually striking. In addition, enclosing a small item in a larger package protects against pilferage.

Plastic tubes have grown in popularity for shampoo concentrates, tanning lotions, and cleansing creams. Plastic tubes have a number of advantages over other containers or dispensers: they are leakproof and unbreakable; they retain their shape throughout use; and dispensing is controlled due to the "suck back" feature.

Aerosols have been an important package in beauty product applications. The development of the aerosol was responsible for the introduction of the product hair spray; aerosols have captured the market for shaving creams, have made significant inroads in packaging deodorants, and have entered the fragrance market. The newest developments in the aerosol field are plastic containers with a metal propellent cartridge or "natural spray" pump (ref. 16).

Changes in glass packaging for beauty products are often overlooked because of the success of plastics. The new shapes and colors in packages for men's toiletries are evidence of the glass industry's attempts at innovative design. Similar efforts at decorative effects have been made by the collapsible metal tube industry to recapture their share of the health products market.

The decrease in packaging weight per dollar of consumer expenditure exhibited in figures B-54, B-55, and B-56 indicates the substantial shift to plastics which are lighter in weight than other packaging materials. Plastic's share is expected to continue to grow, and total 1980 packaging is projected to be 1.4 million tonnes.

B.16 Other General Merchandise (30)

The category labeled Other General Merchandise includes such diverse items as automobiles, electrical appliances, clothing, furniture, toys books, and sporting goods. Expenditures for these items have grown rapidly, about 6 percent annually. While the diversity of included products makes it difficult to identify trends, many of the products are associated

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with leisure activity which increases with affluence. In addition, as disposable incomes increase, consumers purchase higher quality, more expensive clothing, furniture, automobiles, and the like. Trends in expenditures are shown in figure B-59.

Some of the items in this category are sold to the consumer without packaging (cars, furniture); others may use substantial quantities of material (toys, china). However, the packaging requirements of most of these items are quite different from the previously discussed commodities. Since they are not perishable items, shelf life is not a packaging concern nor is chemical compatibility of product and package. The main functions of the package for these items is protection against breakage or damage from handling of the product. Colorful, eye-catching colors and designs are an important marketing technique. Trends in the usage of materials for packaging other general merchandise are shown in figure B-60 and in table B-36.
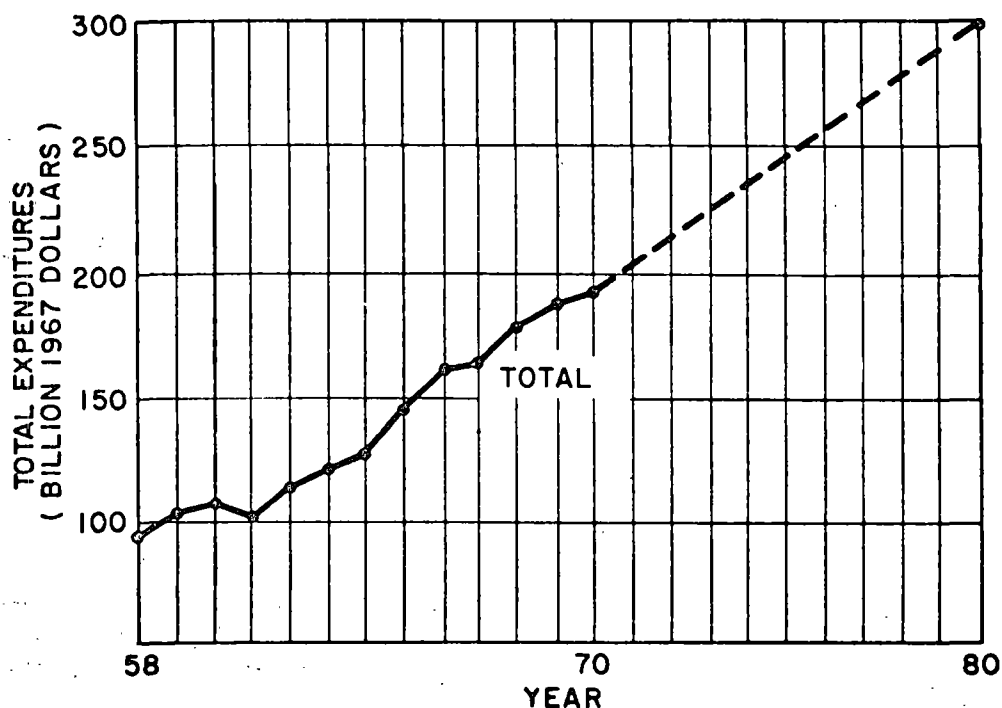
Figure B-59. Other General Merchandise consumption (Source: Unpublished data, Bureau of Labor Statistics).
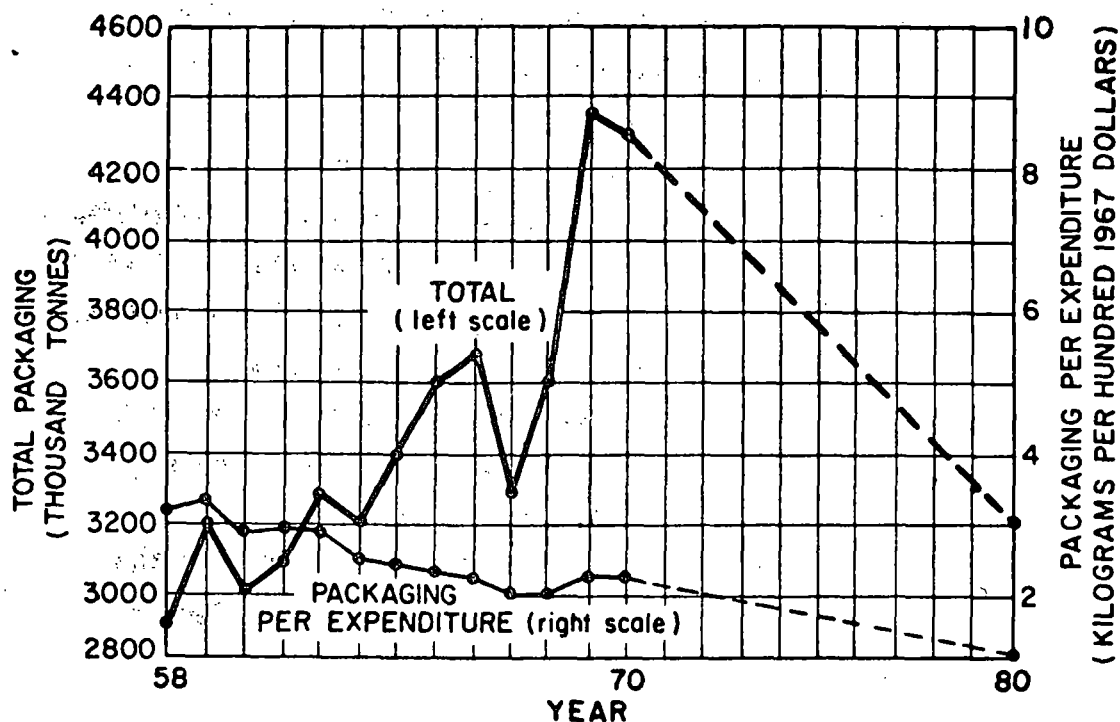
Figure B-60. Other General Merchandise packaging (Source: Research Triangle Institute).

Table B-36. Trends in the distribution of materials used for packaging Other General Merchandise (30) and projections of 1980 packaging

Packaging materials	Percentage share of weight			Projected packaging, 1980 (thousand tonnes)
	1958	1970	1980	
Paper	59.36	54.45	50.30	1,618.9
Plastics	2.86	14.73	22.00	708.0
Glass	9.51	2.46	1.00	32.2
Steel	27.84	27.71	26.00	836.8
Aluminum	0.43	0.65	0.70	22.5
Total packaging	100.00	100.00	100.00	3,218.4*

*Based on projections of 1.08 kilograms of packaging per $100 of consumer expenditures on $0.298 billion for consumer expenditures on Other General Merchandise (30).

Source: Research Triangle Institute.

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Appendix C: PACKAGING MODEL

C.1 Introduction

A model of consumer products packaging has been developed
to provide quantitative estimates of some of the more significant impacts
of various regulatory and fiscal strategies. The model is a comparative
statics one, designed to compare "with and without" the policy instrument
using 1970 values as a benchmark.

In its simplest form, the model consists of a set of inputs,
outputs, and a structure for generating the output estimates.

Although the model is constructed to provide product-by-product
analyses for the 30 consumer products used in this study, its primary
purpose is to provide aggregate estimates of the impacts of specific
strategies. Any implications for a particular product should be cautiously
interpreted.

C.2 Model Input

The model is designed to accept as input one or more of the following
policy instruments applied to each of nine package material types:

    (a) A tax per tonne on packaging;

    (b) A tax per unit on rigid packaging;

    (c) A tax per tonne on packaging exempting recycled materials;

    (d) A regulation requiring the use of a minimum amount of recycled
        materials in product packaging, by share of package weight.

C.3 Model Output

The output of the model consists of estimates of the values for
the following packaging system parameters before and after the imposition
of a policy instrument:

    (a) Weight of solid waste packaging by material;

    (b) Weight of major virgin materials used in the manufacture of
        each packaging material;

    (c) Weight of additional recycled materials used by material;

    (d) Equivalent kilowatt-hours of energy used to produce each
        material;

    (e) Employment in the packaging industries;

    (f) Dollar value of tax revenues;

    (g) Consumer expenditures for each consumer product;

(h) Price increases in each consumer product;

(i) Losses in consumer surplus.

C.4 Model Structure

The packaging model consists of several interrelated elements that transfer a policy instrument to estimates of the values for the output parameters. A flow diagram is presented in figure C-1. The major elements of the model are discussed below.

C.4.1 Raw Materials Cost

Two of the alternative policy instruments will affect the cost of raw materials. These instruments are a tax on packaging with an exemption for recycled materials and a regulation requiring the use of recycled materials in product packaging.

In the case of a tax on packaging with an exemption, if there is no opportunity to substitute recycled for virgin material inputs and if the supply curve for virgin materials is perfectly elastic over the relevant range, the price of raw materials will increase by the amount of the tax. If, however, opportunities for the substitution of other inputs do exist, then such substitutions may offset some of the tax. The most interesting opportunity is the possibility of substituting recycled materials for virgin materials. For example, in figure C-2, if the current situation regarding the demand (D) and supply (S) for recycled materials were as shown, there would be no recycling. Now if the imposition of a tax on virgin material were to shift the demand for recycled materials to D^1, recycling in the amount of R would occur, partially offsetting the tax.

In the case of a regulation requiring the use of a minimum content of recycled materials, the new cost of raw materials inputs would be:

$$c^1 = C(1 - r) + S(r)$$

where:

c^1 = average cost per tonne for raw materials after imposition of the regulation,

C = average cost per tonne for virgin materials,

r = recycling regulation,

S = average cost per tonne for recycled materials.

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INPUT

STRUCTURE

OUTPUT

SUPPLY OF
RECYCLED MATERIALS

CHANGE IN THE COST OF RAW
MATERIALS USED IN PACKAGING
(e.g., TAX ON PACKAGING
WITH AN EXEMPTION FOR
RECYCLED MATERIALS)

REGULATION TO USE MINIMUM
CONTENT OF RECYCLED
MATERIAL IN PACKAGING

CHANGE IN THE COST OF
PACKAGING MATERIALS
(e.g., TAX PER TONNE)

CHANGE IN THE COST
OF CONTAINERS (e.g.,
TAX ON CONTAINERS)

DEMAND FOR RECYCLED
MATERIALS

CONSUMPTION OF RECYCLED
MATERIALS

COST OF PACKAGING
OF CONSUMER PRODUCTS

EXPENDITURES FOR
CONSUMER GOODS

ELASTICITY OF DEMAND
FOR CONSUMER PRODUCTS

PRICE OF RAW
MATERIALS

PRICE OF PACKAGING
MATERIALS

REVISED COST OF PACKAGING
OF CONSUMER PRODUCTS

REVISED CONSUMER EXPENDITURES
FOR CONSUMER PRODUCTS

LOSSES IN
CONSUMER SURPLUS

CONSUMER PRODUCT PRICES

CONTAINERS PER TONNE
OF PACKAGING

CHANGE IN CONSUMER
PRODUCTS PACKAGING
COEFFICIENTS

TOTAL PACKAGING OF
CONSUMER PRODUCTS

STRUCTURE OF CONSUMER
PRODUCTS PACKAGING

REVISED STRUCTURE OF
CONSUMER PRODUCTS
PACKAGING

NATURAL RESOURCE
COEFFICIENTS

PACKAGING SOLID WASTE

TAX REVENUE

NATURAL RESOURCE
CONSUMPTION

EMPLOYMENT COEFFICIENTS

EMPLOYMENT

Figure C-1. Flow diagram of packaging model.
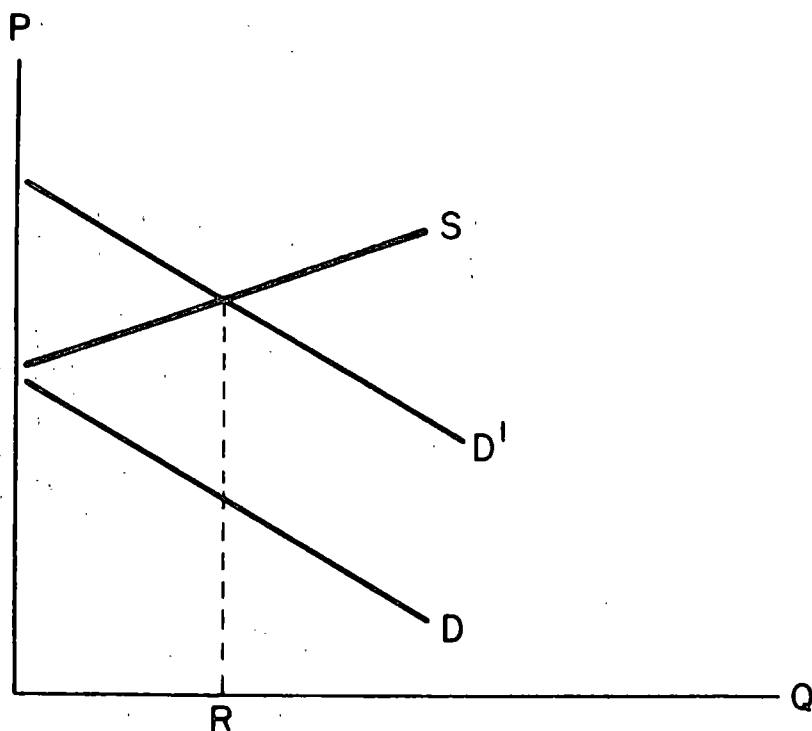
Figure C-2. Hypothetical demand and supply
for recycled materials.

Unfortunately, while a number of studies for EPA have provided qualitative discussions and some data on current prices for recycled materials, no quantitative estimates of supply and demand over a range have been developed. For this study, it has been necessary to develop some very tentative estimates of these functions for use in the model. They are provided only to give an illustration of how the use of recycled materials might be affected by these strategies and should not be rigorously interpreted.

The supply function for recycled materials will depend on the costs of reclaiming the waste products. Since resource recovery on any significant scale will require the application of advanced systems rather than reliance on current voluntary programs, it has been necessary to estimate the costs of such a system for various levels of resource recovery. The U.S. experience is limited to a few pilot systems. One

of these systems is the Black Clawson plant in Franklin, Ohio, for which operating cost estimates for several plant sizes are available. By using this data plus information on the city sizes and the paper and steel content of municipal waste, "supply" functions for recycled paper and steel have been developed. Specifically, the procedure has been as follows:

(a) Calculate the plant size for recovering the paper and steel in solid waste for several city sizes ranging from major cities to smaller cities based on an average annual rate (0.66 tonnes) of per capita solid waste generation;

(b) Determine the cost per tonne of solid waste processed for each plant size for the Hydrasposal unit alone (used to recover steel) and the Hydrasposal and Fibreclaim (used to recover paper) units together;

(c) Assuming that the paper yield per tonne of waste processed is 0.200 and the steel yield is 0.062, calculate the cost per tonne of reclaiming each separately, for each city size;

(d) Based on the same yields, calculate the recoverable paper and steel available for each city size;

(e) Array the costs per tonne of paper and steel recovery in ascending order, accumulating the share of the national amount of recoverable resources available at each cost relative to the 1970 consumption of these resources for packaging manufacture;

(f) Assuming divisibility, develop a linear function for each material.

The resulting supply functions for paper and steel are:

$$SP_p = 23.32 + 69.25 (Q_p)$$

$$SP_s = 45.80 + 249.44 (Q_s)$$

where:

SP_p, SP_s = supply prices of recovered paper and steel in dollars per tonne,

Q_p, Q_s = shares of national paper and steel packaging production using recycled paper and steel.

Since no costs were available for recovering aluminum, plastics, or glass, their supply functions have been assumed to be infinitely

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elastic at the following prices:

Plastics = \$1,000/tonne,

Glass = \$25/tonne,

Aluminum = \$300/tonne.

First approximations of the demand for recycled materials can be determined by assuming that, if properly sorted and graded postconsumer paper, plastic, glass, steel, and aluminum wastes were available to the producers of these materials for packaging applications at prices less than those of the virgin materials for which they could substitute, they would be purchased and used up to the technological limits.

The demand function for each of the recycled materials has been developed as follows:

(a) Costs of raw materials and number of production employees by region of the United States for each packaging material were obtained from the appropriate Census of Manufactures report.

(b) 1967 production (or shipments) as reported in the Census of Manufactures was allocated to the regions in proportion to the number of production employees in each region.

(c) Unit costs of raw materials in dollars per metric tonne of production were calculated by dividing the cost of raw materials by the estimated production for each region.

The unit costs can be viewed as maximum prices that would be paid for recycled materials in each region. The data used is shown in table C-1. Demand curves were prepared by arraying the unit costs in descending order of magnitude and accumulating the share of production corresponding to each price. These curves provide a basis for reflecting regional differences in the costs of virgin materials and as such offer an alternative to the use of a single national average value for the costs of raw materials. The latter approach would imply an all or nothing reaction to shifts in the relative prices of virgin and recycled materials rather than the more likely continuous adjustment. The curves are only very preliminary approximations, however, of the actual demand curves.

The resulting demand functions are:

$$DP_p = 7.45 - 2.60 \ (Q_p)$$

$$DP_{pl} = 344 - 1.38 \ (Q_{pl})$$

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Table C-1. Regional production and raw materials cost of
packaging materials production

Region	Estimated share of U.S. production (percent)	Cost of raw materials per tonne of product (dollars)
	Woodpulp	
New England	11	$ 7.14
Middle Atlantic	1	7.69
North Central	5	3.87
South Atlantic	31	5.82
West	52	4.98
	Plastic	
Northeast	37	343.30
North Central	41	351.05
South	13	413.42
West	9	386.39
	Glass container	
Middle Atlantic	37	17.34
North Central	34	17.84
South Atlantic	18	19.09
East South Central	3	16.59
North South Central	8	18.47
	Steel	
Northeast	27	30.73
North Central	41	37.04
South	16	24.26
West	6	29.93
	Aluminum	
South	67	71.10
West	33	84.76

Source: U.S. Department of Commerce, Census of Manufactures.

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$$DP_g = 17.98 - 3.88 \, (Q_g)$$
$$DP_s = 26.61 - 2.61 \, (Q_s)$$
$$DP_a = 91.90 - 20.90 \, (Q_a)$$

where:

DP_p, DP_{pl}, DP_g, DP_s, DP_a = demand prices for recovered paper, plastics, glass, steel, and aluminum in dollars per tonne;

Q_p, Q_{pl}, Q_g, Q_s, Q_a = share of national paper, plastics, glass, steel, and aluminum packaging production using recycled materials.

Technological substitution limits for recycled materials were selected based on the literature or discussions with industry representatives.

Paperstock can be substituted for wood pulp in many products. In practice, however, the integrated industry relies primarily on virgin pulp; paperstock recycling is not extensive. Contaminants present on or in waste paper unfavorably affect recycling. This factor reinforces the industry's orientation toward virgin materials. For this study it has been assumed that the share of waste paper inputs could increase 30 percent, substituting for woodpulp.

Thermoplastics, the major plastic used in packaging applications, are recyclable with known technology. Thermosetting plastics, however, cannot be recycled (ref. 1). For this study, it has been assumed that the substitution limit for recycled plastics is 80 percent.

From a technical standpoint, the percent of cullet in the furnace charge can be as much as 80 and even as high as 100 for some lower quality products such as water bottles and ashtrays. However, the Glass Container Manufacturers Institute (GCMI) suggests 50 percent as an upper limit for glass container production (ref. 2).

The technical limits to substituting scrap steel for pig iron vary depending upon the type of furnaces. Electric furnaces can use 100 percent scrap, open hearth furnaces 70 to 80 percent, basic oxygen furnaces 50 to 60 percent, and Bessemer furnaces 20 percent. Based on the scrap consumption in 1967 of about 55 percent of maximum (ref. 3), the limit for postconsumer scrap has been set here at 45 percent.

There appear to be no technical limitations to the recycling of aluminum scrap. However, since there is typically a substantial amount of scrap generated in-plant from such processes as ingot rejections, ingot scalping, and sheet trimming (called run-around scrap), it appears unwarranted to assume that postconsumer aluminum waste would exceed 45 percent (ref. 4).

C.4.2 Cost of Packaging Materials

The cost of packaging materials can be altered directly by a tax on packaging (either per unit or per tonne) or indirectly by requiring the use of a specified amount of materials recycled from postconsumer waste in lieu of virgin materials. In all cases, the effect is to increase the cost of product packaging.

Estimates of the current cost of product packaging by material and consumer product were obtained by dividing the 1970 value of shipments by the weight of packaging for each material and consumer product. Using these estimates as a base, the percentage change in the cost per tonne of product packaging due to a policy instrument is calculated.

C.4.3 Structure and Cost of Product Packaging

The materials structure of packaging and the cost of packaging consumer products may be altered by the imposition of an instrument that increases the cost of packaging materials. This section develops the conceptual framework in which to analyze the impact of increases in packaging materials cost on the structure of packaging and consumer product prices and provides estimates of changes in the structure of packaging due to changes in the cost of the packaging materials.

Packaging may be considered a resource input in the production of consumer goods. For this analysis, it is convenient to think of 10 resources $(X_1, \ldots, X_{10})$ as inputs in the production of any consumer product; nine of these inputs $(X_1, \ldots, X_9)$ are packaging materials, and the tenth (X_{10}) subsumes all other inputs. The technical relationship between the quantity of final product produced and various combinations of inputs is summarized by a production function. It has been assumed that all consumer goods are produced according to a production

function that is linear homogeneous in the 10 resource inputs, that is, if all 10 inputs are increased by a constant K, then output is increased by K.*

Several properties of efficient production according to a linear homogeneous function should be mentioned. The production function describes alternative possible combinations of inputs that will produce a specified quantity of output. Given input prices, the firm can then determine the minimum cost combination of inputs for any specified output. The production function may be expressed symbolically as:

$$Q_A = f(X_1, \ldots, X_{10}), \tag{1}$$

where Q_A is the output of consumer product A. Because a linear homogeneous function has been assumed, we may multiply all inputs and output in eq. 1 by a constant $(1/Q_A)$ to derive the function:

$$1 = f\left(\frac{X_1}{Q_A}, \frac{X_2}{Q_A}, \ldots, \frac{X_{10}}{Q_A}\right). \tag{2}$$

That is, the production function may be expressed entirely by the various combinations of inputs that will produce one unit of output; the alternative input proportions are independent of the amount of output. Given input prices, there is then one input proportion that is the minimum cost solution for any output. Such a production function is said to manifest constant returns to scale.

A second property of a linear homogeneous production function, given constant input prices, is that marginal cost is equal to average cost and is constant for all levels of output. This result follows directly from the previous discussion: to produce any marginal unit of output, inputs

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*This does not imply a production function that is linear homogeneous in all inputs. Resource X_{10} is a summary of the combination of all nonpackaging inputs; X_{10} is then itself an unspecified production function. For example, consider a consumer product--bread: the 10th input is a summary of the combination of labor, capital, grains, etc., used in producing bread; it may be thought of as the unpackaged loaves. The assumption above states that if the quantity of unpackaged loaves and the quantity of all packaging inputs are doubled, then the amount of final product (packaged bread) is doubled.

are combined in the same proportion and quantity as in the production of the first unit. Let r_i be the price of input i, then the marginal cost of producing any marginal unit of output is:

$$\text{Marginal Cost} = \sum_{i=1}^{10} r_i \frac{X_i}{Q_A} = \text{Average Cost}. \tag{3}$$

This has two implications for the analysis. First, the supply curve to the consumer product market, which is the industry marginal cost curve, is perfectly elastic (horizontal). Second, a strategy that will increase input cost will result in a parallel upward shift in the supply curve equal to the change in average cost.

Finally, we assume competitive resource and product markets. In the resource market, this implies that any consumer goods industry views the prices of his inputs as given. The assumption of competition in the product market means that the equilibrium condition is satisfied where the price of the final product is equal to the marginal cost of production.

We shall consider the effects of a strategy that raises the cost of product packaging under two types of production technologies: fixed technical coefficients and variable coefficients. For illustrative purposes, two inputs (X_1, X_2) are assumed in the production of a consumer product (A).

Case 1: Fixed Technical Coefficients

If the current state of technology is such that, for each specified output, there is but one possible combination of inputs, the production process is said to have fixed technical coefficients. This production function may be represented by isoquants as in figure C-3. An isoquant is a geometric curve that indicates all combinations of the two inputs that will produce a given output. In figure C-3, three of the isoquants are drawn representing output levels a_1, a_2, a_3. The isoquant labeled a_1 shows that to produce a_1 units of A, the process requires x_1 units of X_1 and x_2 units of X_2; input substitution is not possible.

Assuming a linear homogeneous production function, the case of fixed technical coefficients implies that there is a single fixed input proportion required for any level of production. Such a production
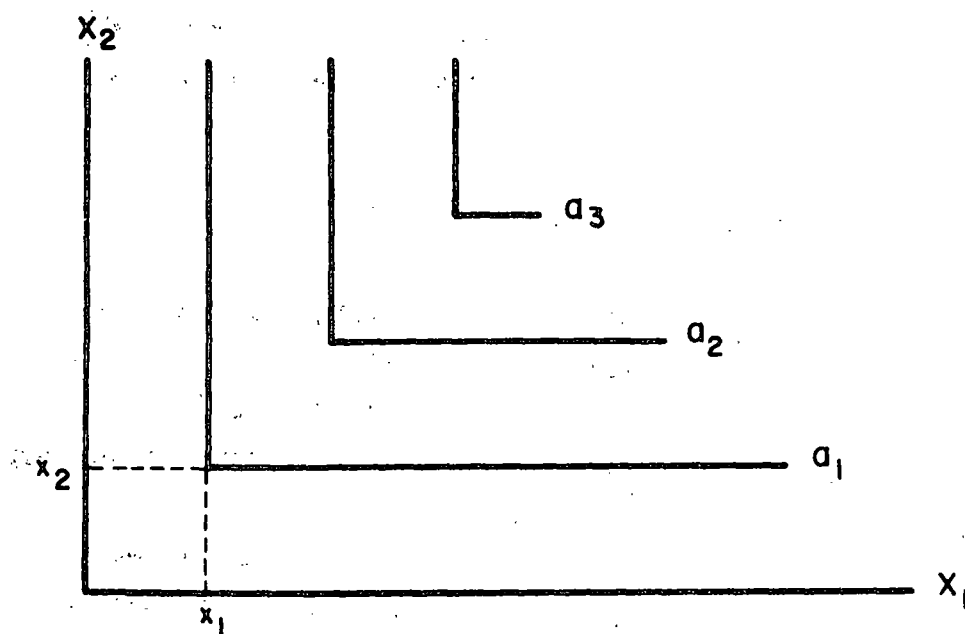
Figure C-3. Fixed coefficient technology
expressed by isoquants.
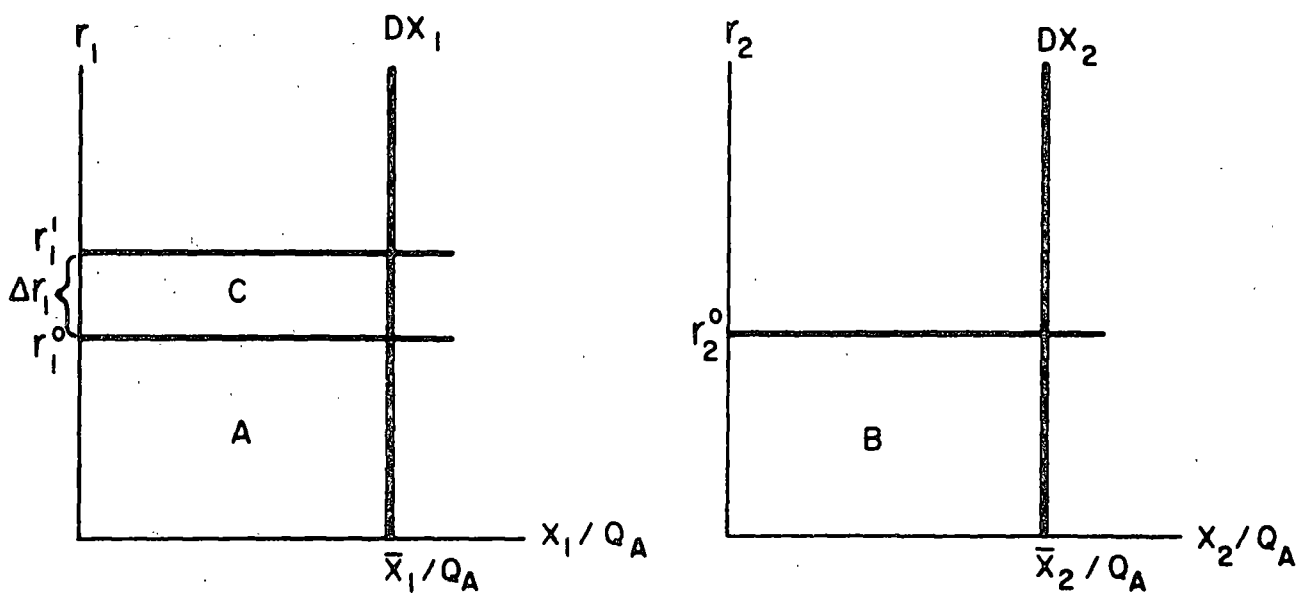
Figure C-4. Demand schedules for inputs X_1 and X_2 per unit of output
under fixed coefficient technology.

function may be represented as:

$$1 = f\left(\frac{\overline{X}_1}{Q_A}, \frac{\overline{X}_2}{Q_A}\right)$$

(4)

where $(\overline{X_1/Q_A})$ is the fixed quantity of input X_1 needed to produce any unit of A. Input proportions would therefore be insensitive to changes in input costs. A schedule relating demand for a factor per unit of product output to the price of the factor would appear as in figure C-4 (DX_1, DX_2).

Let r_1^0, r_2^0 be the initial prices of the factors, (we have assumed competition in the resource market; therefore, the producing industry is a price taker and does not believe the input price will be affected by the absolute quantity it purchases). Producing industry A purchases $(\overline{X_1/Q_A})$ units of X_1 and (X_2/Q_A) units of X_2 for each unit of output produced. The average cost of producing each unit is the sum of areas A and B in figure C-4. By eq. 3 above, this is the marginal cost of each unit of output and is the supply curve faced by the consumer market (fig. C-5). If consumer demand is D_A in figure C-5, equilibrium output is Q_0, product price is $P_0 = AC_0$, and the use of packaging materials X_1 and X_2 is $(\overline{X_1/Q_A}) \cdot Q_0$ and $(\overline{X_2/Q_A}) \cdot Q_0$, respectively.

Suppose the cost of packaging inputs X_1 is increased by amount t_1 due to the imposition of a strategy. The price of input X_1 is increased to $r_1^0 + t_1$. Having assumed fixed technical coefficients, the demand for input X_1 per unit of output A is unchanged at $(\overline{X_1/Q_A})$ (fig. C-4). Average cost, or marginal cost, per unit of output, however, has increased to area A + B + C. The supply curve to the consumer market is shifted by a parallel amount equal to the increased unit cost of production (C). As in figure C-5, the new equilibrium output is Q_1, product price is $P_1 = P_0 + C$, and the use of packaging materials X_1 and X_2 is $(\overline{X_1/Q_A}) \cdot Q_1$ and $(X_2/Q_A) \cdot Q_1$. If the increase in input cost were due to a tax, total tax revenue is the rectangular area D in figure C-5.

In the above example, the tax t_1 has decreased the use of packaging materials X_1 and X_2 and, therefore, the amount of packaging entering
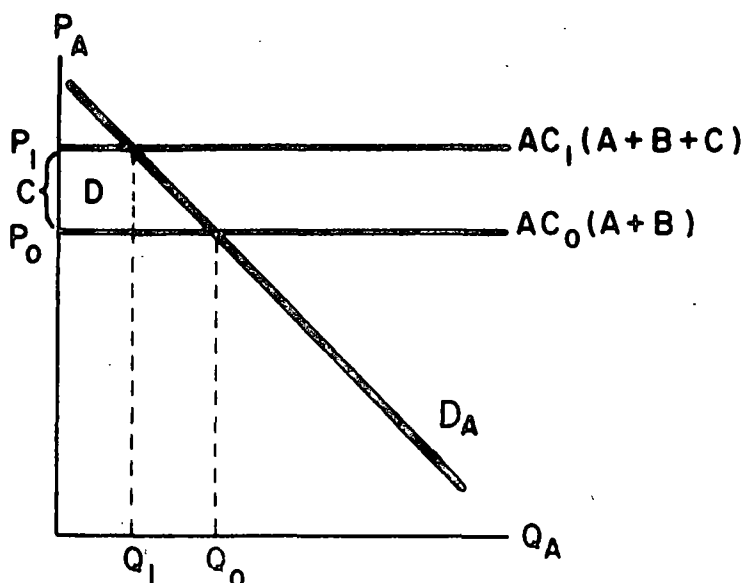
Figure C-5. Effect on consumer demand
of an increase in factor price.

solid waste by

$$\left(\frac{\overline{X}_1}{Q_A}\right)\left(Q_0 - Q_1\right), \quad \left(\frac{\overline{X}_2}{Q_A}\right)\left(Q_0 - Q_1\right). \tag{5}$$

In this case, $(\overline{X_1/Q_A})$ and $(\overline{X_2/Q_A})$ are constant; therefore, the
single critical factor in determining the reduction in solid waste
generation is the responsiveness of consumer demand $(Q_0 - Q_1)$ to changes
in product price.

Case 2:   Variable coefficients

If factor inputs are substitutes in production, then a production
function defines alternative resource combinations that will produce
a specified quantity of output. In the case of an industry producing
according to a linear homogeneous function, there exist alternative
input proportions to achieve any level of output. Given product prices,
the minimum cost input proportion will be the same for all levels of
output. However, as input prices are changed, the optimum input
proportion will change as producers are able to substitute in favor
of less costly inputs. At initial prices (r_1^0, r_2^0) of inputs X_1 and

X_2, producers will employ inputs in producing a unit of A so that per unit cost is a minimum $[(X_1/Q)_0, (X_2/Q)_0]$. If the price of factor X_1 increases to $r^1 = r_1^0 + \Delta r_1$, then the per unit cost of production will increase by $\Delta r_1 (X_1/Q)_0$. However, with input substitution possible, producers may offset some of the increased production cost by using more X_2 and less X_1 in producing a unit of output. The locus of points X_1/Q at alternative prices r_1 (holding constant the price of factor X_2) defines the industry's demand curve for input X_1 per unit of production (DX_1 in fig. C-6). Similarly, holding r_1 constant, a schedule relating quantities of X_2 demanded per unit of production and the price of input X_2 may be derived (DX_2 in fig. C-6).

Assume the price of input X_2, (r_2^0), is constant but that a strategy is imposed that increases the price of input X_1 from r_1^0 to $r_1^1 = r_1^0 + \Delta r_1$. Referring to schedule DX_1 in figure C-6, the use of X_1 in producing each unit of output will decrease from $(X_1/Q)_0$ to $(X_1/Q)_1$.

From the schedule DX_2 in figure C-6, at price r_2^0, $(X_2/Q)_0$ units of X_2 were used per unit of output. However, this schedule was derived for a given price of input X_1. As r_1 increased from r_1^0 to r_1^1, the demand schedule per unit of output for factor X_2 shifed upward to DX_2^1 indicating
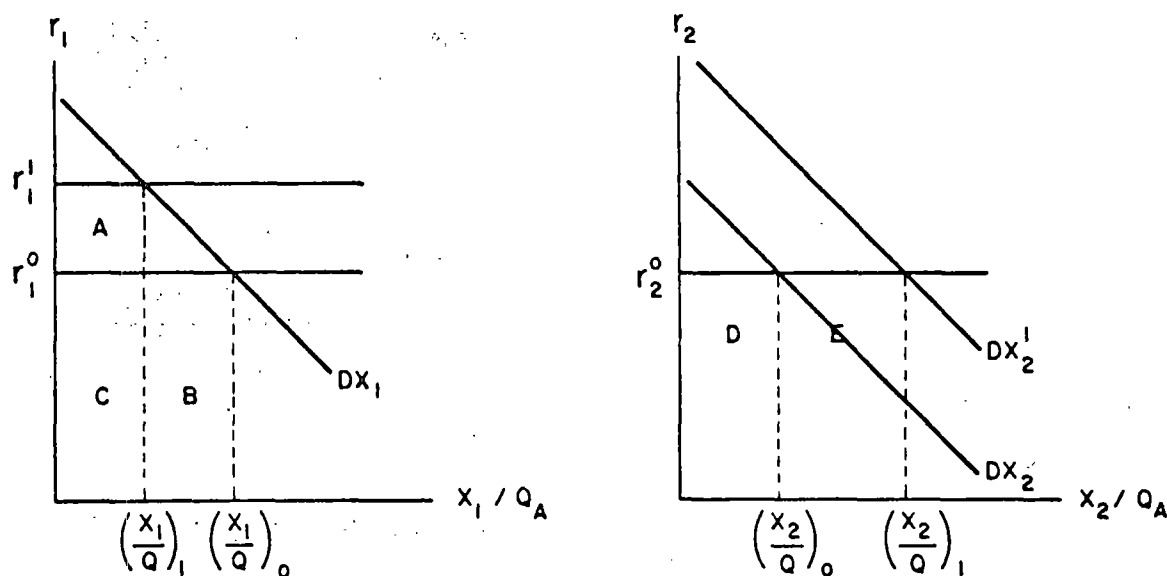
Figure C-6. Demand schedules for inputs X_1 and X_2 per unit of output under variable coefficient technology.

that X_2 is substituted for the now higher priced X_1. Demand for X_2 per unit of production is therefore increased to $(X_2/Q)_1$ as a result of the increase in the price of input X_1.

As in case 1 above, the increase in the cost of packaging will increase the price of the consumer product by an amount equal to the increased unit cost of production. Prior to the strategy, the cost of employing X_1 for a unit of output was area C + B in figure C-6. After the imposition of the strategy, area A + C is spent on factor X_1 for each unit of output. Therefore, the change in unit cost of production due to factor X_1 is the area A - B. Initially, the contribution of input X_2 to unit cost was equal to area D in figure C-6. With the increase in price of input X_1, input substitution occurs and more of X_2 is employed, thereby increasing the contribution of X_2 to unit costs by area E. Total change in unit cost is therefore A - B + E, and product price will increase by the same amount.

Case 1 and Case 2 Compared:

To compare the effect of a strategy that affects input prices in the case of input substitution with the effect in the case of fixed technical coefficients, consider the isoquant (Q1VC) in figure C-7 which depicts the production possibilities in the case of variable coefficients. An output level of one unit for such a production function is shown. The isoquant indicates that one unit of output may be produced by using x_1^0 units of X_1 and x_2^0 units of X_2; it may also be obtained by combining x_1^1 units of X_1 and x_2^1 units of X_2, or any other combination corresponding to that isoquant. The optimum input combination will be determined by relative factor prices.

The efficient combination of resources X_1 and X_2, given prices r_1^0, r_2^0, may be determined by superimposing an isocost line on the diagram in figure C-7. The isocost line shows the alternative combinations of inputs that may be purchased given input prices and total expenditure; the slope reflects relative prices and the intercept on the vertical or horizontal axis indicates the total outlay. At initial prices r_1^0, r_2^0, a unit of output may be produced at a minimum cost of AC_0 by using x_1^0 units of X_1 and x_2^0 units of X_2. If the price of X_1 increases to r_1^1, producers find it more cost efficient to substitute units of

X_2 for the now higher priced X_1. Therefore, at prices r_1^1, r_2^0, producers will employ x_1^1 units of X_1 and x_2^1 units of X_2 at a cost of AC_1 to produce a unit of output.

However, if the production process dictates fixed coefficients (as depicted by QlFC in fig. C-7), then, given the new factor prices, the isoquant-isocost solution occurs at a cost of AC_2. The input proportion is unresponsive to factor prices, and the new average cost fully reflects the increase in factor price. If input substitution is possible, producers are able to offset some of the cost increase caused by employing more of X_2 and less of X_1 per unit of output.

An increase in the price of one factor causes a greater increase
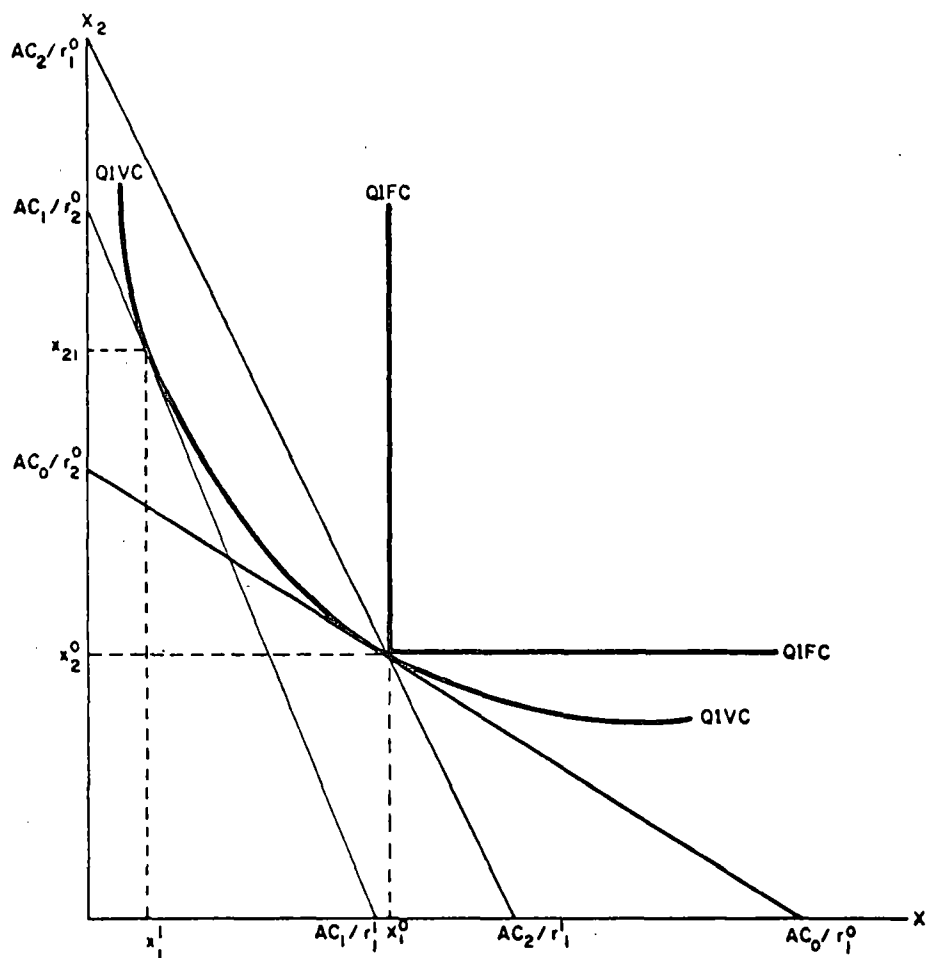
Figure C-7. Effects on unit cost of an increase in factor price variable coefficients vs. fixed coefficients.

in average cost if the production technology is fixed coefficient
(AC_2) than with a variable coefficient process (AC_1). As shown in
figure C-8, the new product price faced by the consumer will be higher
for a commodity produced according to fixed technical coefficients;
therefore, final demand will be less under fixed coefficients (Q_2) than
under variable coefficients (Q_1).

Moreover, in the case of variable coefficients, an increase in the
price of input X_1 has changed the rate at which packaging factors X_1 and
X_2 are employed in producing a unit of product; that is, the strategy
has altered the rate and composition of solid waste generation associated
with a unit of product. Under fixed technical coefficients, the amount
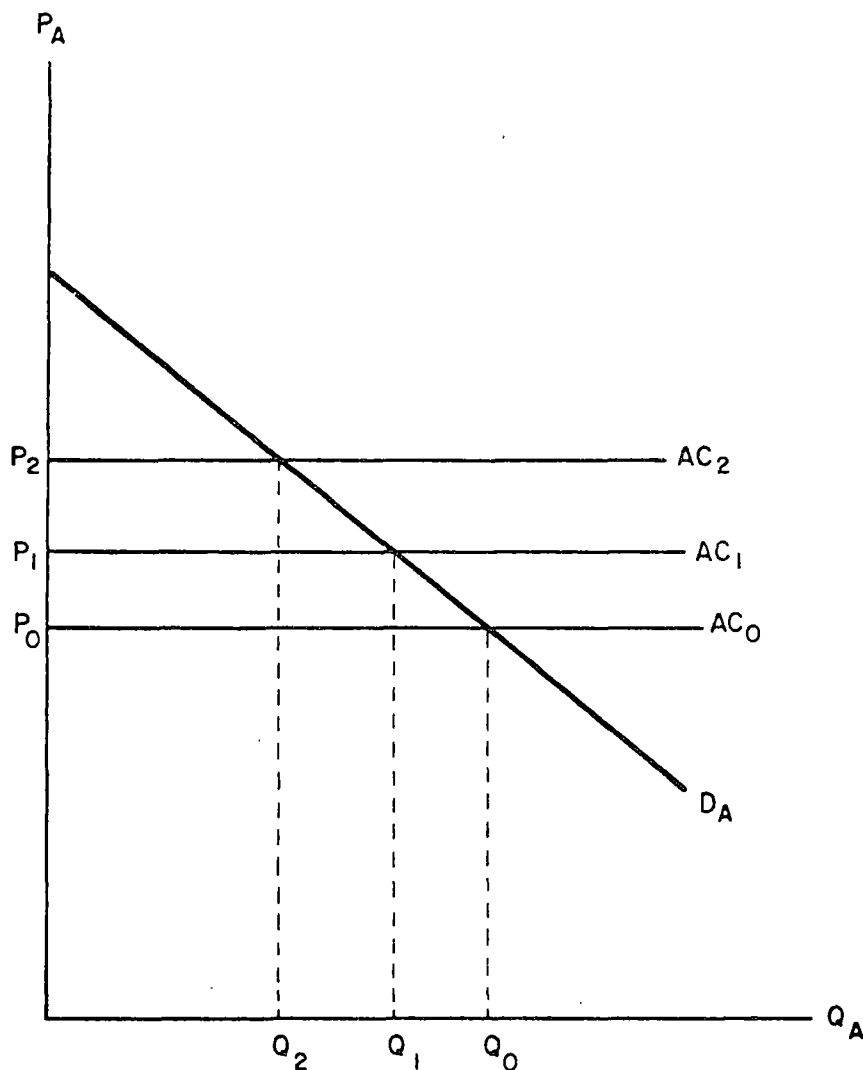
Figure C-8. Effect on consumer demand of an increase in input
prices: fixed coefficients vs. variable coefficients.

of each packaging material used per unit of product is unchanged, and the effect of the strategy depends only on the responsiveness of consumer demand to price changes. With factor substitution, the generation of solid waste depends not only on the response of the consumer sector but also on the degree of factor substitutability.

The effect on consumer product price (P) of a policy instrument that changes the cost of a packaging material may be symbolically derived by recalling the expression in eq. 3 (dropping subscripts on P and Q):

$$P = MC = r_1 \left(\frac{X_1}{Q}\right) + r_2 \left(\frac{X_2}{Q}\right) \qquad (6)$$

Differentiating eq. 6 with respect to r_1 yields:

$$\frac{\partial P_A}{\partial r_1} = \frac{X_1}{Q} + r_1 \frac{\partial \left(\frac{X_1}{Q}\right)}{\partial r_1} + r_2 \frac{\partial \left(\frac{X_2}{Q}\right)}{\partial r_1}. \qquad (7)$$

The first term in eq. 7, X_1/Q, is a measure of the cost increase due to the higher price of factor X_1.

The term

$$\frac{\partial X_1/Q}{\partial r_1}$$

(own-price response) is the slope of the function relating demand for X_1 per unit of output to its own price and the expression

$$r_1 \frac{\partial (X_1/Q)}{\partial r_1}$$

represents the cost saving from using less of X_1 to produce a unit of product. The term

$$\frac{\partial (X_2/Q)}{\partial r_1}$$

represents the amount by which the demand curve for factor X_2 shifts upward as the price of factor X_1 changes (cross-price response) and the expression

$$r_2 \frac{\partial (X_2/Q)}{\partial r_1}$$

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indicates the addition to unit cost from using more X_2. In the case of fixed technical coefficients, the second two terms in eq. 7 are zero; with variable coefficients,

$$r_1 \frac{\partial \left(X_1/Q\right)}{\partial r_1} + r_2 \frac{\partial \left(X_2/Q\right)}{\partial r_1} \tag{8}$$

measures the amount by which a factor price increase may be offset by substitution of factors.

Letting Q_0 and Q_1 denote product demand before and after the increase in input price, the quantity of packaging input X_1 consumed and entering solid waste has decreased by:

$$Q_0 \left(\frac{X_1}{Q}\right)_0 - Q_1 \left(\frac{X_1}{Q}\right)_1 . \tag{9}$$

But $(X_1/Q)_1$ may be expressed as

$$(X_1/Q)_0 + \frac{\partial (X_1/Q)}{\partial r_1} \, dr_1$$

where the second term indicates the amount by which producers substitute out of factor X_1. Substituting into (9):

$$\left(\frac{X_1}{Q}\right)_0 (Q_0 - Q_1) - \frac{\partial (X_1/Q)}{\partial r_1} \, dr_1 \, (Q_1) . \tag{10}$$

The first term represents the reduction in solid waste due to packaging factor X_1 in the case of fixed coefficients. The second term measures the change in the amount of packaging factor X_1 consumed due to factor substitution. Since

$$\frac{\partial (X_1/Q)}{\partial r_1}$$

is negative, the reduction in the use of packaging input X_1 is greater in the case of factor substitution than in the case of fixed technical coefficients.

Similarly, the following expression may be derived for the change in use of packaging factor X_2:

$$\left(\frac{X_2}{Q}\right)_0 (Q_0 - Q_1) - \frac{\partial (X_2/Q)}{\partial r_1} \, dr_1 \, (Q_1) \tag{11}$$

Again, the first term is a measure of the change in the quantity of packaging factor X_2 entering solid waste under fixed technical coefficients. The second term indicates the change in consumption of factor X_2 due to factor substitution. However, the cross-price response

$$\frac{\partial(X_2/Q)}{\partial r_1}$$

is positive; therefore, the reduction in the use of X_2 is less in the case of variable coefficients than in the case of fixed technical coefficients. Indeed, it is possible for the amount of factor X_2 entering the solid waste stream to increase if factor substitution is possible.

C.4.3.1 Estimation of Substitution Parameters

The effectiveness in reducing solid waste generation of a packaging strategy in the case of variable coefficients depends not only on the change in consumer demand (as in the case of fixed coefficients) but also on the new optimum input proportions. Both the input proportions and the change in consumer demand are affected by the magnitude of the own-price and cross-price parameters. Estimates of these parameters were developed for the packaging materials in each of 30 consumer product categories. Packaging materials that comprised an appreciable share (greater than 5 percent) of total packaging in terms of weight (for flexible packaging) and quantity (for rigid packaging) per dollar of consumer expenditure in each category were selected for regression analysis. Each regression equation included own price, the price of other materials, and time (a proxy for the influence of other variables) as the explanatory variables. Data collected over the 1958-70 period (except for Beer and Soft Drinks, for which aluminum and steel data were available only over the 1967-72 period) afforded 13 time series observations for the estimation of each relationship, thus constraining the number of explanatory variables that could be included in each relation without seriously diminishing the power of the tests used to determine the significance of the included explanatory variables. The measures of responsiveness of the use of a given packaging material in producing a given consumer product were estimated from an equation of the following general form:

$$\ln \frac{X_i}{Q_A} = b_0 + \sum_{i=1}^{9} b_i \ln p_i + b_{10} \ln t \qquad (12)$$

where:

$\ln$ = the natural logarithm,

X_i/Q_A = use of input i in producing a unit of consumer product A, measured in kilograms of packaging per hundred dollars (constant) of consumer expenditures,

$b_0, \ldots, b_{10}$ = parameters to be estimated,

p_i = price of input i,

t = time in years,

The estimated own-price and cross-price coefficients permit calculation of the effect on the packaging structure and average cost of production of an increase in the cost of the nine packaging materials. One cautionary remark needs to be made. Based on the historical data, the change in usage of packaging materials in response to changes in relative prices of packaging materials have been estimated. However, nonpackaging factors of production may be substitutes for packaging inputs. For example, packaging provides a marketing function; other forms of advertising may therefore be substituted for packaging. If the costs of the packaging inputs used in producing a good for the consumer market increase, the producer may find it more cost efficient to decrease packaging inputs in favor of nonpackaging advertising. The estimated substitution coefficients would reflect the producer's use of less packaging per unit of output. However, estimates were not made of the amount by which nonpackaging factors are increased in response to changes in the cost of packaging. Such investigation was precluded in this study by the difficulty of identifying nonpackaging inputs for all 30 consumer products, the availability of data, and the problems of measurement (e.g., packaging is measured in physical units, advertising in dollars).

An increase in the use of nonpackaging inputs represents an addition to unit costs that is not fully reflected in the model estimates. Consider the isoquant for a unit of production of good A depicted in figure C-9. Let X_1 be a packaging factor and X_2 a nonpackaging factor. At initial prices (r_1^0, r_2^0), a unit of product is produced by using X_1^0, X_2^0 units of the
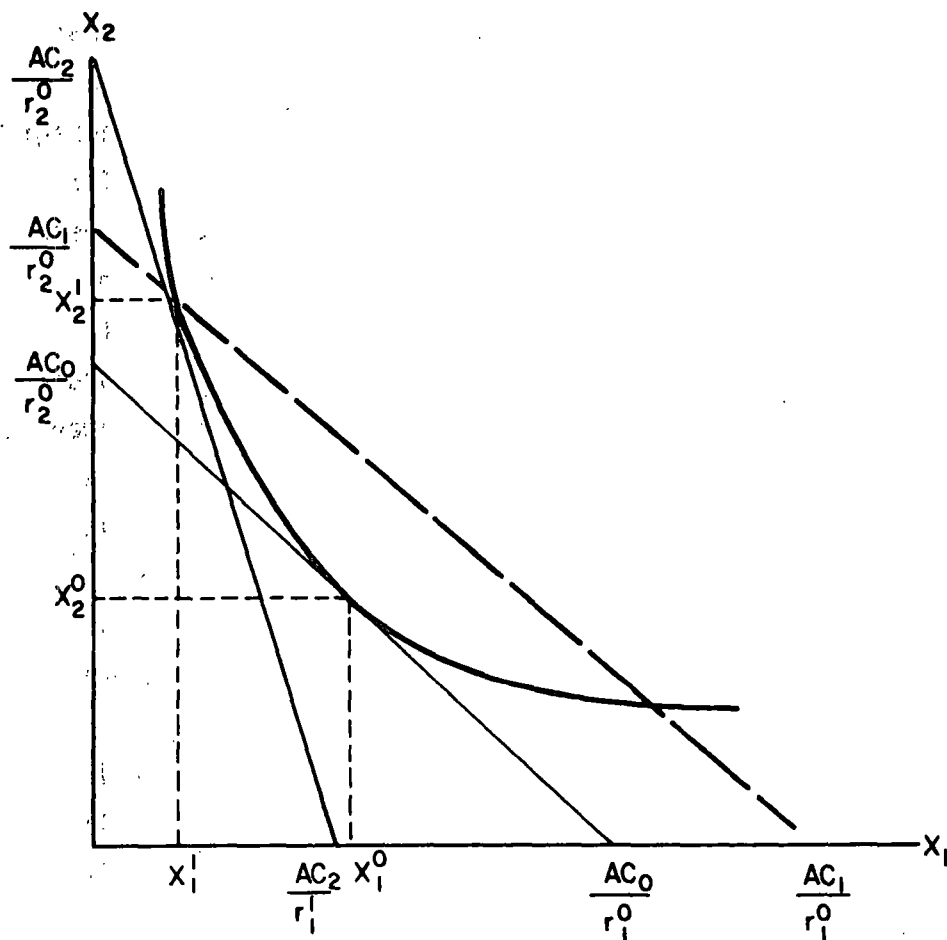
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Figure C-9. Production isoquant.

factors at a cost of AC_0. After the packaging strategy is imposed, X_1^1, X_2^1 units of the factors are employed at a cost of AC_2. The change in cost $(AC_2 - AC_0)$ may be separated into two components: the isocost parallel to AC_0 indicates how much more it would have cost $(AC_1 - AC_0)$ to produce a unit of output if factors had been combined in amounts X_1^1, X_2^1 at the initial prices; the distance between the AC_2 and AC_1 isocosts reflects the increased payment to the factor X_1 when the packaging strategy is imposed (prices of nonpackaging factors are assumed to be constant). That part of the cost change represented by $AC_1 - AC_0$ depends in part on the degree of substitution to nonpackaging factors and prices of

those factors and is not estimated in the model. The $AC_2 - AC_1$ cost increase depends on the change in packaging prices due to a strategy and the change in usage of packaging factors; this component is the measure of increased production cost estimated in the model. Therefore, the increase in cost of production (and product price) should be interpreted as a lower limit for goods produced according to a variable coefficient technology. The change in consumer demand and the reduction in solid waste are likewise lower bound estimates.

The equations in table C-2 include at least one significant price coefficient. Several other equations, as well as alternative specifications of these equations, were estimated but not reported because of the lack of any price coefficients of meaningful significance. The equations are estimated in log-log form, permitting the coefficients to be interpreted as elasticities (the estimated percentage change in the variable on the left-hand side occurring in response to a 1-percent change in the price variable whose coefficient is being considered, each being measured from its respective logarithmic mean in the data). The t-values are indicated in parentheses below their respective coefficients; the level of significance is indicated by asterisks as superscripts to the right of the coefficients. R_2 and the F-value due to regression are reported to the right of each equation; the former indicates the degree of fit of the estimated regression line to the data points ($R_2 = 1$, if perfect fit occurs) and the latter indicates the significance of the set of explanatory variables taken as a unit (all equations except for the ones for Other Cleaning Supplies and Cosmetics and Hand Products have statistically significant sets of explanatory variables).

All own-price coefficients have a negative sign, indicating that a 1-percent change in the price of a given material will result in a percentage change in its use as indicated by the coefficient but in the opposite direction. Similar interpretations apply to negative signs before cross-price coefficients (indicating complementarity); positive signs refer to movements in the same direction (indicating substitutability). The symbols are defined in table C-3; the estimated equations are reported in table C-2.

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Table C-2. Significant regression results
(t values in parentheses below coefficients)

Baked Goods

$Y_5 = -927.323^{***} - 2.458^{***}X_6 + 123.531^{***}X_{10}$
$(-12.32) \quad (-3.841) \quad (12.443)$

$R^2 = 0.958$
$F_{REGR} = 113.133$

Diary Products

$Y_1 = -365.822^{***} - 1.339^{**}X_1 + 49.387^{***}X_{10}$
$(-4.772) \quad (-3.001) \quad (4.848)$

$R^2 = 0.718$
$F_{REGR} = 12.703$

Meat Products

$Y_2 = -1504.355^{***} - 4.245^{***}X_5 + 193.880^{***}X_{10}$
$(-11.774) \quad (-3.813) \quad (11.804)$

$R^2 = 0.949$
$F_{REGR} = 92.462$

Fish Products

$Y_1 = -1190.220^{***} - 0.643X_1 + 0.511^{**}X_2 - 1.533^{**}X_5 + 157.272^{***}X_{10}$
$(-10.717) \quad (-1.354) \quad (2.157) \quad (-2.315) \quad (10.739)$

$R^2 = 0.976$
$F_{REGR} = 62.033$

$Y_2 = -2173.426^{***} - 3.023^{***}X_1 - 4.735^{***}X_5 + 286.595^{***}X_{10}$
$(-12.604) \quad (-2.957) \quad (-3.386) \quad (12.605)$

$R^2 = 0.960$
$F_{REGR} = 72.356$

$Y_5 = -1220.290^{***} - 0.297X_1 + 0.477X_2 - 2.123^{**}X_5 + 162.836^{***}X_{10}$
$(-8.243) \quad (-0.463) \quad (1.499) \quad (-2.390) \quad (8.287)$

$R^2 = 0.963$
$F_{REGR} = 51.032$

Poultry Products

$Y_2 = -1614.913 - 2.292^{**}X_1 - 3.121^{**}X_5 + 213.190^{***}X_{10}$
$(-12.711) \quad (-2.984) \quad (-3.047) \quad (12.726)$

$R^2 = 0.962$
$F_{REGR} = 76.993$

Produce

$Y_2 = -1628.243 - 1.434^{**}X_1 + 0.438X_2 - 1.350^{*}X_5 + 215.271^{***}X_{10}$
$(-13.113) \quad (-2.657) \quad (1.658) \quad (1.822) \quad (13.147)$

$R^2 = 0.966$
$F_{REGR} = 137.465$

$Y_5 = -718.915^{***} - 0.004X_1 + 0.047X_2 - 1.174^{*}X_5 + 96.059^{***}X_{10}$
$(-7.047) \quad (-0.010) \quad (0.240) \quad (-2.147) \quad (7.951)$

$R^2 = 0.971$
$F_{REGR} = 67.215$

Candy and Chewing Gum

$Y_1 = -642.511^{***} - 0.496^{**}X_1 + 85.273^{***}X_{10}$
$(-18.071) \quad (-2.431) \quad (18.192)$

$R^2 = 0.986$
$F_{REGR} = 345.837$

Cereals, Flour, and Macaroni

$Y_2 = -1275.433^{***} + 1.523^{*}X_1 - 0.212X_2 + 168.441^{***}X_{10}$
$(-5.560) \quad (1.844) \quad (-0.442) \quad (5.568)$

$R^2 = 0.967$
$F_{REGR} = 86.725$

$Y_5 = -566.203^{***} - 1.143^{*}X_5 + 75.681^{***}X_{10}$
$(-6.447) \quad (-1.853) \quad (6.534)$

$R^2 = 0.845$
$F_{REGR} = 27.259$

Other Foods

$Y_1 = -812.431 - 1.055^{***}X_1 + 0.442^{*}X_2 + 107.726^{***}X_{10}$
$(-8.910) \quad (-3.409) \quad (2.202) \quad (8.969)$

$R^2 = 0.950$
$F_{REGR} = 72.250$

$Y_5 = -839.532^{***} + 0.228X_2 - 2.124^{**}X_5 + 111.914^{***}X_{10}$
$(-6.240) \quad (0.648) \quad (-2.523) \quad (6.313)$

$R^2 = 0.912$
$F_{REGR} = 31.266$

$Y_7 = -544.568^{***} - 0.121X_6 - 0.497^{**}X_7 + 72.921^{***}X_{10}$
$(-9.001) \quad (-0.607) \quad (-3.106) \quad (9.139)$

$R^2 = 0.960$
$F_{REGR} = 71.939$

Other Cleaning Supplies

$Y_5 = 378.274 - 3.023^{*}X_5 + 50.773X_{10}$
$(-1.709) \quad (-1.945) \quad (1.739)$

$R^2 = 0.292$
$F_{REGR} = 2.091$

Packaged Medications

$Y_1 = -291.441^{***} - 0.333^{*}X_7 + 38.888^{***}X_{10}$
$(-7.360) \quad (-1.754) \quad (7.448)$

$R^2 = 0.906$
$F_{REGR} = 48.057$

Cosmetics and Hand Products

$Y_9 = -254.852 - 1.624X_6 - 3.189^{**}X_9 + 34.259X_{10}$
$(-0.660) \quad (-1.744) \quad (-2.245) \quad (0.885)$

$R^2 = 0.674$
$F_{REGR} = 6.198$

Shaving Products

$Y_8 = -1991.419^{***} - 3.671^{***}X_8 + 263.206^{***}X_{10}$
$(-8.055) \quad (-4.358) \quad (8.054)$

$R^2 = 0.951$
$F_{REGR} = 96.779$

Other Toiletries

$Y_5 = -1260.105^{***} - 2.574^{***}X_5 + 167.352^{***}X_{10}$
$(-14.379) \quad (-4.373) \quad (14.430)$

$R^2 = 0.966$
$F_{REGR} = 141.841$

Other General Merchandise

$Y_3 = -433.229^{***} - 1.363^{**}X_3 + 57.496^{***}X_{10}$
$(-3.911) \quad (-2.454) \quad (3.936)$

$R^2 = 0.630$
$F_{REGR} = 8.508$

Pesticides

$Y_7 = 1661.162^{***} - 2.759X_7 - 218.544^{***}X_{10}$
$(5.870) \quad (-2.461) \quad (-5.855)$

$R^2 = 0.911$
$F_{REGR} = 50.972$

Note: * - significant at the 10 percent level.
       ** - significant at the 5 percent level.
       *** - significant at the 1 percent level.

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Table C-3. Estimation of price elasticities of packaging materials

DESCRIPTION OF SYMBOLS

$i = 1, 2, \ldots, 10$ index for packaging material
1 = flexible paper
2 = flexible plastic
3 = flexible steel
4 = flexible aluminum
5 = rigid paper
6 = rigid plastic
7 = glass
8 = rigid steel
9 = rigid aluminum
10 = time (in years)

$Y_i = 1, \ldots, 4$ = natural logarithm of tons of packaging material i per dollar of personal consumption expenditure on given end use item

$Y_i = 5, \ldots, 9$ = natural logarithm of number of containers of packaging material i per dollar of personal consumption expenditure on given end use item

$X_i = 1, \ldots, 9$ = natural logarithm of price of packaging material i

$X_i = 10$ = natural logarithm of time (in years)

C.4.3.2 Problems in Estimation

Insignificant own-price and cross-price (substitution and complementary) coefficients could have occurred as a result of any one of several estimation problems, many of which could not be empirically isolated. In fewer than 10 instances, one of the following three problems arose:

(a) A spurious (logically unjustified) coefficient appeared significant;

(b) A significant coefficient appeared unreasonably large (leading to a suspicion of severe bias, even after including time as an explanatory variable);

(c) Within a consumer product category, one or more coefficients indicated statistically significant substitution of a given material for others when its own price changed, without indicating a statistically significant own-price elasticity.

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In each of the above three cases, these estimates were further investigated and removed from the regression equations whenever other significant coefficients appeared in the same equation; in each case, little change was generally observed in the magnitude, sign, and significance of the other coefficients.

Estimation problems that might lead to either insignificant or extraneous estimates include the following.

(a) Problems of data quality: In certain cases, explained elsewhere in this report, no primary data were available on price and/or quantity measures for packaging materials and consumer products as defined; thus approximations had to be made to form the necessary indexes, and allocation strategies had to be derived to fill in missing data cells.

(b) Problems of data quantity: A maximum of 13 annual observations were available for estimation within each equation (only 6 were available for Beer and Soft Drinks). Construction of a highly elaborate model was restricted as a result. In nearly all of the equations estimated, the Durbin-Watson statistic fell in a range in which positive autocorrelation could be neither accepted nor rejected (acceptance of positive autocorrelation would invalidate the use of ordinary least squares to estimate the desired coefficients). Additional data, providing the quality of such data is acceptable, could serve to reduce the standard errors of the estimated coefficients, thus increasing the power of the significance tests used and likely resulting in a larger number of significant coefficients.

(c) Problems in level of aggregation: The manner in which the data were aggregated, and the level of aggregation, while particularly useful for certain purposes, may not have been optimal for purposes of statistical estimation. The latter requires that certain homogeneity properties (in terms of relative sizes of variances) be satisfied before grouping occurs. If these criteria are not followed, substitutions in response to shift in price variables may be occurring but may go undetected unless they are between the categories defined.

(d) Identification problems: An assumption applied throughout the estimating procedure was that no packaging material supply constraints exist: an industry wishing to purchase a given packaging material may purchase as much or more as little as desired at a given price. Price variations were then assumed to result from variations in supply prices

alone. The estimating procedure did not allow the detection of supply constraints and thus price variations as a result of demand variations (demand variations being accounted for in the model by the use of time as a proxy for all nonprice variables affecting demand); own-price and cross-price elasticities of the wrong sign may appear whenever such constraints are not taken into account explicitly, particularly whenever the magnitude of demand shifts exceed the magnitude of supply shifts over the estimation period.

(e) Multicollinearity: Observations from time series data are typically correlated to some degree; standard methods of statistical estimation require the explanatory variables to be uncorrelated, or only slightly so. In certain of the regression equations, the correlation matrix indicated an unacceptable (greater than ± 0.90) level of correlation between pairs of supposedly independent explanatory variables; in these instances the equation was reestimated, dropping the variable of least empirical significance. The result of such a procedure is to lower the standard error of the remaining coefficient at the expense of introducing some bias in its estimate.

(f) Time asymmetry: Certain effects that occur continuously over the data period are irreversible; whereas the data indicate that the price of plastics has continuously declined over time and that its use has continuously increased, the use of glass has continuously decreased over time. Without including the time variable, a significant coefficient often appeared, indicating substitution of plastics for glass whenever the price of plastics fell. Since much of this substitution was for safety purposes (a large share of which was later captured by the nonprice variable time), taxation of plastics will probably not result in a symmetric substitution of glass for plastics.

(g) Range constraints: The elasticity estimates hold only for the range of price and quantity variations in the data; strategies to reduce solid waste or to encourage recycling that imply a variation in prices or quantities exceeding those in the data should not employ the estimated coefficients.

(h) Specification bias: A small degree of specification bias exists in each of the reported coefficients. The largest contributor

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to such bias was removed upon the insertion of time as an explanatory variable. Eliminating cross-price variables, to remove multicollinearity among them, contributed to specification bias in the remaining price coefficient, although such bias was noted to be fairly small in each case.

C.4.4 Demand Elasticities

In order to translate changes in the price of a consumer product that result from imposition of a packaging strategy into changes in the quantity of the product purchased by consumers, it is necessary to obtain some knowledge of consumer demand for the product in question. This required knowledge of the consumer demand curves may be conveniently summarized by the construct of elasticity of demand.

The elasticity of demand is a measure of the responsiveness of demand to a change in one of its determinants: own price, prices of other commodities, or income of buyers. It is often expressed as the percentage change in the quantity demanded in response to a 1-percent change in commodity price or other determinants. Demand is considered elastic, or responsive to price changes, if the own price elasticity of demand coefficient is less than -1 (e.g., -2.3). This implies that total expenditures (quantity times price) will decrease when the price increases. If total expenditures increase with a price increase, the elasticity coefficient is greater than -1 (e.g., -0.7) and demand is termed inelastic. If the elasticity coefficient is equal to -1, the elasticity is termed unitary, and there is no change in total expenditures as prices change.

In the general theory of consumer demand, price elasticity is higher for the more narrowly defined product. A narrowly defined product has many close substitutes; hence, consumers will increase their purchases of these substitutes as prices of the product in question rise. In addition, products whose purchases constitute large portions of consumers' budgets tend to be more price elastic than those that constitute a smaller fraction of the budget.

In order to estimate price elasticities of demand, it is neccessary to obtain data on quantities of the product purchased at various prices. Data on prices are readily available for the products used in this study. However, data are available only on product expenditures and not on quantities sold. This available information

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can be used to calculate expenditure elasticities directly (percent change in expenditures divided by percent change in price) but not price elasticities. Fortunately, price elasticities can be obtained from expenditure elasticities, as shown by the following algebraic manipulations.

Let

$$\eta_p = \text{price elasticity of demand} = \frac{dQ}{dP} \cdot \frac{P}{Q},$$

$$\xi_p = \text{expenditure elasticity of demand} = \frac{dPQ}{dP} \cdot \frac{P}{PQ}$$

where P = price and Q = quantity.
Since dPQ = PdQ + QdP,

$$\xi_p = \frac{PdQ}{dP} \cdot \frac{P}{PQ} + \frac{QdP}{dP} \cdot \frac{P}{PQ} = \eta_p + 1$$

Therefore, the price elasticity of demand equals the expenditure elasticity of demand minus 1. The approach followed for this study was to estimate the expenditure elasticities of demand for each of the consumer products under consideration and to obtain the price elasticities of demand by subtracting one from this number.

In estimating the expenditure elasticities, expenditures per capita in the United States were hypothesized to be a function of product price and disposable personal income per capita. Additional explanatory variables, such as prices of other products and measures of shifts in consumer tastes, were not included in these analyses, since it was felt that the partial equilibrium model described above would be adequate for this study.

A price index was developed for each of the consumer products and expressed in real terms by dividing by the consumer price index for the year in question. The income variable was also expressed in real terms by dividing by the GNP implicit price deflator for personal consumption expenditures. Fourteen observations were available for each product, for the years 1958-71.

Various functional forms of the equations were estimated, but the elasticities reported below were obtained from ordinary least squares

estimates of a double logarithmic specification that provides a constant expenditure elasticity.* This type of specification is frequently used in consumer demand studies. It was selected for this study since an analysis of alternative linear specifications indicated that, for most commodities, the price elasticities of expenditure were relatively constant throughout the period for which data are available.

In the context of this study, it is important to determine whether the estimated price elasticity of demand is statistically different from zero. Since $\eta_p = \xi_p - 1$, a test of the null hypothesis that $\eta_p = 0$ is equivalent to the test that $\xi_p = 1$. The results reported below were developed from the appropriate test of the expenditure elasticity.

The results of the estimating procedure are shown in table C-4. As discussed above, E = logarithm of expenditures per capita, P = logarithm of relative prices, and I = logarithm of income. The coefficient of determination is denoted by R^2.

The estimated price elasticities for Beer and Soft Drinks were obtained from a previous RTI study (ref. 5). These elasticities were estimated directly from quantity data on consumption and included an independent variable of the changing age distribution of the population to represent variations in consumer tastes. The estimated price elasticities for both of these products is -0.2.

C.4.5 Product Prices, Consumer Expenditures, and Consumer Surplus

Consumer expenditures in 1970 on each of the 30 consumer products, prior to the imposition of a packaging mechanism, are shown in table C-5.

The imposition of a mechanism will change the cost and structure of packaging as discussed in section C.4.3. Changes in product prices are obtained from the revised packaging cost structure. Revised consumer expenditures are determined by applying the estimated demand elasticities to the calculated price change.

Loss in consumer surplus is calculated by estimating consumer

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*Letting E and I designate expenditures and income, respectively, the equations were estimated in the following form: $\log E = b_0 + b_1 \log P + b_2 \log I$. In this specification, $\xi_p = \dfrac{dE}{E} / \dfrac{dP}{P} = \dfrac{d \log E}{d \log P} = b_1$. Therefore, the (constant) price elasticity of expenditure can be obtained directly from the estimated regression coefficient of the logarithm of the price.

Table C-4. Demand elasticities

Consumer product	Estimated equation		R^2	η_p
Baked Goods	E* =	-2.78 +0.04p*-0.05I*	0.35	-0.96
Dairy Products	E =	5.04 -1.65p -0.98I	0.93	-2.65
Frozen Foods	E =	-25.15 +0.82p +2.70I	0.90	-0.18†
Fresh and Cured Meat	E =	-2.82 -0.31p +0.08I	0.40	-1.31
Fresh and Cured Fish and Seafood	E =	-9.64 -1.79p +0.47I	0.55	-2.79
Fresh and Cured Poultry	E =	-8.06 -0.09p +0.49I	0.90	-1.09
Produce	E =	-1.67 -0.43p -0.17I	0.92	-1.43
Distilled Spirits	E =	-8.76 +0.48p +0.68I	0.96	-0.52
Wine	E =	-17.53 +0.93p +1.55I	0.85	-0.07†
Prepared Beverages	E =	-0.72 -0.46p -0.44I	0.91	-1.46
Candy and Chewing Gum	E =	-3.32 -1.21p -0.11I	0.97	-2.21
Canned Foods	E =	-2.08 -0.97p -0.18I	0.43	-1.97
Cereals, Flour, and Macaroni	E =	-4.28 +0.14p -0.03I	0.14	-0.86
Pet Foods	E =	-13.52 -0.82p +1.02I	0.99	-1.82
Tobacco	E =	-4.63 -0.65p +0.20I	0.08	-1.65
Other Foods	E =	-2.83 -0.17p -0.07I	0.19	-1.17
Soaps and Detergents	E =	-9.57 +0.46p +0.60I	0.74	-0.54†
Other Cleaning Supplies	E =	1.59 -5.50p -0.88I	0.26	-6.50†
Pesticides	E =	2.17 -2.31p -1.18I	0.91	-3.31
Other Household Supplies	E =	10.19 -3.07p +0.72I	0.91	-4.07
Packaged Medications	E =	-10.52 -0.31p +0.71I	0.98	-1.31
Oral Hygiene Products	E =	-15.81 +0.36p +1.27I	0.91	-0.64†
Cosmetics and Hand Products	E =	-16.16 -1.07p +1.34I	0.97	-2.07
Hair Products	E =	-31.38 +1.14p +3.30I	0.95	0.14†
Shaving Products	E =	-17.38 -0.66p +1.44I	0.98	-1.66
Other Beauty Aids	E =	-20.38 -2.53p +1.77I	0.99	-3.53
Other Health Aids	E =	-5.38 +0.77p +0.15I	0.40	-0.23†
Other General Merchandise	E =	-12.59 +0.67p +1.57I	0.99	-0.33†

* E is natural logarithm of personal consumption expenditures per capita 1967 dollars; p is the natural logarithm of the price index for the consumer products (1967 = 100) divided by the consumer price index (1967 = 100); I is the natural logarithm of personal income per capita in 1967 dollars.

† Not statistically different from zero at 5-percent level. For purposes of this study, demand was assumed to be perfectly inelastic (η_p = 0).

Source: Research Triangle Institute.

Table C-5. Consumer expenditures by consumer product category, 1970
(million 1967 dollars)

Consumer product	
Baked Goods	$ 8,841
Dairy Products	12,682
Frozen Foods	5,525
Fresh and Cured Meat	22,807
Fresh and Cured Fish and Seafood	525
Fresh and Cured Poultry	3,397
Produce	10,267
Distilled Spirits	7,061
Wine	1,289
Beer	6,279
Soft Drinks	3,149
Prepared Beverages	2,763
Candy and Chewing Gum	2,840
Canned Foods	6,148
Cereals, Flour, and Macaroni	2,218
Pet Foods	1,031
Tobacco Products	9,094
Other Foods	6,789
Soaps and Detergents	1,655
Other Cleaning Supplies	946
Pesticides	150
Other Household Supplies	2,454
Packaged Medications	1,603
Oral Hygiene Products	693
Cosmetics and Hand Products	888
Hair Products	1,219
Shaving Products	625
Other Beauty Aids	476
Other Health Aids	3,161
Other General Merchandise	191,037
Subtotal	317,612
Other services	215,317
Total	$ 532,929

Source: U.S. Department of Commerce, _Supermarketing_ Magazine.

surplus before and after the imposition of a strategy. The loss depends on the magnitude of the price change and the elasticity of demand. As indicated in section C.4.3, the increase in consumer price due to a packaging strategy is a lower bound estimate of the true price change. Therefore, the loss in consumer surplus must be interpreted as a minimum estimate of the loss in consumer welfare.

C.4.6 Natural Resource Consumption

Natural resource consumption is calculated by applying a fixed set of resource coefficients to each packaging material. The coefficients used in the model are shown in table C-6.

C.5 Programmed Solution

The programmed solution of the packaging model presented is explained below. A description of each table of the computer printout is provided along with a specification of the intermediate calculations.

C.5.1 Input Data

The program accepts as input data the following unique information for each of 23 packaging materials (table C-7):

1) A linear demand function for recycled materials:

$$DPR_i = a_i - b_i Q_i \tag{13}$$

where

DPR_i = demand price of recycled material used in packaging materials i

a_i = intercept (input data), dollars per tonne

b_i = slope (input data), dollars per tonne

Q_i = proportion of packaging material i produced from material recycled from postconsumer waste.

The demand curves for recycled materials were developed from the assumption that if postconsumer wastes were available to the producers at prices equal to or less than those of virgin materials for which they could substitute, then they would be purchased. Therefore, the demand curve for recycled materials is, in addition, a specification of the current prices paid for the virgin materials used in producing package i. The area under the demand curve is a measure of the average cost of using virgin raw materials in producing package i.

2) A technical limit (S_i) on the proportion of recycled

Table C-6. Natural resource coefficients

Packaging Material	Natural Resource Inputs per Tonne of Packaging Material	
Paper	Raw materials	
	Wood pulp	0.668
	Waste paper	0.278
	Chlorine	0.013
	Caustic	0.015
	Soda ash	0.008
	Sodium sulfate	0.033
	Lime	0.016
	Energy (equiv. kWh)	2,450
Plastics	Raw materials	
	NLG feed stocks	1.210
	Field condensates	0.071
	Refinery feed stocks	0.741
	Energy (equiv. kWh)	3,235
Glass	Raw materials	
	Glass sand	0.667
	Limestone	0.218
	Soda ash	0.217
	Feldspar	0.076
	Prepared saltcake	0.001
	Water for dust control	0.005
	Home cullet	0.250
	Energy (equiv. kWh)	1,331
Steel	Raw materials	
	Iron ore and agglomerates	0.986
	Scrap	0.501
	Coke	0.396
	Fluxes	0.227
	Mill cinder and scale	0.028
	Energy (equiv. kWh)	2,581
Aluminum	Raw materials	
	Bauxite	4,388
	Lime makeup	0.119
	Soda ash makeup	0.483
	Petroleum coke	0.510
	Pitch	0.164
	Cryolite	0.041
	Aluminum trifluoride	0.024
	Energy (equiv. kWh)	17,152

Source: Raw materials coefficients provided by EPA or developed by Research Triangle Institute from data in Census of Manufactures; energy coefficients developed by Research Triangle Institute from data in Census of Manufactures. All coefficients represent major direct requirements for materials production and package fabrication.

Table C-7. Packaging materials

1.	Converting paper	(26412, 26415)
2.	Bag paper	(2431)
3.	Glassine	(2643)
4.	Boxboard	(2651, 2652, 2654, 2655)
5.	Paper closures	(26451/81)
6.	Cellophane	(2821)
7.	Polyethylene	(2821)
8.	Polypropylene	(2821)
9.	Plastic sheet	(2821)
10.	Polystyrene and other thermoformed (2821)	
11.	Plastic closures (30794/71)	
12.	Plastic bottles	(3079)
13.	Plastic tubes, cups, jars, boxes, baskets, foams (3079)	
14.	Glass jars	(3221)
15.	Glass refillable bottles (3221)	
16.	Glass nonrefillable bottles (3221)	
17.	Steel cans	(3411)
18.	Aerosol cans	(3411)
19.	Metal closures	(34616, 34617)
20.	Aluminum foil	(3352)
21.	Aluminum plates	(3352)
22.	Aluminum cans	(3411)
23.	Collapsible tubes (3496)	

materials that may be used in the production of package material i.

3) A linear function specifying supply prices of the recycled materials:

$$SPR_i = c_i + d_i (S_i Q_i)$$

where

SPR_i = supply price of recycled materials used in packaging material i

c_i = intercept (input data), dollars per tonne

d_i = slope (input data), dollars per tonne

$$S_iQ_i = \text{proportion of packaging material i that could be}$$

produced from the amount of the recycled material
supplied (Q_i) multiplied by the technological
limit on the use of recycled materials.

4) A policy instrument imposed on packaging material i:

  a) A tax per tonne on packaging (t_i)

  b) A tax per unit on rigid packaging (C_i)

  c) A tax per tonne on the virgin materials used to produce packaging materials (Δa_i)

  d) A requirement to use a minimum amount (r_i) of recycled materials.

Strategies may be applied in combination on each packaging material and the values t_i, C_i, Δa_i, r_i may be unique to each material.

In addition, the following base year (1970) data are taken as input data:

1) Q; a 23 x 30 matrix of elements g_{ij}, (i = 1, ...,23; j = 1, ..., 30) where g_{ij} is the initial amount (tonnes) of packaging material i used in consumer product j.

2) V; a 23 x 30 matrix of elements v_{ij} where v_{ij} is the initial value (1967 dollars) of packaging material i used in consumer product j.

3) V/Q; a 23 x 30 matrix of elements (v_{ij}/g_{ij}) indicating the initial cost of packaging material i used in consumer product j.

4) PCE; a 30 x 1 vector of elements (pce_j) where pce_j is the initial expenditure (1967 dollars) on consumer product j.

5) Q/PCE; at 23 x 30 matrix of elements (g_{ij}/pce_j).

6) V/PCE; a 23 x 30 matrix of elements (v_{ij}/pce_j).

7) x_{ij}; a 23 x 30 matrix of elements (x_{ij}) where x_{ij} is the number of containers produced from a tonne of material (x_{ij} = 0 for flexible packaging).

C.5.2 Use and Cost of Packaging Materials

It is assumed that recycled materials will be employed to the technical limit by producers who are willing to pay more for the recycled materials than the supply price they face. In figure C-10, the price willingly paid for recycled materials (DPR_i curve) is greater than the price at which recycled materials may be purchased (SPR_i)
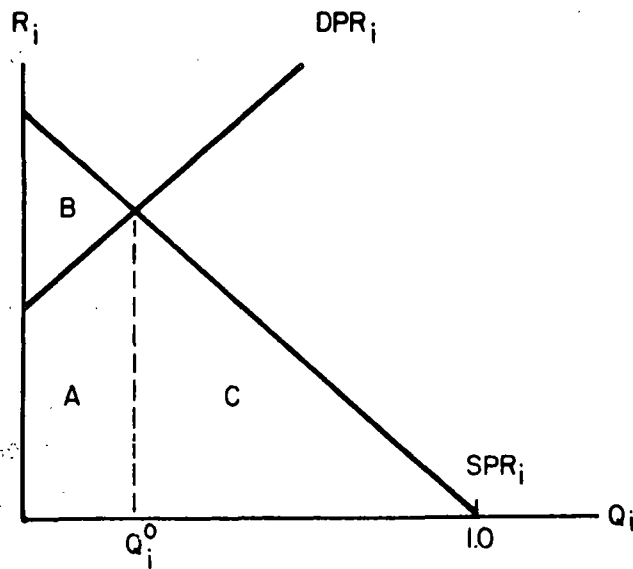
Figure C-10. Hypothetical market for recycled materials.

in the production of Q_i^0 units of packaging material i. The horizontal
axis (Q_i) is expressed in terms of share of production; therefore
the result depicted indicates that recycled materials will be employed
to the technical limit (S_i) in producing Q_i^0 percent of packaging i.

The value Q_i^0 may be determined by solving for the intersection
of the demand for recycled materials (1) and the supply price function (2).
The proportion of packaging material i that will contain recycled
materials is therefore,

$$Q_i^0 = \frac{a_i - c_i}{b_i + d_i (S_i)} \qquad 0 \leq Q_i^0 \leq 1 ; \qquad (15)$$

and the share of recycled materials used is $S_i Q_i^0$, the share of virgin
materials is $(1 - S_i Q_i^0)$.

As indicated previously, the demand curve for recycled materials
is, at the same time, a specification of the purchase prices of virgin
materials. The area under the DPR_i curve (A + B + C) would therefore
measure the average cost of using only virgin materials in producing
packaging material i.

In the example in figure C-10, Q_i^0 of production employs recycled materials to the limit S_i. The supply curve specifies the prices at which the marginal units of recycled materials may be purchased, and the area under the SPR_i curve to the point Q_i^0 represents the cost for recycled materials used in producing Q_i^0 proportion of output (area A). Area A + B (the area under the demand curve to output Q_i^0) represents the cost of the raw materials used in producing Q_i^0. The cost of materials (which are all virgin) used in producing the output $1 - Q_i^0$ is represented by area C. The initial average cost of materials used in production (R_i^0) may be calculated as:

$$R_i^0 = S_i \int_0^{Q_i^0} \left[C_i + d_i(S_i Q_i) \right] dQ_i + (1 - S_i) \int_0^{Q_1^0} (a_i - b_i Q_i) dQ_i \tag{16}$$

$$+ \int_{Q_i^0}^1 (a_i - b_i Q_i) dQ_i$$

Two of the packaging strategies affect the cost and usage of raw materials. A tax on virgin materials (Δa_i) will shift the demand function for recycled materials (and the purchase prices of virgin materials) by a parallel amount equal to Δa_i. The revised share of recycled materials is:

$$Q_i^1 S_i = \frac{a_i + \Delta a_i - C_i}{b_i + d_i (S_i)} \tag{17}$$

and the revised cost of materials is calculated as:

$$R_i^1 = S_i \int_0^{Q_i^1} \left[C_i + d_i(S_i Q_i) \right] dQ_i + (1 - S_i) \int_0^{Q_i^1} (a_i + \Delta a_i - b_i Q_i) dQ_i$$

$$+ \int_{Q_i}^1 \left[a_i + \Delta a_i - b_i Q_i \right] dQ_i \tag{18}$$

A regulation requiring the use of a minimum proportion (r_i) of recycled materials will affect the cost of raw materials used. It is

assumed that the regulation imposes a requirement that is equal to
or less than the technological limit (S_i). Therefore, firms using
recycled materials prior to the imposition of the strategy will not
be affected by the strategy; those using only virgin materials prior
to the regulation will employ recycled materials according to the
requirement. The revised usage of recycled materials will be:

$$Q_i^0 \, S_i + (1 - Q_i^0) \, r_i, \qquad (19)$$

and the revised cost of materials:

$$R_i^2 = S_i \int_0^{Q_i^0} \left[c_i + d_i \, (S_i Q_i) \right] \, dQ_i + (1 - S_i) \int_0^{Q_i^0} (a_i - b_i Q_i) \, dQ_i$$

$$(19)$$

$$r_i \int_{Q_i^0}^1 \left[c_i + d_i (S_i Q_i) \right] \, dQ_i + (1 - r_i) \int_{Q_i^0}^1 (a_i - b_i Q_i) \, dQ_i$$

Usage of virgin materials and cost of raw materials are calculated
for each of 23 packaging materials. For display purposes, the 23 materials
have been aggregated to the 9 summary materials used throughout the study
by weighing the cost calculations by the 1970 consumption of the materials.

C.5.3 Relative Change in Cost of Packaging Materials

The change in price (ΔP_{ij}) of each of the 23 packaging materials
used in packaging product j is the sum effect of the four strategies.

The change in price due to a tax on virgin materials is the change
in raw materials costs calculated above $(R_i^1 - R_i^0)$. The change in price
due to a regulation was also calculated in the previous section $(R_i^2 - R_i^0)$.
A tax on packaging directly will increase the package price by the amount
of the tax (t_i). The change in price per tonne of a packaging material
is calculated by multiplying each element (x_{ij}) of the X matrix by the
amount of the container tax (c_i). The elements x_{ij} indicate the
average number of containers; to package product j produced from a tonne
of material. $c_{ij} = x_{ij} c_i$ is the change in price per tonne due to a
container tax.

The total price change may then be calculated as:

$$\Delta P_{ij} = (R_i^0 - R_i^0) + (R_i^2 - R_i^0) + t_i + C_{ij} \tag{20}$$

and the relative change in cost as:

$$\Delta P_{ij} / (r_{ij}/g_{ij}) \tag{21}$$

These elements in eq. 21 define a 23 x 30 matrix. The 23 packaging materials are aggregated to the summary 9 materials for subsequent analysis by weighting the relative cost change by the 1970 usage of materials within each of the 30 consumer products (table C-8).

C.5.4 Revised Packaging Coefficients

The structure of packaging is summarized by the coefficients that indicate the usage of materials (by weight) per unit of production (measured in constant dollar expenditures). The imposition of a strategy that affects prices of the packaging materials may alter the structure of packaging. Estimates of the responsiveness of materials usage to changes in relative prices were summarized in section C.4.3. These elasticity coefficients (b_{ij}^k) indicate the percentage change in the use of a material (k = 1, ...,9) used in packaging a product (j = 1, ..., 30) given a 1 percent change in own price or the price of another packaging input (i = i,..., 9). The relative change in the structural coefficients (table C-9) are therefore calculated as:

$$\frac{\Delta q_{ij}/pce_j}{q_{ij}/pce_j} = \sum_{c=1}^{9} b_{ij}^k \left[\frac{\Delta P_{ij}}{(r_{ij}/q_{ij})} \right] \tag{22}$$

The revised structural coefficients are determined from the initial input structure and the relative change in structure.

C.5.5 Revised Cost of Production

The change in price of the packaging material due to a policy instrument(s) multiplied by the revised use of the material (weight) per unit of production (measured in constant dollar expenditures) provides estimates of the change in the average cost of production in table C-10. The increase in average cost of production--given the assumptions of a

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Table C-8. Relative change in cost of packaging materials

	1	2	3	4	5	6	7	8	9	10
1	0.0929	0.0744	0.0929	0.0929	0.0929	0.0929	0.0929	0.1028	0.0	0.0
2	0.0157	0.0176	0.0159	0.0182	0.0183	0.0182	0.0167	0.0	0.0	0.0
3	0.0263	0.0263	0.0263	0.0263	0.0263	0.0263	0.0	0.0	0.0	0.0263
4	0.0202	0.0202	0.0202	0.0202	0.0202	0.0202	0.0	0.0	0.0	0.0202
5	0.0428	0.0428	0.0428	0.0428	0.0428	0.0428	0.0428	0.0428	0.0	0.0428
6	0.0	0.0137	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.1194	0.0	0.0	0.0	0.0	0.0	0.1010	0.1010	0.1032
8	0.0009	0.0233	0.0011	0.0	0.0	0.0	0.0	0.0	0.0	0.0390
9	0.0164	0.0	0.0164	0.0	0.0	0.0	0.0	0.0	0.0	0.0282

	11	12	13	14	15	16	17	18	19	20
1	0.1028	0.1028	0.0928	0.0	0.0893	0.1028	0.0792	0.0954	0.0880	0.0880
2	0.0	0.0	0.0142	0.0	0.0169	0.0	0.0134	0.0136	0.0	0.0
3	0.0263	0.0263	0.0	0.0263	0.0	0.0263	0.0	0.0263	0.0	0.0263
4	0.0	0.0202	0.0202	0.0	0.0	0.0202	0.0202	0.0202	0.0202	0.0
5	0.0428	0.0428	0.0428	0.0428	0.0428	0.0	0.0428	0.0428	0.0428	0.0428
6	0.0	0.0137	0.0	0.0	0.0	0.0	0.0	0.0345	0.0137	0.0137
7	0.1097	0.1123	0.0	0.1128	0.0	0.0	0.0	0.1144	0.0	0.1054
8	0.0390	0.0390	0.0	0.0390	0.0	0.0390	0.0	0.0229	0.0	0.0
9	0.0282	0.0264	0.0	0.0282	0.0	0.0303	0.0	0.0161	0.0	0.0

	21	22	23	24	25	26	27	28	29	30
1	0.0	0.0879	0.0880	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0908
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0126
3	0.0263	0.0263	0.0263	0.0263	0.0263	0.0263	0.0263	0.0263	0.0263	0.0263
4	0.0	0.0	0.0202	0.0202	0.0	0.0	0.0	0.0202	0.0202	0.0202
5	0.0	0.0428	0.0	0.0	0.0	0.0	0.0	0.0428	0.0428	0.0428
6	0.0	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0137	0.0364
7	0.1052	0.1056	0.1045	0.1046	0.1036	0.1038	0.1038	0.1038	0.1044	0.1049
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0379
9	0.0	0.0	0.0056	0.0056	0.0056	0.0056	0.0	0.0056	0.0	0.0136

Table C-9. Relative change in the structural coefficients

	1	2	3	4	5	6	7	8	9	10
1	0.0	0.0996	0.0	0.0	0.0562	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.1817	0.4834	0.3427	0.1909	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.1051	0.0	0.0	0.0	0.0908	0.0	0.0502	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0-0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	11	12	13	14	15	16	17	18	19	20
1	0.0	0.0	0.0460	0.0	0.0	0.0	0.0	0.0942	0.0	0.0
2	0.0	0.0	0.0	0.0	0.1365	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0489	0.0	0.0	0.0908	0.0	0.1293
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0568	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	21	22	23	24	25	26	27	28	29	30
1	0.0	0.0	0.0346	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0360
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1101	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.2897	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0179	0.0	0.0	0.0	0.0	0.0

Table C-10. Change in average cost of packaging

	1	2	3	4	5	6	7	8	9	10
1	0.0005	0.0005	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	0.0	0.0
2	0.0003	0.0001	0.0002	0.0000	0.0000	0.0000	0.0002	0.0	0.0	0.0
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	0.0	0.0006
4	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0	0.0	0.0	0.0000
5	0.0009	0.0012	0.0009	0.0008	0.0007	0.0007	0.0008	0.0005	0.0	0.0005
6	0.0	0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0000	0.0	0.0	0.0	0.0	0.0	0.0015	0.0049	0.0060
8	0.0000	0.0000	0.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0029
9	0.0001	0.0	0.0001	0.0	0.0	0.0	0.0	0.0	0.0	0.0006

	11	12	13	14	15	16	17	18	19	20
1	0.0002	0.0003	0.0006	0.0	0.0005	0.0002	0.0002	0.0003	0.0005	0.0004
2	0.0	0.0	0.0005	0.0	0.0001	0.0	0.0001	0.0001	0.0	0.0
3	0.0003	0.0005	0.0	0.0000	0.0	0.0001	0.0	0.0000	0.0	0.0001
4	0.0	0.0000	0.0000	0.0	0.0	0.0001	0.0000	0.0001	0.0000	0.0
5	0.0005	0.0000	0.0009	0.0004	0.0004	0.0	0.0003	0.0008	0.0064	0.0003
6	0.0	0.0000	0.0	0.0	0.0	0.0	0.0	0.0004	0.0007	0.0005
7	0.0226	0.0067	0.0	0.0033	0.0	0.0	0.0	0.0039	0.0	0.0002
8	0.0050	0.0012	0.0	0.0081	0.0	0.0055	0.0	0.0002	0.0	0.0
9	0.0007	0.0000	0.0	0.0002	0.0	0.0000	0.0	0.0000	0.0	0.0

	21	22	23	24	25	26	27	28	29	30
1	0.0	0.0001	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0001
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000
3	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
4	0.0	0.0	0.0000	0.0000	0.0	0.0	0.0	0.0000	0.0000	0.0000
5	0.0	0.0012	0.0	0.0	0.0	0.0	0.0	0.0086	0.0015	0.0001
6	0.0	0.0002	0.0001	0.0001	0.0005	0.0004	0.0004	0.0004	0.0001	0.0000
7	0.0005	0.0002	0.0031	0.0031	0.0033	0.0030	0.0030	0.0030	0.0033	0.0000
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0001
9	0.0	0.0	0.0001	0.0003	0.0000	0.0	0.0000	0.0	0.0	0.0000

linear homogeneous production function and competitive product markets--is equal to the increase in product price. Summing each column in table C-10, therefore, is a measure of the percentage change in the price of the product. Using the price elasticities of consumer demand estimated in section C.4.4, revised personal consumption may be derived.

C.5.6 Base Line Data

Prior to the imposition of a strategy, solid waste generation, resource requirements and expenditures for consumer goods assume the value of 1970 observations. The data collection for packaging materials used (all assumed to be discarded to solid waste) and expenditures for consumer goods was discussed in appendix A. Natural resource consumption energy requirements, and employment requirements were calculated by applying a fixed set of coefficients to the packaging materials usage.

C.5.7 Impact of the Packaging Strategy

The estimate of revised consumption (based on demand elasticities and change in product price) multiplied by the revised structure of packaging provides a measure of the quantitites of each packaging material consumed by consumer product after the imposition of the strategy (table C-11). The set of resource and employment coefficients applied to revised packaging material usage yields estimates of revised natural resource and employment requirements.

The change in the quantity of packaging consumed may be separated into the components: the change due to producers' substitution of one packaging material for another in response to an increase in the prices of materials; and the change due to the decrease in consumer demand for a product in response to higher product prices. Revised use of packaging materials due to input substitution may be expressed as the product of the revised structural coefficients and initial consumption.

$$(g_{ij}/pce_j) \text{ revised} \cdot (pce_j) \text{ initial} \qquad (23)$$

Revised packaging usage due to the change in consumer demand is expressed as the product of the initial structural coefficients and revised consumption.

$$(g_{ij}/pce_j) \text{ initial} \cdot (pce_j) \text{ revised} \qquad (24)$$

The proportionate change in materials usage can be attributed to technological substitution and/or change in product consumption. In the case of fixed technical coefficients, the effect of

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Table C-11.   Revised quantity of packaging
(Thousand tonnes)

	1	2	3	4	5	6	7	8	9	10
1	206.2243	278.8274	124.1956	574.3628	12.5399	78.9047	255.6403	149.5854	0.0	0.0
2	100.3951	40.6151	38.7374	46.0517	0.6771	5.0914	77.6007	0.0	0.0	0.0
3	5.1624	7.5815	3.0845	14.3070	0.3616	1.9930	0.0	0.0	0.0	168.7435
4	7.9700	5.4154	36.9230	0.6339	0.0181	0.0815	0.0	0.0	0.0	2.8064
5	349.2285	711.3970	235.0554	838.0466	17.5866	115.0505	369.2776	149.4042	0.0	137.7831
6	0.0	21.9773	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	14.5353	0.0	0.0	0.0	0.0	0.0	496.1082	284.9297	1714.2678
8	2.7170	26.5352	1.6330	0.0	0.0	0.0	0.0	0.0	0.0	824.5579
9	26.2648	0.0	15.8760	0.0	0.0	0.0	0.0	0.0	0.0	169.5199

	11	12	13	14	15	16	17	18	19	20
1	35.4443	31.5990	75.2121	0.0	46.2275	9.4241	95.7967	92.7093	35.4715	15.4224
2	0.0	0.0	63.6237	0.0	12.1560	0.0	26.1923	45.7085	0.0	0.0
3	39.9537	1.7903	0.0	3.6320	0.0	4.2184	0.0	3.9641	0.0	4.1731
4	0.0	1.7008	6.4120	0.0	0.0	3.5901	7.8849	20.3610	1.8144	0.0
5	68.0025	103.9277	117.2230	109.4912	41.8965	0.0	116.0074	233.7649	480.3621	13.8232
6	0.0	5.1472	0.0	0.0	0.0	0.0	0.0	130.8148	53.1165	23.0882
7	3220.4873	836.1509	0.0	891.6616	0.0	0.0	0.0	1207.6689	0.0	9.8700
8	704.7808	146.2130	0.0	2196.8184	0.0	254.3297	0.0	68.0988	0.0	27.8510
9	94.7423	0.0592	0.0	57.7581	0.0	0.1088	0.0	7.5075	0.0	0.0

	21	22	23	24	25	26	27	28	29	30
1	0.0	15.7595	32.2479	15.0595	21.3011	26.7624	12.8890	10.2260	72.6666	1040.1028
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	360.7019
3	0.6337	3.2419	6.5000	2.9030	4.1344	5.1710	2.5237	1.9932	14.0616	15.1293
4	0.0	0.0	0.5417	0.2722	0.0	0.0	0.0	0.8666	1.2701	15.9667
5	0.0	132.0179	0.0	0.0	0.0	0.0	0.0	177.6833	217.1835	1302.1926
6	0.0	23.5939	4.7847	2.1773	18.1554	22.8614	10.9512	8.6661	10.4328	272.6130
7	3.6221	25.3820	221.7226	98.6200	133.8861	168.0199	83.4666	62.7984	478.4897	105.9299
8	10.2301	32.7793	1.3542	0.6350	0.0	45.7229	11.5370	69.2418	2.8123	1176.3088
9	0.0	0.0	4.3333	9.0720	1.7653	0.0	0.1803	0.0	0.0	11.9525

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Table C-12. Revised consumption

CONSUMER PRODUCT	INITIAL CONSUMPTION (0000000$)	REVISED CONSUMPTION CONST(0000000$)	PERCENT CHANGE IN CONSUMPTION	PERCENT CHANGE IN PRICE	REVISED CONSUMPTION CURRENT(0000000$)	PERCENT CHANGE IN CONSUMPTION	LOSS IN CONSUMER SURPLUS
1	8841.137	8826.375	-0.167	0.174	8841.750	0.007	15.368
2	12681.566	12616.707	-0.511	0.193	12641.180	-0.318	24.414
3	5524.805	5524.805	0.0	0.181	5524.805	0.0	10.021
4	22806.973	22764.434	-0.187	0.142	22796.902	-0.044	32.445
5	525.423	523.502	-0.366	0.131	524.191	-0.235	0.687
6	3396.680	3391.850	-0.142	0.130	3396.281	-0.012	4.428
7	10267.406	10245.258	-0.216	0.151	10260.746	-0.065	15.472
8	7060.941	7051.836	-0.129	0.248	7069.348	0.119	17.503
9	1288.774	1288.774	0.0	0.486	1288.774	0.0	6.268
10	6279.152	6265.848	-0.212	1.060	6332.375	0.848	66.459
11	3148.740	3130.313	-0.585	2.926	3222.447	2.341	91.865
12	2762.724	2726.052	-1.327	0.909	2751.170	-0.418	24.952
13	2840.156	2827.337	-0.451	0.204	2833.137	-0.247	5.787
14	6147.801	6003.137	-2.353	1.194	6076.566	-1.159	72.570
15	2217.631	2215.732	-0.086	0.100	2217.940	0.014	2.207
16	1031.488	1020.493	-1.066	0.586	1026.534	-0.480	6.009
17	9093.953	9085.020	-0.098	0.060	9090.434	-0.039	5.412
18	6789.086	6742.160	-0.691	0.591	6782.266	-0.100	39.972
19	1654.716	1654.716	0.0	0.759	1654.716	0.0	12.557
20	946.208	946.208	0.0	0.154	946.208	0.0	1.460
21	149.912	149.601	-0.207	0.063	149.695	-0.145	0.094
22	2454.321	2436.281	-0.735	0.181	2440.714	-0.554	4.416
23	1603.281	1595.458	-0.488	0.372	1601.430	-0.115	5.957
24	693.458	693.458	0.0	0.406	693.458	0.0	2.818
25	888.053	879.814	-0.928	0.448	883.794	-0.480	3.962
26	1218.750	1218.750	0.0	0.402	1218.750	0.0	4.902
27	625.244	621.200	-0.647	0.390	623.636	-0.257	2.428
28	476.449	455.130	-4.475	1.268	461.169	-3.207	5.904
29	3160.810	3160.810	0.0	0.553	3160.810	0.0	17.470
30	191036.688	191036.688	0.0	0.050	191036.688	0.0	94.620
TOTALS	317611.563	317097.125		0.189	317547.313		598.426

a strategy on solid waste depends solely on the change in product consumption. If demand is perfectly inelastic, then a strategy will affect solid waste only if input substitution is possible.

Revised consumption in constant dollars (table C-12) is determined from the demand elasticities and the percent change in product price. The demand elasticities indicate the percent change in quantity demanded in response to a 1 percent change in price. The revised constant dollar expenditure column therefore represents the change in the amount purchased (measured in initial prices), but does not reflect the higher prices consumers pay. Revised consumption in current dollars incorporates the price change. it may be shown that the price elasticity of expenditures (η_E) is equal to the price elasticity of demand (η_D) plus 1.

$$\eta_E = \eta_D + 1 \tag{25}$$

Revised expenditures in current dollars were calculated using the identity in eq. 25, the estimated demand elasticities, and the calculated price change.

Consumer surplus was discussed in chapter 4, section 4.3.2.1. Loss in consumer surplus is a cost to society of the packaging strategy. The loss in consumer surplus is calculated as:

$$pce_j \left(\frac{dP_j}{P_j} \right) \left(1 + \frac{1}{2} \eta_D - \frac{dP_j}{P_j} \right) \tag{26}$$

where P_j is the price of consumer product j.

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