Chapter 3

Eight Amenity Groups

CONTENTS

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This chapter examines characteristics of eight major household amenity groups and explores options for the next two decades. It does not cover national defense or government activities not directly associated with a household amenity. The discussions form a diverse set but are all designed around the following plan. They begin with a description of the way amenity might be measured—a description of the units that might be used to gauge progress even if measurement is difficult because of the absence of good data. Second, they show how themes raised in the previous chapter apply in each amenity group. The themes include trade-offs between time, consumer spending, and government spending; growth in specialized markets; and changes in regulations that affect consumer purchasing. They end with a brief description of hypothetical patterns of future spending, These descriptions are used later in this volume to explore the potential impact of future consumption patterns on economic structure and on jobs.[1]

[1] A reader interested in tracing the performance of a specific amenity network from consumption recipe to job generation can read appropriate sections from chs. 3,6,9 and 12.

FOOD

There are two criteria against which to measure changes in the price, quality, information, and other factors that influence a nation's diet:

1. do the changes improve the quality, variety, and convenience of the food purchased and
2. has the new diet improved health?

Growth in choice available to most American households does not necessarily translate into a diet more likely to promote health. Indeed, higher incomes may lead to diets that are less healthy if consumption of fats and alcohol increases while consumption of bulk fiber declines.z An unhealthy diet may be purchased as a result of an informed decision to ignore the advice of physicians, ignorance of established links between diet and health (or lack of information about product contents), or the absence of credible information linking diet and health. The relative role of these factors, and therefore the influence of programs designed to facilitate consumer choice, remains ambiguous. These issues are also relevant in the section on spending for health that follows.

Quality and Variety

While people still go hungry in the United States, the quality and variety of the food eaten by most Americans have improved considerably. Many foods have become cheaper, production and packaging technologies have improved, the health implications of different diets are more widely understood, increased trade has brought a wider variety of foods to the U.S. consumer, and more meals are eaten outside the home, partly because more women are in the work force.

[2] L. A, Cohen, "Diet and cancer, " *Scientific American,* vol. 257, No. 5, November 1987, pp. 42-48.

Net Food Purchases

The total quantity of food purchased per person increased by only 5.5 percent between 1965 and 1985 (largely the result of demographic factors), but food quality and diversity appears to have increased substantially. A variety of large and small grocery stores have emerged. The typical new supermarket may sell 15,000 to 20,000 separate products, and large stores may sell many more types.

Red meat consumption per capita peaked in the mid-1970s (red meat prices increased substantially during the late 1970s as lucrative grain exports increased feed prices), but per capita consumption of fish and poultry increased 34 and 69 percent respectively between 1965 and 1985.[3] During the same two decades, per capita purchases of fresh fruits increased 12 percent, with declines in staples such as oranges

[3] K.L. Bunch, "Food Consumption, **Prices and Expenditures"** U.S. **Department of Agriculture, Economic Research Service, Statistical** Bulletin 749, Washington, DC, January 1987,

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and grapefruit offset by large increases in demand for more exotic fruits; per capita consumption of fresh vegetables grew 30 percent while that of frozen vegetables grew 50 percent. Increased variety in American cooking is measured in part by the near doubling in per capita consumption of spices over the period. There was also a 30-percent increase in per capita consumption of sugars and other sweeteners.

A survey by the U.S. Department of Agriculture (USDA) in 1978 showed that the average respondent ate 25 to 28 different types of food over a 3-day period, although the range was from 4 to 63 unique food items.[4] Total consumption varied greatly with age and sex; males older than 23 appear to eat more than the average number of foods, and females aged 15 to 22 consume less than the averages

Eating Away From Home

A system for tracking food expenditures developed by USDA suggests that by 1983, some 40.9 percent of all money spent on food was eaten away from home.G Only about 20 percent of the quantity of food and beverages consumed are eaten away from home; 3,7 out of 21 meals are eaten away from home.7 By the turn of the century, the average American may spend half of every food dollar away from home.

The choice of eating place depends heavily on household type and income (see table 3-l). The addition of a family member over the age of 65 typically increases household spending in cafeterias by 9 percent. The addition of a child of age 12 or younger reduces overall spending in all food service establishments by 7 percent, but increases spending in fast food restaurants by 26 percent and in take-out restaurants by 16 percents Single-person households, whether young or old, spend a large share of their food budget away from home—typically 45 percent.g Families with working wives spend 28 percent more on food away from home than comparable families with housewives, although the increase drops to 7 percent after controlling for income;l" most of the rise goes to specialty restaurants. In contrast, elderly households spend more in cafeterias and less in specialty restaurants.

It is apparent that the food purchased in fast food restaurants has become more diverse. In addition to the traditional hamburgers, french fries, soft drinks, sweets, and pizza, fast food now embraces seafood, chicken, sandwiches, breakfast items, baked potatoes, and salad. The number of cuisines available as fast food has also increased, and now includes Mexican, Chinese, Indian, and other types. However, since fast food outlets have often expanded their markets at the expense of family-run restaurants, often serving regional menus, it is not obvious that real diversity has increased.11

Growth in other segments of the food service sector, particularly in more expensive restaurants, has introduced many Americans to varied cuisines. The "upgrading" of food purchasing patterns—resulting in higher prices per amount of food consumed—has been expressed most recently in the growth of the "up-market hamburger restaurants," which not only offer a more diverse and expensive menu but also sell alcohol. Traditional restaurants still claimed 51 percent of all sales in "separate eating places" in 1982, but fast food was a close second with 44 percent. [12] Of franchised restaurants, 42 percent serve hamburgers, 17.5 percent pizza, 12.4 percent chicken,

[4] J. Krebs-Smith, et al., "Variety in Foods, " *What Is America Eating? (New* York, NY: National Academy Press, 1986).

'Ibid.

[6] U S Department of Agriculture, Economic Research Service, *U.S. Food Expenditures, 1954-78: New Measuresat Point* of Sale and by *Type of* Purchaser, AER-431, Washington, DC. The USDA statistic is considerably higher than that reported by the U.S. Bureau of Labor Statistics. In that survey, eating away from home represented 28 percent of all personal consumption expenditures for food by 1983, an increase from 24 percent 10 years earlier. The USDA series includes expenditures for foods in places where **food sales are not the main enterprise** (such as hotels and motels, airlines, recreation places, military installations, and retail stores) and also includes the value of government food **subsidies** (such as the school lunch program). It is difficult to determine whether differences in definitions can account for the magnitude of the difference.

[7] John M. **Con nor, et al.,** *The Food Manufacturing Industries* (Lexington, MA: D.C. Heath & Co., 1985), pp. 24-25.

[8] U.S Department of Agriculture, Economic Research Service, "Food Consumption, Prices and Expenditures 1963-83," Statistical Bulletin No. 713, Washington, DC, 1984.

[9] A. Arbel, "Higher Energy Cost and the Demand for Restaurant Services—A Time-Series Analysis," *International Journal of Hospitality Management, vol. 2, No. 2, 1983,* pp. 83-87.

[10] J. Kinsey, "Food Away From Home Expenditures by source of Household Income, " paper presented at the annual meeting of Agricultural Economics Association, Clemson, South Carolina, 1981.

[11] John M. Connor, **review comment,** Department of Agricultural Economics, Purdue University, 1987.

[12] U.S Department of commerce, **Bureau of Economic Analysis, "Franchising"** in the Economy, 1982-1 984," report, Washington, DC, 1984.

Table 3-1 .—Dining Out, 1985

Restaurant type	Proportion of occasions
A. Diners' Preferences	
Quick-service (primarily fast-food)	**64.l%**
Hamburger	**24.7**
Pizza	**10.8**
Chicken	**5.3**
Ice cream	**4.4**
Sandwich	**3.5**
Donut	2.1
Mexican	1.9
Fish/seafood	
Oriental	0.6
All other	9.4
Midscale (table service, limited alcohol)	27.1%
Varied menu	9.7
Family style	4.0
Cafeteria	3.1
Family steak	2.2
Oriental	0.9
Fish/seafood	0.6
Italian	0.6
Mexican	0.6
All other	5.4
Upscale (full-service)	8.8%
Varied menu	4.2
Hotel	1.2
Fish/seafood	0.8
Mexican	0.8
Oriental	0.7
Italian	0.4
Steak	0.4
All other	0.3

B. Who Dines Out	Average number of meals per week
All individuals	3.7
Men	4.2
Women	3.4
Household size:	
One member	4.3
Two members	3.1
Three members	3.9
Four members	4.1
Five or more members	3.7
Household income:	
Under $l0,000	2.8
$10,000-14,999	3.2
$15,000-19,999	3.6
$20,000-24,999	3.7
$25,000-34,999	3.8
$35,000-49,999	4.5
$50,000 and over	4.6

C. *Dining Dollars*	Percent of food dollar spent away from home
1955	25.00/6
1967	29.2
1972	33.6
1977	37.4
1982	38.2
1983	39.5
1985 (est)	40.0

SOURCE National Restaurant Association, 1985, cited in 'Leisure Lifestyles," The *Wall Street Journal*, Apr.21, 1988, p. 180.

4.9 percent Mexican food, 4.5 percent seafood, and 2.4 percent pancakes.

Nutritional Consequences

General Trends

Has all this led to a more healthy diet? The question is vexing because of uncertainties about the links between diet and health. Nutritional factors have been linked to a number of chronic diseases, such as cancer, diabetes, heart disease, and osteoporosis. Researchers are generally agreed that over-consumption of foods high in fat, salt, or cholesterol significantly increases the risk of heart disease. Some researchers have estimated that 30 to 60 percent of cancers stem from dietary factors.[13] Cancer appears to need both an agent that creates a mutation in DNA and a ''promoter" agent that leads to tumor growth. Some foods may actually be "antipromoters''and inhibit tumor formation.14 But since it is difficult to link the disease with specific diets or foods, nutritionists remain tentative in recommending preventive steps. The risk of giving misleading information must be weighed against the likelihood that the information can help improve people's health.l5

The risks of contamination in food from pesticides and other sources remain controversial. Standards for processed and fresh foods differ greatly. Many foods have naturally occurring chemicals that are

[13]National Academy Of Sciences, **National Research Council,** *Diet, Nutrition,* **and** *Cancer* **(Washington,** DC: National Academy Press, 1982), pp. 1-14.

[14]L.A. Cohen, op. cit., footnote 2.

[15]The National Research Council's Committee on Diet, Nutrition, and Cancer concludedin 1982 that ''cancers of most major sites are influenced by dietary patterns.'' But the committee further concluded that **"the data are not sufficient to quantify the contribution of diet to the overall cancer risk or to determine the percent reduction in risk that might be achieved by dietary modifications." See Jean-Pierre Habicht, "The Role of Nutrition Research in Policy and Program** Planning," in *What Is America Eating?* **op. cit.** footnote 4, **pp. 144-147.**

highly carcinogenic. Net risk proves difficult to establish.l6

Adherence to emerging dietary guidelines designed to lower the risk of specific diseases may lead to nutrient intakes below the Recommended Daily Allowances (RDAs) established by the National Research Council's Food and Nutrition Board for the nutrient needs of healthy individuals in the United States. Which guideline is then correct? One expert has observed that:

> . . . lowering of recommended total fat and salt intakes for disease prevention is almost always incompatible with American palates and pocketbooks if the diet must also fulfill all the RDAs. If one also wants to consume a diet with fewer potential carcinogens and more protective factors against cancer, attaining the RDAs is jeopardized even more.17

Conversely, adherence to some diets that satisfy the RDAs could increase health risks.18

Increasing variety of foods can also improve diet. Consumption of a greater variety of foods has been associated with a higher degree of compliance with established dietary guidelines; greater variety has been positively correlated to higher intakes of each of 11 nutrients.l[8]

Americans have enjoyed a steady increase in average per capita consumption of virtually all critical minerals and nutrients. In recent years, consumption of products high in saturated fat and cholesterol has declined–animal fats by 20 percent, eggs by 19 percent, and whole milk by 58 percent. Consumption of "other milk beverages," which include low-fat and skim milk, increased a spectacular 300 percent in 20 years.[20] Consumption of cholesterol declined from a peak of 570 mg/capita in the late 1950s to 480 mg/capita in 1985 (there has been no measurable decline since 1975). The American Heart Association diet recommends 300 mg/day of cholesterol—200 mg/day for those with elevated cholesterol levels in their blood.2l A recent study indicates that 81 percent of Americans knew about the health effects of cholesterol in 1986; the same survey found that while only 23 percent claim to have actually changed their eating habits as a result of this information, this percentage is nearly double that of 1983.[22]

High fat diets have been linked with breast cancers, and there is weaker evidence linking high fat/Iow fiber diets to cancers of the colon, pancreas, ovaries, and prostate. The fact that different kinds of fats and fibers appear to have different effects has greatly complicated efforts to construct links. For example, Eskimos in Greenland and people living in Greece and Spain have comparatively low levels of breast cancer even though they have high fat intake—possibly because the fat was derived from fish and olive oil.23 While per capita consumption of animal and vegetable fats rose rapidly between 1900 and the 1960s, between 1965 and 1985 per capita consumption of animal fats declined 20 percent while consumption of vegetable fats and oils increased 60 percent.[24]

As refrigeration replaced salting, pickling, and smoking as a form of food preservation, deaths from gastric cancer fell sharply. The Japanese, who still eat a significant amount of food preserved in traditional ways, suffer far higher rates of stomach cancer.

After increasing 56 percent between 1965 and 1981, alcohol consumption per capita has since fallen steadily, declining 8.6 percent between 1981 and 1985. Beer consumption also began declining in 1981, falling to 34.5 gallons per person per year in 1985, as has consumption of distilled spirits. Wine consumption has increased steadily since 1965 (to 3.8 gallons per person per year in 1985). In 1985, more than 14 percent of the total consumption of

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[16] During 1987, two studies conducted by the U.S. General Accounting Office found that less than 0.1 percent of imported food was checked for illegal pesticides or high levels of legal chemicals like lead. Two studies by the National Academy of Sciences criticized the U.S. Department of Agriculture's poultry inspection and techniques for determining carcinogens in tomatoes, potatoes, oranges, apples, pork, and a variety of other common products. Cited in Keith Schneider, "Congress Looks to the American Table Amid Questions on Food Safety," *The New York* Times, **Jan. 22, 1987, p, A14.**

[17] J. p, Habicht, **op. cit.,** footnote 15.

[18] Johanna T. Dwyer, "Nutrition Education, " *What/s America Eating?* **op. cit., footnote 4; see also** J.P. Habicht, op. cit., footnote 15.

[19] J. Krebs-Smith, et al., **op. cit.,** footnote **4, pp.** 126-140.

[20] K.L. Bunch, op. cit., footnote 3.

[21] D.M. Hegsted and R.J. Nicolosi, **"Individual Variation** in Serum Cholesterol Levels," *Proceedings of the National* Academy *of Sciences , vol.* 84, No. 17, Sept. 2, 1987, p. 6259; L. Roberts, "Measuring Cholesterol Is As Tricky As Lowering It,'' Science, vol. 238, No. 4826, Oct. 23, 1987, pp. 482-83.

[22] Cholesterol Awareness Survey," The National Heart, Lung and Blood Institute of the National Institute of Health, Bethesda, MD, Dec. 4, 1986.

[23] L.A. Cohen, op. **cit., footnote** 2, P. 46.

[24] K. L. Bunch, **op. cit.,** footnote **3, p.** 39.

wine was in the form of "coolers," a mixture of wine and fruit juice.[25]

Averages, of course, can hide a number of ills. Serious defects in diets remain for special populations such as the elderly, the homeless, the poor, migrant laborers, female-headed households, pregnant women, and psychologically debilitated people.

Unfortunately, there is no reliable information on the diets and nutritional status of the population at risk.[26] There are other important gaps in our knowledge because existing surveys are not comprehensive or are out of date. By one estimate, however, there may be as many as 12 million children and 8 million adults who are chronically short of nutrients necessary for growth and good health. The National Household Food Consumption Survey of 1982 found that more than 80 percent of households where spending on food was similar to that of food stamp-recipients failed to obtain the RDAs.[27] An examination of households at risk of poor nutrition indicates that in 1977, 12 percent of Americans were not getting enough food energy and nearly one-quarter failed to get enough vitamin B-6 (see table 3-2). Given a continuation of present trends, the analysis suggests that the dietary status of the population will actually worsen in terms of five out of six components examined. About one-quarter of U.S. households would continue to have availability levels of calcium and vitamin B-6 below 75 percent of the RDA in 1995. The GNP would have to increase much faster than 3 percent annually to make a marked improvement on the dietary availability of some nutrients for the groups receiving inadequate nutrition.

[25] **Ibid., p. 5.**
[26] J.P. Habicht, op. cit., footnote 15.
[27] J.L. Brown, "Hunger in the U.S.," *Scientific American, vol.* 256, *No. 2,* **February 1987, pp.** 37-41.

Table 3-2.—Percentage of Households With Selected Dietary Availability Levels Below 75 Percent of the Recommended Daily Allowance (1977/78 and 1995, assuming 3 percent annual growth in GNP)

Year	Food energy	Calcium	Iron	Magnesium	Vitamin A	Vitamin B-6
1977	11.9	24.4	8.0	13.6	16.7	23.4
1995	12.6	25.2	8.4	14.0	15.8	24.0

SOURCE: "Future Food Patterns of the U.S. Population," cooperative agreement between the University of Missouri at Columbia and the Office of Technology Assessment, No. 433-7130.0, October 1985.

Claims that Americans are going hungry have been disputed using statistics showing no increase in childhood anemia. Given the poverty of data it is difficult to resolve the issue with precision. For example, not much is known about the relationship between the supply of food and its utilization by specific individuals and various types of households. The per capita food consumption series maintained by USDA provides only crude consumption estimates for the "average" American. Only one national survey, the 1977 to 1978 National Food Consumption Survey (NFCS), is currently available for assessing major variations in food consumption among individuals and households within the U.S. population. Limited annual surveys initiated by USDA in 1985 (Continuing Survey of Food Intakes by Individuals) will improve this database.

Even assuming that data on nutritional status were much improved, scientific understanding of the health consequences of diet remains tentative in many respects. Probably the most salient example concerns the RDAs. Simply put, the specific health risks associated with nutrient intakes below the RDAs remain largely unknown.[28]

Eating Away From Home

The increase in eating out is complicating dietary assessments. According to one estimate, the 16 percent of all eating and drinking occasions that occur away from home supply 18 percent of total food energy and about 16 percent of most vitamins and minerals. Men and children consume more of their food away from home than do women, and so obtain more of their food energy and nutrients from those occasions.[29]

One recent study of snacking and away-from-home eating indicated that "where and when foods were consumed had very limited impact on their nutritional status." The researchers noted, however, that future investigations might profitably focus on those

[28] Betty **B. Peterkin, "Assessment of Diet Quality and the U.S. Department of Agriculture's Nutrition Policy and Research,"** *What/s America Eating?* **op.** cit., footnote 4.
29 Robert B. Reese and **Sharon J. Mickle, "Where to Eat—At Home or Away?" 1982** *Yearbook of Agriculture* **(Washington DC: U.S. Government Printing Office, 1983).**
[30] Karen **J.** Morgan and Basile **Goungetas, "Snacking and Eating Away from** Home," *What Is America Eating?* op. **cit., footnote 4, p. 123.**

who are nutritionally at risk. Furthermore, the away from home share of food expenditures has increased since 1977 and will probably continue to do so over the next decade. The nutritional consequences of this important trend warrant more attention.

Choices and Consequences

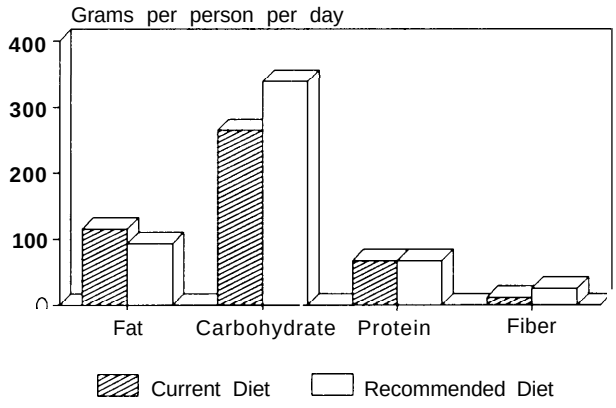
The Trend scenarios for expenditure on the Food amenity (as defined in ch. 2) are based on present patterns of household expenditure, and no significant changes in regulatory programs affecting food prices. The Alternative scenarios differ in that they assume that all Americans have access to a healthy diet and that all income groups pay more attention to the health consequences of their diet. Figure 3-1 indicates the changes that would occur in American eating habits if the recommendations of the National Research Council and other recent studies of diet and health were followed.

While they do not correspond precisely to the recommendations shown in figure 3-1, USDA has developed estimates of "nutritious" diets that could be purchased by households with different incomes. These diets contain recommended intake of calories and nutrients and would reduce fat, cholesterol, sweeteners, and sodium below current levels. They contain more grain products, vegetables, and fruits, and less cheese, eggs, fats, oils, sugar, and soft drinks, than are now eaten in most U.S. households. These diets were used to explore the implications of a shift to a different pattern of food consumption in America. The "liberal" USDA diet was used as an estimate of the way Americans might eat if the U.S. gross national product (GNP) grew 3 percent per year and the "moderate cost" diet was used for the 1.5 percent case. These plans are based on the eating habits of the upper half of all households ranked by expenditure on food.

Food expenditures at home and away from home for the different scenarios are given in table 3-3. The total value of purchases of the Food amenity (including alcohol) is actually lower in the Alternatives than in the Trend cases, even though they explicitly provide healthy, balanced diets for all Americans and assume a continued increase in purchases of food away from home.

The Alternative cases assume that expenditures on cigarettes and alcohol fall below the Trend cases. These estimates are based on a continuation of past trends in per capita consumption expenditures—roughly, a 1.6 percent annual increase in alcohol consumption between 1960 and 1983, and a —0.9 percent decrease in tobacco between 1973 and 1983.

Figure 3-1.-Current and Recommended Diet



SOURCE: L.A. Cohen, "Diet and Cancer," *Scientific American,* November 1987, p. 48; and National Cancer Institute, Division of Cancer Prevention and Control, "Annual Cancer Statistics Review, " January 1988.

HEALTH

Society's *Recipe for Health*

The debate over the proper recipe for good health must be one of mankind's oldest. Although health and life expectancy depend partially on hereditary factors, many aspects of health can be influenced or controlled by individual or social actions. These include the following:

- Time and energy spent in promoting one's own health or avoiding illness, including the time needed to remain informed about appropriate health strategies and any loss of amenity associated with changes in lifestyle required to promote good health (e.g., avoiding fast driving, smoking, drinking, and inappropriate diets).
- Disease prevention through vaccination and

Table 3-3.—Consumption Scenarios for Food (billions of 1983 dollars)

	1983	2005 Trend 3%a	2005 Trend 1.5%a	2005 ALT 3%bc	2005 ALT 1.5%c
Food and alcohol					
At home	298.4	433.0	402.0	387.0	321.0
Away from home	123.6	235.0	146.8	259.0	164.0
Tobacco	28.0	31.2	35.5	22.0	25.0
Total Food in personal consumption expenditures	450.O	699.2	584.3	668.0	510.0
Government purchases of food	1.7	3.3	2.4	3.3	2.4
Total	451.7	702.5	586.7	671.3	512.4
Percent share of gross national product	13.2	10.7	12.4	10.3	10.9

[a]Computed from extrapolative analysis discussed in ch. 2; Trend = Trend Scenario.

[b]Expenditure in ALT 3% food at home (excluding tobacco) in the ALT case is similar to estimates made by J. Blaylock and D. Smallwood ("Projected Growth in American Food Spending," National Food Review #32, U.S. Dept. of Agriculture (USDA)); ALT = Alternative Scenario.

[c]The 118.6 million households in 2005 are divided into 3 categories, single households (28.2 million), family of 2 (33.8 million), and the rest, assumed family of 4 (56.7 million). The number of households in each group is multiplied by the U.S. Department of Agriculture estimate of the weekly cost of a nutritious food plan, using the moderate cost plan for the 1.5% scenario and the liberal plan for the 3% scenario. (See U.S. Department of Agriculture, Consumer Nutrition Division, *Family Food Plans 1983*, March 1983.) The costs are as given below:

	Dollars per week	
	Liberal	Moderate
Single member family	34.6	28.1
2 member family	60.8	50.3
4 member family	90.7	80.3

The resulting totals are then calculated on an annual basis. The annual totals, which are based on the assumption that all meals are taken at home, are then adjusted to take into account meals outside the home.

It is assumed that in the moderate cost plan, one meal in five is taken out of the home. One-fifth of the estimated Food expenditure is therefore deducted from the total and doubled in value (approximately 20% of all Food and 40°/0 of all spending for food was away from home in 1983-see text). In the liberal food plan it is assumed **that one meal in four is taken away from home.**

Alcohol is estimated independently, and then divided *between* **food at home and food away from home categories at the 1983 levels (60 and 40°A respectively). For 30/. case, (real) per capita expenditure on alcohol is increased by annual average of 1.60/0** (as **during 1960-83 period, multiplied by 2005 population). For 1.5%.** case, **consumption is assumed to be one-half of 30/. ALT.**

Per capita tobacco consumption in the 3°/0 growth case is assumed to decline 22°/0, roughly following 1973-83 trends projected to 2005. Consumption in the ALT 1.5% case is reduced by the ratio between low growth and high growth tobacco consumption computed for the trend cases.

SOURCE Office of Technology Assessment, 1988.

early detection of disease, by routine testing for such things as high blood pressure and cancer.

- Public investments in such things as air and water pollution abatement (public spending for pollution control and other health and safety objectives increased from approximately $7 billion in 1972 to a peak of $9.7 billion in 1978, then fell to $8 billion in 1983).[31]
- Investments in occupational health and safety.
- Aspects of home- or work-life that contribute to stress.
- Purchases of treatment to remedy problems once they have occurred.

In principle, it should be possible to compare the relative benefits of investments in each of these categories.[32] Given current state of knowledge about the determinants of health, this proves impossible in practice. The situation is made all the more confusing by the rules governing health spending. Only the patient has a clear incentive to optimize spending to maximize real health, yet the patient may not be well informed of alternatives, and may not be in control of the choices made in her name.

The economics of health involve a complex combination of public funding, public regulation, and private decisionmaking. Health markets differ from ordinary markets in several important ways:

1. The flow of information between provider and client in the market for health services is unlike that in other markets, depending more heavily on trust among the clients and professional integrity among the providers. Furthermore, the parties are frequently on an unequal footing.[33] There are even cases where it may

[31]Andrew Martin, **"public Health and Safety, " contract** report **prepared** for the Office of **Technology Assessment, 1985.**

[32]A *formal theory* **of the "production function"** *of health* **is suggested** in several sources, See, for example, Michael Grossman, *The Demand /or Health (New* York, NY National Bureau of Economic Research, 1972); H.L. Blum, *Planning for Health (New* York, NY: Human Sciences Press, 1974); and Jack Hadley, *More Medical Care, Better Health?* (Washington, DC: Urban Institute Press, 1982).

[33]Frances H, Miller, "Secondary Income From Recommended Treatment: Should Fiduciary Principles Constrain Physician Behavior, " in Bradford H. Gray (cd.), *The New Health Care for Profit* (Washington, DC: National Academy Press, 1983),

be ethically (and legally) possible to withhold information from the individual being treated.
2. Many kinds of competitive behavior that would be celebrated in ordinary commercial competition cannot be permitted in the practice of medicine. While it is difficult to raise complaints about an enterprise that manages to sell individuals more shoes than they need (indeed, much of the U.S. economy depends on consumption that goes beyond need), there is general consensus that it is unethical to encourage a patient to purchase more medical treatment than is needed. The medical community now accepts the patenting of drugs, devices, and techniques,[34] but controversy continues over whether it is appropriate for physicians to sell drugs and other products directly to patients.
3. Perhaps most importantly, health care involves a complex mixture of personal, corporate, and government decisions. In 1950, two-thirds of medical spending came directly from patients. By 1983, 73 percent of all medical spending came from insurance companies or government programs such as Medicare and Medicaid.[35]

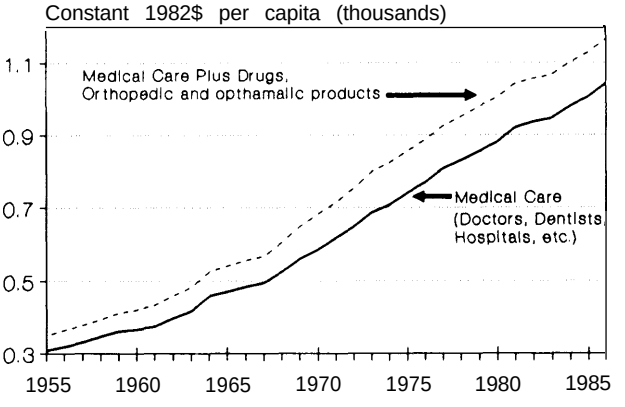
The Record

American spending on health has grown rapidly since the 1970s, because of the availability of new and increasingly expensive technology, public programs providing the elderly and the poor with greater access to health care, the difficulty of increasing productivity in a business dominated by personnel costs, and a variety of other factors. Health care costs have risen at an average rate of 1.75 percent faster than all personal expenditure costs since the 1950s, and in spite of efforts to contain costs, health care costs increased more than 2.5 percent a year between 1980 and 1986.[36] These statistics must be treated with considerable caution since our ability to measure inflation in health care in a period of rapid change is plainly limited. For example, an appendectomy conducted in 1986 may appear identical to one performed in 1972, but advances in medical practice are likely to make the 1986 procedure safer.

While the relative role of the different factors contributing to health costs proves difficult to disentangle (a modest effort is made inch. 6), the result has been a spectacular growth in per capita health care spending. Figure 3-2 shows changes in per capita spending for health care. Real per capita spending (that is spending adjusted for inflation) increased an average of 5 percent per year between 1972 and 1986. The growth in spending is much higher than would be expected by the aging of the U.S. population.

Explaining the links between spending and expected outcomes in U.S. health care is a treacherous undertaking. It proves virtually impossible to use available statistics to disentangle decisions made in response to competent medical advice (e.g., decisions to smoke, drive without seat belts, and engage in lifestyles likely to decrease health status), decisions made in ignorance of the proper way to use the medical enterprise, and decisions made in ignorance about the health implications of behavior. The problem is made all the more difficult by the extent to which a unique set of regulations strongly affects the way consumer desires for good health translate into market incentives in the business community. Cir-

Figure 3-2.-Per Capita Spending for Medical Care



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," historical diskettes, table 2.5.

[34] Robert M. Veatch, "Ethical Dilemma of For-Profit Enterprise in Health Care," B.H. Gray, op. cit., footnote 33.

[35] U.S. Department of Health and Human Services, *Health, United States: 1985* (Washington, DC: U.S. Government Printing Office, December 1985).

[36] More precisely, the ratio of the deflator for "medical care" to the deflator for all "personal consumption expenditures" increased by 1.75 percent per year from 1955 to 1986, based on a regression of data provialed in U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," historical diskettes, *Survey of* Current Business, table ?.10.

cumstantial evidence suggests, however, that the performance of the U.S. health care system could be dramatically improved without any changes in medical technology.

Recent Trends

While it is difficult to determine which factor deserves credit, the health status of the average American has clearly improved during the past few decades. An individual born in the United States in 1984 could expect to live 74.7 years—6.5 years longer than an individual born in 1950. Someone aged 65 in 1950 could expect to live an additional 13.9 years, while a person reaching 65 in 1984 could expect to live an additional 16.8 years.[37] Infant mortality rates fell from 29.2 per thousand in 1950[38] to 11.2 per thousand in 1983 (rates of improvement have fallen somewhat since 1981).

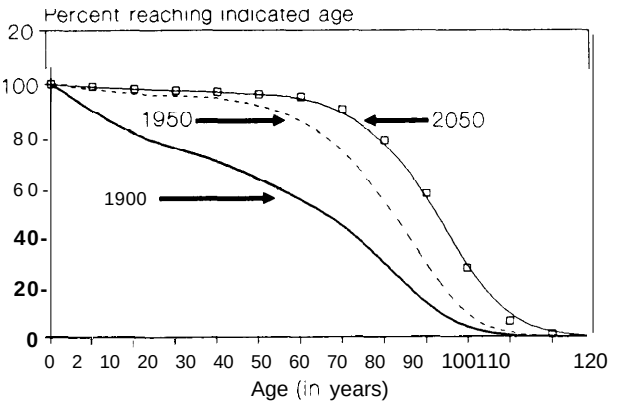
Average improvements in life expectancy have not eliminated the striking difference between life expectancies of different American social groups. Age adjusted death rates for black males, for example, were nearly 50 percent higher than those of white males in 1983.[39]

As figure 3-3 indicates, improved rates of infant mortality may be the most important factor behind increases in average life expectancies; the figure suggests that a decline in deaths at an early age has played a comparatively larger role in lengthening average U.S. life spans than has the fact that older people are living longer.

The factors leading to the improvements in health status are extremely difficult to disentangle. It does appear that as a result both of improved clinical techniques and increased funding of health care for the poor, death from diseases where medical treatment can save lives declined sharply between 1968 and 1980. Deaths from childbirth declined 72 percent, from influenza and pneumonia 53 percent, from tuberculosis 52 percent, and from diabetes 31 percent.[40] Death rates from heart disease and stroke have been declining since 1940. Between 1970 and 1983, age-adjusted death rates from heart disease fell 26% while death rates from stroke were cut in half. There is some evidence that this fall is associated with a decline in cigarette smoking, high serum cholesterol, elevated blood pressure, and lack of exercise. Improvements in medical care have also played an important role.[41] It proves to be nearly impossible, however, to allocate credit for reduced heart disease directly .42

In contrast, death rates from the other major killer, cancer, have risen slightly, growing from 157 deaths per 100,000 in 1950 to 171 per 100,000 in 1985. This is largely because of increasing incidence of lung cancer resulting from smoking. Death rates from stom-

Figure 3-3.-Changes in Patterns of Mortality



How to Read This Figure: Given the mortality rates of 1900, 54°/0 of all people would reach age 60. Using mortality rates of 1950, 75°/0 of all people reach age 60.

SOURCE: U.S. Department of Health and Human Services, Social Security Administration, "Life Tables for the United States, 1900-2050, " Actuarial Study No. 89, Baltimore, MD, December 1983.

[37] U.S. Department of Health and Human Services, *Health, United States, 1984* (Washington, DC: U.S. Government Printing Office, December 1984).

[38] U.S Department of Health, Education, and Welfare, Public Health Service, *Health Status of Minorities and Low-income Groups* (Washington, DC: U.S. Government Printing Office, 1979).

[39] U.S. Center for Health Statistics, *Vital Statistics of the United States*, cited in U.S. Bureau of the Census, *Statistical Abstract of the United States: 1987* (107th cd.), Washington, DC, 1986.

[40] U.S. Center for Health Statistics, unpublished data for 1982, cited in D.E. Rogers, R.J. Blendon, and T.W. Moloney, "Who Needs Medicaid?" *New England Journal of Medicine,* vol. 307, No. 1, July 1, 1982, pp. 13-18.

[41] U.S. Department of Health, Education, and Welfare, Public Health Service, "Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention," DHEW (PHS) Publication No. 79-55071, 1979; U.S. Department of Health, Education, and Welfare, Public Health Service, Proceedings of the Conference on the Decline in Coronary Heart Disease Mortality, National Heart, Lung, and Blood institute, National Institutes of Health, NIH Publication No. 79-1610, 1979.

[42] S. Pelland W.E. Fayerweather, "Trends in the Incidence of Myocardial Infarction and in Associated Mortality and Morbidity in a Large Employed Population, 1957-1983," New England Journal of Medicine, vol. 312, No. 16, Apr. 18, 1985, pp. 1005-1011.

ach, uterine, and some other cancers have declined slightly during the past 20 years. Deaths from all cancers except lung cancer fell from 144 per 100,000 in 1950 to 125 per 100,000 in 1985.[43]

Risk factors in the development of other cancers include: alcohol, smoking, certain viral infections, and exposure to cancer-causing substances in the workplace, in the general environment, or in food and drugs. Research is underway to determine whether high fat/low fiber diets also contribute. Heredity may also play a role. While remarkable advances in treatment for certain types of cancer have occurred, it is not clear that the increase in survival for the more common cancers is due to improved medical care.[44]

As life expectancy rates increase, other health indicators appear to be changing as well. Since 1973, the percentage of the population reporting some limitation of activity has remained essentially the same, while the average number of restricted-activity days per person per year increased from 14.6 days in 1970 to a peak of 19.1 in 1980 and 1981 and fell to 14.5 days in 1983. Blacks have more restricted-activity than whites (16.6 v. 14.3 in 1983). Bed-disability days remained roughly constant for people under 65 (5.3 days/year in 1970 v. 5.4 days/year in 1983) but rose steadily for those over 65 (13.8 days/year v. 16.7 days/year in 1983).[45]

The changes (particularly the reversal of reported disability since 1981) are difficult to interpret. The number of days each American is likely to spend in poor health is in part symptomatic of improved medical technology, such as the development of diagnostic techniques resulting in earlier awareness of disease. Changing public attitudes toward disability, improved social supports for the disabled, and changes in employer-granted sick leave may also increase the reporting of disability. The changing figures may also be a result of medical progress, which is able to save lives but not necessarily prevent lengthy periods of illness.[4G]

Factors Influencing American Health

The United States spends as much or more for health care per person than any nation in the world, yet U.S. life expectancy rates are lower and infant mortality rates higher than they are in many other advanced economies. Moreover, different States within the United States exhibit a range of life expectancies that have little obvious relation to spending on health care. Average male life expectancy in Hawaii, for example, was higher than that recorded by any nation in the world in 1981, while life expectancy in Louisiana was lower than that in Cuba, Singapore, and Bulgaria.[47]

The life expectancy of Seventh Day Adventists living in California is more than 11 years longer than the U.S. average. U.S. life expectancy could increase by 0.7 years if rates of mortality in 1984 were equal to that of the white population in the United States, and 5.1 years longer if average U.S. mortality rates were raised to that of the healthiest geographic regions in the United States. This exceeds the 4.4 year gain in life expectancy achievable by eliminating cancer.[48] Achieving these gains would require *both* changes in access to high quality medical care and changes in the social conditions and lifestyles that may create higher incidence of disease in the least healthy population groups.

While there are many unanswered questions, differences in health status are obviously linked to the following factors:

- hereditary factors;
- diet, driving habits, stress, and other aspects of lifestyle;
- preventive medicine;
- access to health care for treatment of illness and appropriate use of health care; and
- the quality of the care delivered, including technical advances.

[43] U.S. Department of Health and Human Services, National Cancer Institute, "Annual Cancer Statistics Review," summary, Washington, DC, January 1988.

[44] P.M. Boffey, "Cancer progress Are the Statistics Telling the Truth?" *The New York Times,* Sept. 18, 1984; A.R. Feinstein, D.M. Sosin, and C.K. Wells, "The Will Rogers Phenomenon: Stage Migration and New Diagnostic Techniques as a Source of Misleading Statistics for Survival in Cancer," New *England Journal of Medicine, vol. 312, No. 25,* June 20, 1985, pp. 1604-1608.

[45] U.S. Center for Health Statistics, *Vital and Health Statistics*, Series 10, cited in *Statistical Abstract ofthe United States: 1987,* op. cit., footnote *39,* Table 160.

[46] L.M. Verbrugge, "Longer Life but Worsening Health?: Trends in Health and Mortality of Middle-aged and Older Persons," Milbank Memorial Fund Quarterly, *Health and Society, vol. 62, 1984,* pp. *475-519.*

[47] The Japanese, one of the world's longest-lived peoples, take far less interest in smoking cessation than does the United States.

[48] See U.S. Congress, Office of Technology Assessment, "Health, " sector study, Washington, DC, 1987.

Social class, measured by levels of education, income, or occupation, affect many of these variables and correlate strongly with mortality and morbidity rates.[49] Even psychological illnesses, like depression and schizophrenia, are strongly linked to social class.[50] It is, of course, often difficult to distinguish cause from effect when examining correlations, since poor health is often a direct cause of low income.

Education seems to be strongly correlated with good health if only because education is correlated with income.[51] Education appears to be connected with knowledge about health effects of lifestyles and the way health care facilities can be used. Figure 3-4, for example, shows the strong connections between use of seat belts and education. Similarly, the mortality rates of well educated white males aged 25-63 are significantly lower than those in the same group with comparatively poor educations.[52] Women with low levels of education have a much higher number of babies with low birthweights.[53]

WE, M. Kitegawa and P.M. Hauser, *Differential Mortality in the United States* **(Cambridge,** MA: **Harvard University** Press, 1973).

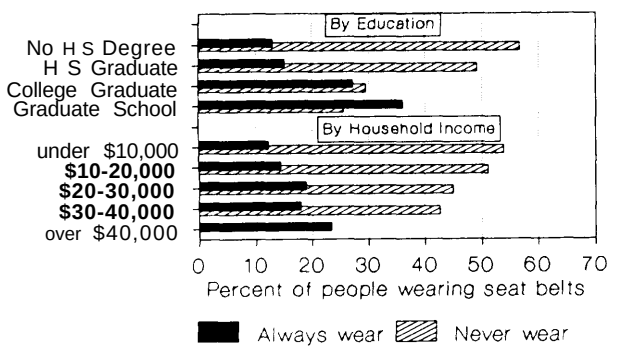
[50]S.L. S_{yme} and L.F. Berkman, "Social Class, Susceptibility and Sickness" *American Journal of* Epidemiology, vol. 104, No. 1, July 1976, pp. 1-8.

[51]Based on data by region in the 1970 U.S. Census, cited in J. Hadley, op. cit., footnote 32, pp. 59-61.

[52]E.M. Kitegawa and **P.M. Hauser, op. cit.,** footnote **49.**

[53]Institute of **Medicine,** *Preventing Low Birth weight* **(Washington** DC: **National Academy Press, 1985). See** also U.S. Congress, Office of Technology Assessment, Neonatal *Intensive Care for Low Birthweight Infants: Costs and Effectiveness,* Health Technology Case Study 38 (Washington, DC: Government Printing Office, December 1987).

Figure 3-4.-Seat Belt Use in 1983



SOURCE: U.S. Department of Transportation, Federal Highway Administration, "Personal Travel in the U.S.—A Report on the Findings From the 1983-1984 Nationwide Personal Transportation Study," Volume I, Washington, DC, August 1986, tables 10-2 and 10-3.

Strong social ties, measured by numbers of social contacts, church membership, and membership in social organizations, appear to be correlated with low mortality rates.[54] Evidence of the strong correlations between behavior and health is also evidenced by the fact that marriage is strongly correlated with longer life expectancy. Men appear to benefit more from marriage than women.[55]

Hereditary Factors.—Hereditary factors may explain some of the differences in health status of nations and States that appear to have access to identical medical technology. Japanese living in America assume most American patterns of disease, and black Americans have patterns of disease that more closely resemble those of Caucasians than those of West Africa.[56] In fact, Japanese living in California considered "acculturated" to American lifestyles had coronary heart diseased 2.5 to 5 times higher than a group that lived in California but had not adopted Western lifestyles.[57]

Environmental and Lifestyle Factors.-The potential benefits of some measures to prevent disease and promote good health are well established. Smoking, failure to wear seat belts, alcohol abuse, improper diet, dangerous working conditions, stress

[54]The correlation appears even when corrections are made for factors like smoking, obesity, health practices, and health status. A study of Alameda County, California showed strong correlations between social networks and health outcomes. See S.L. Syme and L.F. Berkman, "Social Networks, Host Resistance, and Mortality: A Nine-year Follow-up Study of Alameda County Residents," *American Journal of Epidemiology*, vol. 109, No. 2, February 1979, pp. 186-204. Other studies have found similar, but much weaker correlations; see Syme and Berkman, 1976, op. cit., footnote 50, for a review.

[55]Widowed and divorced individuals have a higher mortality rate than single (never married) or married individuals. See V. R. Fuchs, *Who Shall Live* (New York, NY: Basic Books, 1974), pp. 50-51; G.H. Orcutt et al., "Does Your Probability of Death Depend on Your Environment?" *American Economic Review*, vol. 67, No. 1, February 1977, p. 264; M.C. Sheps, "Marriage and Mortality," *American Journal of Public Health*, vol. 51, No. 4, April 1961, p. 547.

[56]Black Americans have cancer rates more similar to those of white Americans than those of the West African populations from which they originated. Japanese living in Hawaii have cancer rates with patterns more closely resembling those of Caucasians in Hawaii than Japanese in their homeland. In 1970-71, for example, breast cancer occurred at a rate of 300/million people in Japan, about 1,200/million for Japanese in Hawaii, and 1,800/million for Caucasians in Hawaii. On the other hand, stomach cancer incidence was 1,300/million in Japan, 400/million for Japanese in Hawaii, and 200/million for Caucasians in Hawaii. See R. Doll and R. Peto, *The Causes of Cancer* (New York, NY: Oxford University Press, 1981), p. 1201.

[57]M.G. Marmot and S.L. Syme, "Acculturation and Coronary Heart Disease in Japanese-Americans," *American Journal of Epidemiology*, vol. 104, No. 3, September 1976, pp. 225-247.

resulting from unemployment or other causes, exposure to air or water pollution, and a variety of other factors contribute to poor health status. There is reason to believe that most of the improvements in life expectancy achieved between 1900 and 1970 resulted from improved income and living conditions rather than improvements in clinical medicine.[58]

It is estimated, for example, that 25 to 40 percent of cancer deaths result from smoking and 10 to 70 percent from diet.[sg] A significant part of the credit for the reduction in mortality due to cardiovascular disease during the 1970s resulted from changes in diet, exercise habits, and other factors independent of clinical medicine. Control of hypertension through therapeutic pharmaceuticals obviously played a major role in addition to advances in heart surgery and other spectacular therapeutic improvements that occurred during the same period.[60]

Infant mortality and birth defects are strongly linked to prenatal care for the mothers. Two-thirds of all infant deaths occur when the baby is born weighing less than 5.5 pounds.[G1] Poor nutrition, smoking, exposure to toxic substances, alcoholism, and a variety of other conditions contribute to low birthweights and a variety of medical conditions before and after birth.[G2]

Accidents, which account for 6.5 percent of all deaths and are the leading cause of death for those below the age of 44, provide a further illustration of lifestyle effects. Over half of all accidental deaths are due to motor vehicle accidents, and alcohol abuse is the predominant risk factor in these accidents.[63] Other factors influencing the accidental death rate include road conditions, vehicle safety design, and the use of safety devices such as seat belts, air bags, and child safety seats.[64]

Improvements in the speed with which casualties can be treated, the emergence of hospital-based casualty centers, and better rehabilitation programs are also important in reducing mortality and injury rates resulting from accidents.[65] Nearly 60 percent of accidental deaths can be prevented by adequate and timely medical care. The remaining 40 percent, however, occur immediately after the accident. The only way to reduce the mortality rate in these situations is by preventing the accident.[66]

U.S. medicine tends to leave the often complex problem of prevention in the hands of individuals, providing only the techniques for fixing problems once they occur. Hurried physicians, for example, may be more likely to prescribe drugs to control high levels of blood cholesterol than to undertake the time-consuming and difficult task of counseling changes in a patient's diet.[67]

In principle, some of the new mechanisms for financing clinical medicine, such as the self-insuring health maintenance organizations (HMOS), can go part of the way toward reconciling the two kinds of health investment. To date, however, the HMOS do not appear to have taken steps to encourage prevention that are consistently different from those taken by other medical practices.

The United States has made enormous investments to improve or at least slow the deterioration of air and water quality. Unfortunately, little is known about total exposure to potentially hazardous substances or substances that may have beneficial effects. It proves extremely difficult to link environmental hazard to specific health effects even when good data are available, because so many variables are involved. Numerous investigations have resulted in few clear correlations between typical exposure to pollutants and health effects.[G8] Some studies sug-

[58] J. B. McKeowin and S.M. McKinlay, "The Questionable Contribution of Medical Measure to the Decline of Mortality in the United States in the Twentieth Century," *Health* and Society, summer 1977, pp. 405-428; T. McKeown, *The Role of* Medicine: Dream, Mirage or Nemesis (London: Nuffield Provincial Hospital Trust, 1976)

[59] Doll and peto, **op. cit.,** footnote 56, P. 1256.

[60] R.F Gillum, et al., "Sudden Death and Acute Myocardial Infraction in a Metropolitan Area, 1970-1980," New *England Journal of Medicine, vol. 309, No. 22, Dec. 1, 1983* pp. 1353-1358; U.S. Department of Health and Human Services, Public Health Service, "Smoking and Cardiovascular Disease," *Morbidity and Mortality Weekly Report, No. 32, 1984,* pp. 677-679; S. Pelt and W.E. Fayerweather, op. cit., footnote 42.

[61] S. Shapiro, M.C. McCormick, M.C. Starfield, et al., **"Relevance** of Correlates of Infant Deaths for Significant Morbidity at 1 Year of Age," *American Journal of Obstetrics and Gynecology, vol. 136, No. 3,* Feb. 1, 1980, pp. 363-373.

[62] Institute of **Medicine, op. cit., foOtnOte** 53.

[63] H.J. Malin, et a]., **"Alcohol-Related Highway Fatalities Among** Young **Drivers–United States,"** *Morbidity and Mortality Weekly Report, No. 31, 1982,* pp. *641-644.*

[64] S.P. Baker, B. O'Neil, and R.S. Karpf, *The Injury Fact Book* (Lexington, MA: Lexington Books, 1984).

[65] National Research **Council** and the Institute of Medicine, *Injury in America* (Washington, DC: National Academy Press, 1985).

[66] D.D. Trunkey, "Trauma," *scientific American,* vol. 249, No. 2, August 1983, pp. 28-35.

[67] L.A. Cohen, op. cit., foOtnote 2.

[68] For a review of these studies, see A.M. **Freeman III,** *Air and Water Pollution Control (New* York, NY: J. Wiley & Sons, 1982).

gest that a 1 percent reduction in pollution from "stationary source air pollution" (pollution from sources other than cars and trucks) results in a 0.1 percent reduction in mortality rates and 0.1 to 0.4 percent reduction in illness. While 1 to 3 percent of the Nation's groundwater may be polluted by hazardous waste dumps, pesticide and fertilizer runoff, and other materials,[69] little is known about long-term health effects. Improvements in drinking water at the turn of the century played a decisive role in improving health, and outbreaks of disease are only occasionally traced to poor water supplies today. It is possible, however, that low-level exposure to heavy metals and other contaminants in water has long-term health effects not easily measured.[70]

While data on outdoor pollution are reasonably complete, data are extremely poor on exposures received indoors where people spend 90 percent of their time. Indoor concentrations of radon, formaldehyde, tobacco smoke, asbestos, carbon monoxide, and nitrogen dioxide are almost always greater than outdoor concentrations.[71] Pollution from office machines, household chemicals, and a host of other sources usually makes interior air much less safe than external air.

Preventive Medicine.-A variety of medical technologies have the potential to reduce mortality and sickness by early detection of disease, or by treating conditions like high blood pressure that are linked with disease. These measures, however, can be costly. There is considerable disagreement about how best to compare the costs and benefits of prevention and cure.[72] The fundamental dilemma is determining how much it is worth to prolong life, and whether different values should be attached to the quality of the life preserved. One method for resolving this issue involves the use of "discounted years of healthy life. "[73] In this approach, costs include the costs of all preventive measures and any side effects less the savings from treatment costs avoided. The costs of medical care used in survivors' longer expected life have sometimes been included but are more controversial. Benefits include discounted years of added life adjusted to reflect the quality of the added years of life. (e.g., Are the years spent in pain or activity severely limited by the methods used to prolong life?)[74]

Using such measures, it has been shown that the cost of a "discounted year of healthy life saved" due to hypertension screening ranges from $3,300 (1975 dollars) for 20-year-old men to $16,300 for 60-year-old men. Costs would average $7,000 per year of life saved if the costs of a national screening program to detect hypertensives were included.[75] A study conducted on the effectiveness of Pap tests recommended one test every 3 years instead of one test every year.[76]

Clinical Treatment.–A spectacular variety of new and often expensive technologies have reduced suffering and prolonged life in the past few decades. The impact of these technologies, and the way they have reshaped the structure of the Nation's health delivery system, are discussed in chapter 6. Technical progress has been so dramatic and changes in management and regulations so rapid that it is difficult—often impossible—even for experts to provide statistically sound analyses of costs and outcomes.

The obvious links between access to care and good health are clouded not only by the difficulty of separating environmental and behavioral factors from the income available for clinical medicine, but also by the facility by which available resources are al-

[69] U.S. Congress, Office of Technology Assessment, *Protecting the Nation Groundwater from Contamination* **(Washington, DC: U.S. Government Printing Office, 1984).**

[70] American Medical **Association, "Drinking Water and Human Health," Chicago, IL, 1984.**

[71] National **Academy of** Sciences, *Indoor Pollutants* **(Washington,** DC: **National Academy** Press, 1981); H. Levin, "Indoor Air Pollution Research and Its Applications in Office Building Development and Operation, " *The Changing Office Workplace,* J. T. Black, et al. (eds.) (Washington, DC: The Urban Land Institute, 1986).

[72] L.B. Russel, *Is Prevention Better Than Cure?* (Washington, DC: The Brookings Institution, 1986).

[73] M.C. Weinstein and W.B. Stason, "Foundations of Cost Effectiveness Analysis for Health and Medical Practices, " New *England Journal of Medicine, vol. 296, No. 13,* Mar. 31, 1977, pp. 716-721.

[74] L.B. Russel, op. cit., footnote 72, **pp.** 71-72.

[75] See M.C. Weinstein and **W.B. Stason,** *Hypertension, A Policy perspective* **(Cambridge,** MA: **Harvard University** Press, 1976). The hypertension study reveals some of the painful choices that must be made. The discounting technique estimated that a 50-year-old man would be paying $6,900 for each discounted year of life saved ($2,300 if he is lucky enough to have complete success with the treatment). Is this too much for society to spend extending the man's life by about four years when these additional years will occur when the individual is no longer in the work force?

[76] D.M. Eddy, "The Economics of Cancer prevention and Detection: Getting More for Less," *Cancer,* Mar. 1, 1981, p. 1200.

located and the way they are allocated. An attempt to disentangle data from the 1970 census showed a strong positive return to investments in clinical medicine. A 10-percent increase in medicaid spending per enrollee, for example, was found to decrease mortality by 1.6 percent.[77]

Adequate use of the health care system is, of course, not simply a matter of providing adequate funding. There remains the question of how patients choose to use the care. It appears, for example, that 50 percent of patients in the United States do not take prescribed medications in accordance with instructions, and some 20 to 40 percent of recommended immunizations are not obtained.[78] Scheduled appointments for treatments are missed 20 to 50 percent of the time.[79] Again, it is not obvious whether these responses reflect informed market choices or other factors. Explanations include ignorance, fear, distraction, and many others factors, in addition to an inability to afford the treatment.

Many nations with comparatively advanced economies (Sweden, the United Kingdom, Japan, Canada, and West Germany) have achieved comparable or even better national health status than the United States while devoting a smaller percentage of their GNP to health (see table 3-4). These nations all have more ambitious programs for providing universal health care coverage than the United States. Sweden and Japan, the two countries with the best health records, provide both universal health

[77] J. Hadley, **op. cit., footnote 32,** pp. 59-61.

[78] D.L. Sackett, "The Magnitude of **Compliance and Noncompliance," D.L. Sackett and B.B.** Haynes, eds., *Compliance with Therapeutic Regimens* (Baltimore, MD: Johns Hopkins University, 1976), p. 16.

[79] J. p. Kirscht and I.M. Rosenstock, **"Patient's Problems in** Following Recommendations of Health Experts," G.C. Stone, et al. (eds.), *Health Psychology: A Handbook* (San Francisco, CA: Jossey-Bass, 1979), pp. **189-215, cited op. cit., footnote 50.**

Table 3-4.—international Comparisons

	Us.	Canada	U.K.	Sweden	Japan
1) Life expectancy at birth (1981):					
Male	**70.4**	**70.8[a]**	**71.2**	**73.1**	**73.8**
Female	**77,8**	**78.3[a]**	**77.2**	**79.1**	**79.1**
2) Life expectancy at age 65 (1980):					
Male	**14.1**	**14.4[a]**	**13.1**	**14,4**	**14.6[b]**
Female	**18.3**	**18.7[a]**	**17.2**	**18.2**	**17.7b**
3) Infant mortality rate (1981) deaths per 1,000 live births	**11.9**	**9,6**	**11.1**	**6.8**	**[c] 7.1**
4) Health care spending as percent of gross national product	**10.7**	**8.4**	**5.3**	**10**	**5.2**
5) Population (1982) (in millions)	**232**	**25**	**56**	**8**	**118**
6) Percent of population 65 years and older (1981)	**11.2**	**9.7**	**15.3**	**16.5**	**9.3**
7) Crude birth rate per 1,000 population (1982)	**16**	**15**	**13**	**11**	**13**
8) National per capita income (U.S.$) (1981)	**10,094**	9,133	8,222	13,146	7,672
9) Physicians per 100,000 population (1980)	192	182	154	204	128
10) Hospital beds per 100,000 population (1980)	629	877	1,136	I,492[d]	1,064

[a] Data from 1978.
[b] **Data from 1961.**
[c] **Data from 1962.**
dFigure includes nursing home beds.

SOURCES: 1) U.S. data from Health, *United States: 1985* (Washington, DC: U.S. Government Printing Office, December 1965). Canadian data from R. Wilkins and O.B. Adams, "Health Expectancy in Canada, Late 1970s: Demographic, Regional, and Social Dimensions," American Journal of Public Health, vol. 73, No. 9, September 1963, p. 1077. Data for U.K. from "World Health Statistics Annual," 1983, World Health Organization, Geneva, Switzerland. Data for Japan and Sweden from *Health, United States: 1985*, op. cit.
2) U.S. data from *Health, United States: 1985,* op. cit. Canadian data from Wildins and Adams, op. cit. Data for Sweden and U.K. from "World Health Statistics Annual," 1963, op. cit. Japanese data furnished by Ministry of Health and Welfare, Embassy of Japan, Washington, DC.
3) U.S. data from *Health, United States: 1985,* op. cit. Data from Canada, Japan, and Sweden from *Demographic Yearbook, 1982,* United Nations, N.Y. U.K. data from "World Health Statistics Annual," 1863, op. cit.
4) 1962 data for Japan from "Health and Welfare Statistics in Japan," Health and Welfare Statistics Association, Japan, 1965.1963 data for Sweden from "Fact Sheets on Sweden: The Health Care System in Sweden," The Swedish Institute, FS 761Vpb, Sweden, 1963. U.S. 1963 data is from *Health, United States: 198S,* U.S. DHHS Pub No. 68-1232, 1965. Data from the United Kingdom for 1960 from "International Financial Statistics Yearbook, 1961 ," International Monetary Fund, 1861. Data for Canada (1962) from the Canadian Embassy, Washington, DC, personal communication, April 1966.
5) *World Development Report*, The World Bank, Washington, DC, 1964.
6) "World Health Statistics Annual," op. cit., 1963 and 1964. Data for the U.S. is from "Social Security Area Population Projections," 1963, U.S. Department of Health and Human Services, SSA Publication No. 11-11535, 1963.
7) *Wortd Development Report,* **op. cit.**
8) ***Statistical** Yearbook, **1981**,* **United Nations, New York, 1983.**
9) Estimates from *Wor/d Development Report,* **op. cit.**
10) Data from 1960 World Health Organization Statistics reported in "World Health Systems: Lessons for the United States," report presented by the Chairman of the Select Committee on Aging, U.S. House of Representatives (Washington, DC: U.S. Government Printing Office, 1964).

insurance. The United States, which provides neither comprehensive health insurance nor guaranteed access, has the lowest health status. (See box 3-A for a discussion of the limits of existing U.S. funding programs.) The United Kingdom and Canada, with comprehensive health insurance but varying degrees of access, have life expectancies and infant mortality rates in the intermediate range.

These facts may suggest that health care strategies exist in other countries that are economically preferable to the U.S. model. They may also simply mean that Americans are prepared to sacrifice 5 to 10 years of life in order to enjoy aspects of U.S. culture not enjoyed by other cultures that produce less disease. If nothing else, they suggest that significant changes in the cost and success of the U.S. health care system are possible during the next two decades.

Choices and Consequences

Estimates of the future performance of the Nation's medical system require answers to the following types of questions of health care finance and management:

- Will systems be developed that provide employers of all kinds a greater incentive to provide employees with health programs that include prevention and adequate care?
- Will systems be developed that provide access to high-quality health care for those lacking access to well-managed corporate or government health programs? Will there continue to be large differences in the medical benefits received by people in different income groups?
- Will health-related information available to consumers be improved? Will consumers change their behavior as a result?
- Can the incentive systems of the health industry be changed to give patients and providers similar interests in the support of cost-effective health care that balances prevention, health promotion, and other forms of health care?
- Will medical consensus converge at the lower end of the range of health care utilization (implying at least a 40-percent reduction in hospital costs), or will the lower rates prove to be ill advised?
- Will social policy (and private insurance programs) set standards demanding comparatively large numbers of years saved per dollar spent on health care?

Box 3-A.—Medical Coverage for the Poor

America's lower income groups are poorly served by the health care system:

- Medicaid provides coverage to a decreasing number of the poor. In 1985, Title X1X served only 40 percent of the population with incomes below the poverty line; in 1976, it served 65 percent. [1]
- Many States have not adjusted Aid to Families with Dependent Children (AFDC) income levels to account for inflation. From 1970 to 1984, State AFDC benefit levels for a family of four, in constant dollars, failed to keep up with inflation in all but two States–Wisconsin and California; across the country, the median decline in benefit levels, adjusted for inflation, was 33 percent. A study by the U.S. General Accounting Office estimated that 493,000 families lost their AFDC coverage as a result of changes brought about by the Omnibus Budget Reconciliation Act. In 1981, 1 million families had at least 1 member who needed medical care during the year but did not receive it for financial reasons.[2]
- Among the under-65 population, the percentage that is uninsured grew from 14.4 percent in March 1980 to 16.0 percent in March 1983. Between 1981 and 1982, the number of uninsured adults living with an employed, insured spouse almost doubled. Three-fourths of the 35 to 37 million uninsured are either employed or dependents of employed persons.[3]
- As many as 35 million people (17 percent of the population) were uninsured in 1984, including 12 million persons with income below the poverty level who did not qualify for Medicaid.[4]
- About one-third of all uninsured individuals are under the age of eighteen. [5]

[1] Jim Sarsgard, **Actuary, Division of Medicaid Cost Estimates, Office of the Actuary, Department of Health and Human Services, based on Census Bureau Statistics and the Current Population Survey**

[2] **M.E. Lewin, "Financing Care for the Poor and Underinsured An Overview, " in M.E. Lewin (cd.),** *The Health Policy Agenda: Some Critical Questions* **(Washington, DC: American Enterprise Institute, 1985)**

[3] **M. E. Lewin and Lawrence Lewin, "Financing Charity Care in an Era of Competition,"** *Health Affairs,* **spring 1987, p.** 51

[4] **Jim Sarsgard, op. cit.**

[5] **Uwe Reinhardt, "Health Insurance for the Nation's Poor, "** *Health Affairs,* **spring 1987, p. 101**

- Will large medical systems such as integrated hospital systems be able to manage significant savings?

Other issues include:

- Will cures be found for major illnesses such as heart disease, cancer, and senile dementia? If so, will they be cheap (i.e., vaccination), or will they require lengthy and expensive treatment? Will acquired immunodeficiency syndrome (AIDS) or a health menace of equivalent proportions impose new burdens on the system?
- Will government support of medical education and medical research be vigorous? Will public and private regulation of the quality of health care prove adequate?

Considering the Possibilities

Any one of the factors listed above could lead to considerable changes in both the cost of national health care and health of the average American. Few of the factors can be predicted simply by looking at trends—many are matters of public and private choice. Table 3-5 explores some alternatives in quantitative terms. It is based on a 1980 survey linking spending on health care to a patient's age and the condition for which treatment was received.[80] The increase in spending shown in table 3-5 assumes that the cost of intervention remains unchanged. Changes result entirely from assumptions about the success of the intervention. The basic assumption of the calculations is that a person whose death has been avoided by an assumed improvement in some kind of treatment (e.g., a cure for cancer) would have the same risk of dying of other kinds of disease in later years as the average person of the same sex and age.

The results of a calculation like the one displayed in table 3-5 can be difficult to interpret since it includes a variety of offsetting factors. The analysis is not intended to provide a precise forecast, but rather to exhibit the striking range of costs and health out-

[80]The National Medical Care Utilization and Expenditure Survey, conducted by the National Center for Health Statistics. Corrections for underreporting were made following the suggestions of a study of this data conducted by J.M Anderson and E. Thorn, "Estimates of Aggregate Personal Health Care Expenditures in 1980," ICF, 1985. See D. Gillman, "Documentation on the Population Projection Program (PROPOP)," paper prepared for the Office of Technology Assessment, 1985.

Table 3-5.—Hypothetical Scenarios for the U.S. Health Care System

Year	Life expectancy (years at birth) Male	Female	Lifetime disability days (1983= 100) Male	Female	National health care costs (1983= 100)
1983	70.8	78.0	100	100	100
2005:					
AIDS epidemic[a]	70.7	78.0	126	100	140
1983 mortality rates	70.8	78.0	126	100	133
Half infant mortality[b]	71.8	79.2	91	89	134
Social Security Administration pessimistic scenario[c]	73.1	80.5	125	100	137
No smoking[d]	74.3	81.4	108	85	119
Social Security Administration baseline scenario[c]	75.3	82.9	137	110	142
Cancer cure[e]	75.8	83.0	136	104	135
Modest prevention	76.0	84.2	105	82	116
Cure heart disease[g]	77.0	84.0	148	117	144
Extensive prevention	78.4	84.5	111	86	115
Social Security Administration optimistic scenario[c]	78.6	66.4	156	125	146
optimistic prevention	78.7	64.8	91	89	135

[a]AIDS (acquired immunodeficiency syndrome) case assumes no change from 1963 mortality patterns except that death frOm "other causes" increases 21%.
[b]Cuts mortality and morbidity for infant mortality and congenital diseases in half.
[c]Mortality assumptions used by the Office of the Actuary, U.S. Social Security Administration in their forecast of U.S. population growth. See U.S. Social Security Administration, Population Projections 1963: *World Development Report*, The World Bank, Washington, DC, 1964.
[d]Assumes that cigarette smoking is responsible for 15% of heart disease deaths, 32% of cancer deaths, 10% of deaths from vascular disease, 43% Of deaths frOm chronic obstructive lung disease, 16% of deaths from diseases of the digestive system, and 16°A of deaths from all other causes.
[e]Cancer mortality and morbidity falls to zero in 1990.
[f]No smoking, 50% reduction in accident rate from lowered alcohol use and Seat belts and workplace safety.
[g]Reduces heart disease mortality to zero and heart-related illness by 300/. starting in 1990.
[h]Same as (e) except that improved diets are assumed to reduce cancer deaths an additional 67% and deaths frOm digestive diseases 50°/0.
[i]Same as (h) only cuts mortality and morbidity for diseases of infancy and congenital diseases in half.

For more details, see U.S. Congress, Office of Technology Assessment, "Health," sector study, 1987; and D. Gillman, "Health Cost Forecasting for the U.S.," working paper prepared for the Office of Technology Assessment, 1985.

comes possible given a plausible set of assumptions. Total national health care costs hinge on whether comparatively expensive or comparatively inexpensive causes of illness and death are reduced. The costs in the year 2005 depend on the population in that year. This is in part a function of mortality patterns prior to 2005. A comparatively inexpensive "magic bullet" cure for cancer in the year 2000 (the equivalent of a vaccine or penicillin) would reduce costs in 2005, but would increase them in later years because the individuals living longer as a result of the cure would begin to incur other health care costs. The costs are also extremely sensitive to whether the factors that decrease mortality also lead to a corresponding decline in sickness requiring medical attention. The large range of variation in days of disability translate into differences in national health care costs.

Constructing Scenarios

The hypotheses just generated can be combined with assumptions about growth in the intensity of treatment, and from these combinations can be developed scenarios of spending on the Health amenity. In all cases it is assumed that the relationship of government purchases to consumer spending remains the same. The results are summarized in table 3-6. In the 3 percent Trend scenario, these assumptions imply that government purchases of Health as a share of all government purchases rise substantially. The rise is less pronounced in the 3 percent Alternative scenario, following the lower cost "prevent" scenario. However, the share rises 1.5 percent under the Alternative scenario, due to the assumed provision of comprehensive medical care even at low rates of economic growth.

The Trend scenarios are based on an assumption that growth in health care spending will follow 1960-83 patterns, and increase 38 percent faster than total personal consumption expenditures (PCE). This implies that PCE Health expenditures will increase by just over 4 percent annually in the 3 percent growth case, and by about 2.1 percent annually in the 1.5 percent growth scenario.[81]

The Alternative scenarios are based on the "modest" and "extensive" "prevention" scenarios shown in table 3-5, and on an assumption that health care is more equitably allocated among income groups. It is assumed that the rate of growth in intensity of care (in this case measured in constant dollar spending per treatment) is approximately one-sixth the 1972-86 rates because a better match between health care spending and outcome is achieved.

Table 3-6.–Consumption Scenarios for Health (billions of 1983 dollars)

		2005			
	1983	Trend 3%[a]	Trend 1.5%[b]	ALT 3%[c]	ALT 1.5%[d]
Household spending	268	650	420	500	418
Government spending	60	147	95	113	94
Total	328	797	515	613	512
Percent share of GNP	9.6	12.2	10.9	9.4	10.9

ABBREVIATIONS: ALT = alternative scenarios, GNP = gross national product
[a]Assumes U.S. Social Security Administration (SSA) baseline scenario hypotheses illustrated in table 3-5, and per-capita intensity increases at 2.5%/year—roughly half the average rate of the 1972-66 period.
[b]SSA "pessimistic" scenario from table 3-5, and an intensity growth of 0.60/. Per year.
[c]"Extensive prevention" case from table 3-5, and intensity grows at 1/6 historic rates.
[d]"Modest prevention" case from table 3-5, and intensity grows at 1/6 historic rates,

SOURCE: Office of Technology Assessment, 1966

[81]This expenditure trajectory is consistent with projections fOr 1990; Ross H. Arnett III, et al., "Health Spending Trends in the 1980s: Adjusting to Financial Incentives," *Health Care Financing Review, vol. 6, No. 3,* spring 1985.

HOUSING

The Housing Recipe

Unlike health, it is difficult to develop statistics giving an unambiguous measure of housing as an amenity .82 For most, the "American Dream" house

[82]Housing expenses are defined to include all spending on structures, home furnishings, the energy needed to maintain comfortable temperatures, adequate lighting, hot water, cooking facilities, and related needs such as mortgage financing. Energy includes payment for gas, oil, electricity, and other fuels. "Other" includes spending for home furnishings, cookware, water and sewer, and the other products associated with household operation. It does not include products associated with personal business or entertainment such as telephone, stationary, and home electronics. Spending for new housing units is not counted as a "personal consumption expenditure" in the National Income and Product Accounts, but is instead counted as a kind of savings. This distinction between housing as an amenity and housing as an investment is a vexing problem of definition. For the purposes of the analysis presented in this document, spending on home equity is included as a part of spending for the housing amenity.

apparently remains a detached residence, with pleasant grounds, security, and a comfortable interior. A general definition of "quality" in housing includes minimal maintenance (e.g., plumbing that works, roofs that don't leak, and windows that open), good lighting, and a heating and cooling system that provides desired levels of comfort. Recent discoveries about the quality of indoor air are now making clean and safe air a part of "quality" in homes, as well. A good location is also an important, if somewhat ambiguous concept. Definitions of desirable locations include assets such as physical attractiveness, safety, and good public schools; and convenient access to jobs, shopping, and recreational areas. This is becoming an increasingly challenging problem as both husbands and wives commute to work.

Changes in tastes and demographics have a powerful effect on demand for housing. For example, the growth of the elderly population and increases in home health care place new demands on housing for people with mobility limitations. Nearly 40 percent of all persons aged 65 to 74 have some activity limitation, and 63.2 percent of individuals over the age of 74 have some limitation.83 More than five percent of the total population are blind or visually handicapped, 7.4 percent are deaf or hearing impaired, 3.2 percent have some form of lower extremity impairment, and 1.2 percent have upper extremity impairment.[84]

The growth of single-person households and the "other" household categories translates into complex patterns of demand for housing. The decline in leisure time caused by an increase in work-related activities translates not only into demands for shorter, more "intense" vacations (see discussion of recreation and leisure later in this chapter), but also into greater demand for recreational amenities within a house.85 New technologies are redefining the definition of interior amenity. Home entertainment involves an increasingly elaborate and powerful array of video and sound equipment, for example. Home offices are becoming common for professionals and there has been a small (but limited) increase in home-based work. Broadband communications wiring in houses is likely to be as common as telephone wiring today.

The continuing mobility of Americans means that for many people housing is not a permanent investment.[8G] Many make purchases with no intention of sinking deep roots in a community. In 1985, only 58 percent of Americans lived in their 1980 residence. Movers were about equally divided between those moving to a new house in the same county, many of whom were undoubtedly "trading up" to improved residences,87 and those moving out of the county. While two-thirds of the residents of the northeast remained in their 1980 homes, in the west movers outnumbered nonmovers. Nearly one-quarter of the people living in the west moved outside their county and 15 percent moved from another State or another country. Two-thirds of all young adults (age 20 to 34) moved during the first half of the 1980s; nearly one-third moved out of the county. While many elderly persons may move from their residences to retirement communities, 84 percent did not move at all and only 7 percent moved out of the county where they lived in 1980 (see table 3-7).88

[83] U.S Congress, Office of Technology Assessment, *Technology and Aging in America,* OTA-BA-264 (Washington, DC: U.S. Government Printing Office, June 1985), pp. 291-292.

[84] U.S Congress, office of Technology Assessment, *Technology and Handicapped People, OTA-H-179* (Washington, DC: U.S. Government Printing Office, May 1982), p. 22.

[85] C. Vogel, "clustered for Leisure: The Changing Home, " *New York Times Magazine,* June 28, 1987, p. 13.

[86] See the last section of ch. 5 for a discussion of the ways changing economic structure are moving jobs around urban areas and among regions.

[87] H.J. Brown and J. Yinger, *Homeownership and Housing Affordability in the United States: 1963-1985* (Cambridge, MA: Joint Center for Housing Studies, 1986).

'U.S. Bureau of Census, Current Population Survey, Series P-20, 1985.

Table 3-7.—Mobility of the U.S. Population

Asked in 1985 where they lived in 1980, the responses were as follows:

	Now live in the same unit they occupied in 1980	Lived in a different unit same county in 1980	Lived in another county or abroad in 1980
Total	58.3	22.1	19.6
By age:			
Age 5-19	57.0	24.1	18.9
Age 20-34	35.3	33.5	31.2
Age 35-64	68.9	16.2	15.0
Age 65+	83.5	9.2	7.3
By 1985 location:			
Northeast	66.9	18.8	14.3
Midwest	60.9	22.9	16.2
South	56.0	21.5	22.5
West	49.6	26.0	24.4

NOTE: Does not include members of the armed forces except those living off post or with their families on post.

SOURCE: U.S. Department of Commerce, Bureau of Census, CPS Series P-20, 1985.

While much of the discussion in this chapter focuses on the ability of new production technology to tailor products to niche markets and changing tastes, housing will be an exception. The mobility of the U.S. population means that housing is seldom tailored to the tastes of individuals but rather to a homogeneous "resale market."

The fact that homeowning has been a lucrative form of savings for many makes it difficult to link spending patterns with levels of amenity achieved. Programs designed to make housing affordable to the middle class have had the effect of making it an attractive investment. Housing investments are unique because the owner is free from tax on the effective income enjoyed by renting a property to himself. Many households are, as a result, "overhoused," in the sense that their spending on housing exceeds the spending that would have occurred in the absence of this investment incentive.[89] Equity in homes represents 64 percent of the median net worth of homeowners today.[90]

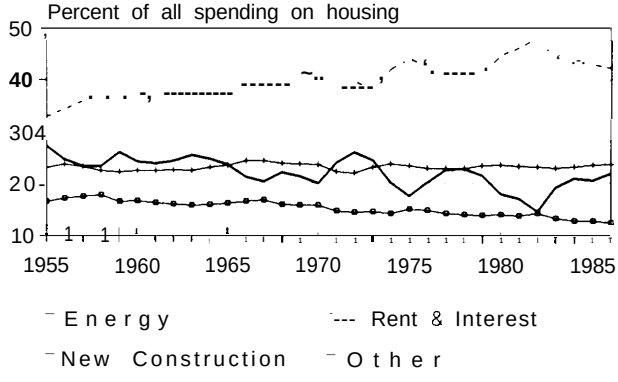
Since 1950 there has been a significant increase in the share of spending for housing that goes to financial institutions, landlords, and insurance companies (see figure 3-5). In contrast, the fraction that goes to an increase in net equity in housing (the "new construction" portion shown in figure 3-5), has fallen steadily since 1950, and has become much more cyclical. The increase in other housing costs has been so great that they make the dramatic increase in energy prices during the 1970s all but invisible. Lower prices for home furnishings ("other" in the figure), and perhaps some saturation in demand for such goods, have resulted in a steady but slow decline in the fraction of spending devoted to this area.

A variety of costs are not directly reflected in the statistics of figure 3-5. For example, residential electricity and gas customers often do not pay their real share of costs because regulatory commissions elect to subsidize residences by charging higher rates to commercial and industrial customers. Few rates reflect the marginal cost of producing energy from new sources. Water and sewerage lead to enormous costs which are typically hidden because much of the cost is provided through the tax base rather than through direct user charges. A survey in Irvine, CA, conducted by its "funding task force," found that the cost of providing streets, parks, schools, flood control, civic and performing arts buildings, and libraries was between $16,500 and $23,800 per dwelling.

[89] U.S. Congress, Congressional Research Service, "Housing Programs **Affecting the Elderly: A History and Alternatives** for the Future," Report No. 82-1 19E, Washington, DC, June 1982.

[90] U.S. Bureau of the Census, Current population Reports, Series P-70. No. 7.

Figure 3-5.-Spending on Housing by Major Category



SOURCE: US. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," historical diskettes, table 2.5.

Trends in U.S. Housing Quality and Affordability

There is reason to believe that on average American housing has improved in virtually all of the areas mentioned. The average housing unit is larger than it was a decade ago even though household sizes are smaller.[91] The number of units with more than one person per room fell from 3.8 percent of all units to 2.6 percent.[92] There has been a significant increase in the number of units equipped with such amenities as air conditioning, garages, and full city water and plumbing,[93] Correspondingly, a smaller

[91] In 1968, the median size **of new** privately owned single-family homes completed in the United States was 1,385 square feet. In 1980, it was 1,595 sq. ft., and in 1985, it was 1,785 sq. ft. See *Statistical Abstract of the United States 1987,* **op.** cit., footnote 39, p. 706.

[92] Irendia Irby, Housing *Problems in the United States,* U.S. Department of Housing and Urban Development, Division of Housing and Demographic Analysis (Washington, DC: U.S. Government Printing Office, **June 1985).**

[93] *Statistical Abstract of the United States 1987,* **op. cit.,** footnote 39, p. 710.

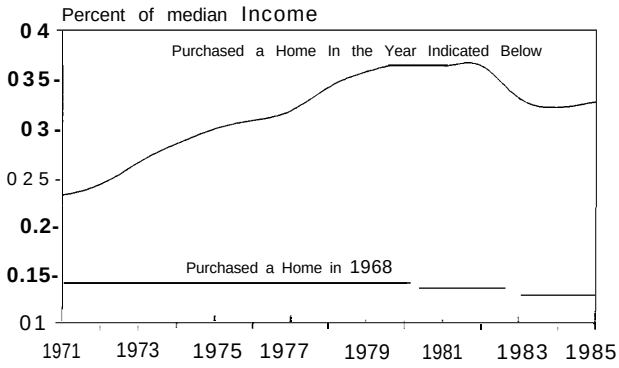
fraction of Americans live in units with major defects.[94] Moreover, the statistics of chapter 2 indicated that these improvements have been achieved without an increase in the average levels of spending for housing as a fraction of overall consumer spending.

Any problems with American housing lie not with the averages but with the difficulties encountered by specific groups. Young families, one-wage earner households, minorities, and individuals trying to find housing in areas of rapidly expanding employment all often face painful decisions about housing. They are forced to rent rather than buy, and may commute longer distances or make other sacrifices in order to find affordable housing. Many still pay a very high fraction of their income for housing. There is a very real danger that recent trends will result in a situation where there will be two sharply divided household classes in America—those fortunate enough to have purchased housing in the 1970s (or inherited a house from them) and all others.

In 1983, homeowners had an average net worth of $97,239, a net worth 920 percent higher than the net worth of renters.[95] This could indicate that only the poorest Americans do not buy housing. It could also indicate that house ownership has been an extremely effective way of increasing individual net worth in the past few decades. Whatever the reason, the 64 percent of the population which owns housing clearly has a strong vested interest in seeing the value of their investments increase, and this makes them a powerful lobby against any measure that would have the effect of lowering the real cost of housing.

Figure 3-6 tells some of the story. In spite of some relief from the extraordinary peak in 1982 due to lowered interest rates, the cost of purchasing and operating a new home has grown spectacularly when measured as a fraction of median income, reaching 32 percent of median household income in 1985. This cost is clearly out of reach for many demographic groups. Families with only a single wage earner face the most pressing difficulties except where the single earner is in a high-income occupation (e.g., a manager or professional; see table 3-8). A new home is far beyond the reach of most female-headed households.

Figure 3-6.-Cost of Home Purchasing for New Homeowners and Families Who Purchased a Home in 1968



How To Read This Figure: In 1985, a family earning the median income that purchased a home in 1968 would be paying about 13 percent of its income for housing (limited hereto mortgage payments, maintenance, and energy). The same family would be paying about 33% of its income for housing if it purchased a house in 1985. Some of the difference results from closing and costs associated with new home purchasing. One-third of these costs are assumed to be paid in the first year of home ownership,

SOURCE: H. James Brown and John Yinger, "Home Ownership and Housing Affordability in the United States: 1983-1985," report for the Joint Center for Housing Studies of the Massachusetts Institute of Technology and Harvard University, Cambridge, MA, 1988.

Table 3.8.—After Tax Cash Costs of a New Home Purchased in 1985 (as a percent of annual income[a])

	Percent
By family type:	
Married couples	30
Both husband and wife work	26
One earner families	46
Single woman household (one earner)	75
By occupation for single earner:	
Precision production, craft, and repair	41
Administrative support including clerical	54
Executive, administrators, and managerial	31

[a]Tax rate not adjusted for income or family type. Assumes 24% marginal tax rate and $3,400 deduction. This error underestimates the real after tax costs of low-income households.

SOURCES: Housing costs taken from "Home Ownership and Housing Affordability in the United States: 1983-1985," Joint Center for Housing Studies of the Massachusetts Institute of Technology and Harvard University, Cambridge, MA, 1988. Income data from U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings,* 1986.

[94]Between 1975 *and 1985,* the percentage of all units defined to be "inadequate" (e.g., they lacked or shared some or all plumbing, lacked or shared some or all kitchen facilities, were inadequately maintained, or had public hall deficiencies, inadequate heating equipment, electrical defects, or inadequate or broken sewer) fell from 10.6 percent to 8.9 percent. Those judged to be "severely inadequate" fell from 4.3 percent to 2.6 percent. See Irendia Irby, op. cit., footnote 92.

[95]*Statistical Abstract of the United States 1987,* op. cit., footnote 39, p. 451.

How can the fraction of income spent on housing remain constant (again see figure 3-5) while housing stretches the resources of the median household? How can the increase in the size of new housing units be consistent with the shrinking fraction of the population able to afford housing? The answer is a growing gap between haves and have nets in housing. Figure 3-6 compares the cost burden of a new homebuyer with the price paid by a household still living in a home purchased in 1968. Housing actually consumes a declining share of the income of the 1968 purchaser in spite of the rapid increase in energy costs that has occurred since 1968.

Accounting for Changing Costs

Three factors account for the sharp rise in housing costs documented in figure 3-6:

1. increasing land costs near areas of employment growth (spurred in part by restrictive zoning and other local policies for limiting growth),96
2. increased cost of financing for housing (resulting directly from deregulation in thrift institutions), and
3. rising energy costs.

While there has been some increase in the cost of construction materials and labor, and some decline in the productivity of labor in residential construction, these do not appear to have had a dominant effect on overall housing costs. Between 1970 and 1980, the cost of a new single-family home actually fell 16 percent in constant dollars while the cost of the materials and labor in the home fell 30 to 40 percent. During the same period the cost of financing increased nearly 80 percent.97Given that many developers make most of their money from financing and land development, it is easy to see how they are likely to add amenities and a few hundred square feet to a property if this will give them a competitive edge.

Between 1975 and 1985, the real cost of a 10,000 square foot lot of improved land increased in price by 66 percent; the price of an unimproved lot increased by 78 percent. Prices were particularly high in areas of high growth like California and Florida. While a 10,000 square foot lot cost $2,500 in Chattanooga in 1980, it cost $187,000 in San Jose, CA.98 Some of this was the result of scarcity in growing areas, some from speculation based on high inflation rates, and some resulted from extensive growth in restrictive zoning.99 Several parts of the San Francisco Bay area have instituted regulations that have increased housing prices by at least 20 to 30 percent. 100

Many other cities have taken measures *to* limit growth, including Montgomery County, MD and Fairfax County, VA in the Washington, DC area; and Fairfield County, CT, and White Plains, NY in the New York City area. Fairfield County and many other areas have adopted ordinances designed to limit both residential and commercial construction. Zoning in over one-third of 75 municipalities covered in a 1976 New Jersey survey required minimum lot sizes greater than 1 acre. Most communities squeeze "manufactured housing" into disadvantaged locations; many do not permit such units at all. [101] Apart from driving up property values, one curious feature of these policies is to decrease population density. This results from the fact that housing density remains fixed in heavily regulated areas while household size declines.102

The rapid increase in financing costs was due to a combination of general inflation with regulatory changes in the banking industry undertaken when short-term rates rose rapidly during the 1970s. investors turned increasingly to money market and other instruments instead of traditional "thrift institutions." In effect, homebuyers are competing for

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[96] R. Babcock, *The Zoning Game* (Madison, WI: The University of Wisconsin, 1964).

[97] "Report of the President's Commission on Housing," Washington, DC, 1982. Figures cited converted to constant dollars using the consumer price index.

[98] *Residential Land Price Inflation Survey* (Washington, DC: The urban Land Institute, 1986).

[99] Robert Cervero, "Jobs-Housing Imbalances in Suburban Employment Markets: An Empirical Investigation," Department of City and Regional Planning, University of California at Berkeley, May 1987.

[100] D. Dowall, The *Suburban Squeeze* (Berkeley, CA: University Of California, 1985).

[101] See S. Seidel, *Housing Costs and Regulations: Confronting the Regulatory Maze (New* Brunswick, NJ: Center for Urban Policy Research, 1978), **p. 174;** and the '(Report of the President's Commission on Housing," op. cit., footnote 97.

[102] M. Gellen, Accessory Apartments *in Singe-Family Housing* (Piscataway, NJ: Center for Urban Policy Research, 1985); D. Schoup, *Curb Parking as a Commons Problem (Los* Angeles, CA: University of California, Graduate School of Architecture and Urban Planning, 1983).

money with other borrowers throughout the economy. [103]

The 1986 changes in tax law affect housing costs in complex ways.104 The number of new rental units is likely to continue the decline that began before the law was changed, partially offset by "non-new" units converted from nonresidential use.

Reacting to Higher Costs

Buyers reacted to the rising cost of housing in a variety of ways. Lending rules were stretched to permit buyers to take higher risks. But there is plainly a limit. The increased cost of housing has led to a decline in ownership rates, particularly for younger families most likely to need new housing (see table 3-9). The need for mobility on the part of younger individuals also contributes to their housing dilemma.

Declines in home ownership are naturally matched by increases in the number of individuals renting. In 1987,55 percent of young adults (aged 25 to 34) lived in rental units–up from 48 percent in 1974. In 1983, 62.5 percent of female single parents were in rental units; the figure was 88.7 percent if they had a child younger than 6. Both statistics represent an increase from 1974. Renters avoided the high cost of home purchasing but were still affected by growing housing costs. In 1987, contract rents averaged 25.5 percent of the income of renting families, up from 20.5 percent in 1974. In 1983, 55 percent of households earning less than 50 percent of the median household income paid more than 30 percent (up from 48 percent in 1974).[105]

Some renters have accepted a decline in housing quality. While the percentage of rented units with defects has declined, the 19-percent increase in the total number of rented units meant that there was a 7-percent increase in the number of families living in inadequate rented housing. Single adults and individuals between the age of 25 and 35 were most likely to live in inadequate rental units. One index of housing inadequacy indicates that inadequate housing declined from 15.5 to 12.8 percent between 1974 and 1983.[106]

Other responses to increased housing costs include living with relatives, forming households of unrelated individuals, or taking in borders. Between 1980 and 1986, the number of total U.S. households increased 9.5 percent. During the same period, the number of households comprised of related subfamilies increased 96 percent, unrelated subfamilies increased 40.3 percent, and unrelated individuals increased 19.2 percent. Single females with children clearly faced the greatest problem finding housing; the number of mother-child families living with relatives increased 173 percent between 1980 and 1986.[107]

For those on the bottom of the ladder, housing has become a disaster. The Nation's mayors report that demand for emergency shelter increased by an average of 20 percent in 25 major U.S. cities during 1986.[108]

While changes in cost burdens are relatively visible, other changes in housing quality are more difficult to measure. There is compelling evidence that other amenities have been sacrificed in order to keep housing costs acceptable. One traditional cure for high land prices is making a trade-off between com-

[103] A. Downes, *The Revolution in Real Estate Finance* (Washington, DC: The Brookings Institution, 1985).

[104] "Description of Provisions of the Tax Reform Act of 1986 Relating to Housing," paper prepared by the National Association of Homebuilders, Government Affairs Division, September 1986.

Table 3.9.–Household Ownership by Age, 1980=87

Age	Percentage owning their own homes 1987	Increase/decrease in percent 1980-87
Under 25	16.1	–5.2
25-29	35.9	–7.4
30-34	53.2	–7.9
35-39	63.8	–7.0
40-44	70.6	–3.6
45-54	75.8	– 1.9
55-64	80.8	1.5
65-74	78.1	2.9
Over 75	70.7	2.9
Total	64.0	– 1.6

SOURCE: W.C. Apgar, Jr. and H.J. Brown, "The Slate of the Nation's Housing 1988," Joint Center for Housing Studies of Harvard University, Cambridge, MA, 1988, p. 12.

[105] Irby, op. cit., footnote 92.

[106] H.J. Brown and J. Yinger, op. cit., footnote 87.

[107] Current Population Reports, op. cit., footnote 88, No. 412.

[108] "The Continued Growth of Hunger, Hopelessness and Poverty in America's Cities: 1986," The U.S. Conference of Mayors, Washington DC, 1986.

muting time and housing costs in suburban and exurban regions.[109] The trade-off has become much more complex as jobs begin to drift toward suburban locations and as husband and wife must compromise on commuting time. Twenty percent of all trips to work are now from suburbs into central cities. The share of people who both live and work in suburbs has risen from 30.5 percent in 1960 to 41.9 percent in 1980. It is 60 percent in greater Boston, Detroit, St. Louis, and Pittsburgh.[110]

While middle class families may have paid a price to combine job access and housing amenity, low income groups, particularly blacks, paid an even greater price since their mobility was highly constrained. Ironically, subsidized low income housing may have the effect of anchoring low income groups to declining areas.[111]

Zoning, housing costs, and multiple-worker families mean that a shrinking fraction of individuals can live in the same community where they work. Only half of the people in the San Francisco area work in the community where they live. There were only 35 jobs for every 100 people housed in "bedroom" communities like Daly City. San Jose, Fremont, Concord, and Alameda averaged 50 to 67 jobs per 100 residents. In other areas, high property costs make residence virtually impossible for middle income families. As a result, there were 203 jobs for every 100 residents of Palo Alto, 172 for every 100 residents in Santa Clara ("Silicon Valley"), 150 per 100 for Sunnyvale, and 132 per 100 for Mountain view.

The effect of sprawl, coupled with the separation of work and housing, has meant that commuting time has increased for many. While there is considerable variation, travel distance has increased while travel time has reportedly declined (implying an increase in commuting speed). Curiously, it is the upper income managers who have elected to travel further to achieve their housing amenity (see table 3-10), in spite of the fact that their time is presumably more valuable. Also, since men commute longer distances than women it appears that women may be taking jobs closer to home, possibly sacrificing income in order to combine lives as a homemaker and paid employee.

Construction Technology

New building technologies (discussed inch. 6) and new materials can reduce the cost and improve the quality of housing. Factory construction can permit reliability and brand-name guarantees for major building components and entire structures because sections are produced consistently under factory conditions. And where markets exist, it should be possible for customers to design houses to their unique needs.[113] It may even be possible to construct homes from modular units that permit relatively easy changes of floor plans. This possibility might permit more flexibility in the design of structures that are purchased both as an amenity and for their po-

[109] For more on this subject, see W. Alonso, Location *and Land Use* (Cambridge, MA: Harvard University Press, 1964); J.D. Carroll, "The Relation of Home to Work Places and the Spatial Patterns of Cities," Social *Forces, vol.* 30, No. 1052, pp. *271-282;* H.J. Brown, "Changes in Workplace and Residential Locations, " *Journal of the American Institute of Planners, No. 41,* 1975, pp. *32-39;* W.A.V. Clark and J.E. Burt, "The Impact of Workplace on Residential Location," *Annals of the Association o/American Geographers, vol. 70, No*1, **Mar. 1980, pp.** 59-67; L. Orr, *Income, Employment and Urban Residential* Location (New York, NY: Academic Press, 1975); and J. Quiggley and D. Weinberg, "Intraurban Residential Mobility: A Review and Synthesis," *International Regional Science Review,* **vol. 2, No. 1,** Fall 1977, pp. 41-66.

[110] Robert Cervero, op. cit., footnote 99.

[111] J. D. Kasarda and **J. Friedrichs, "Comparative** Demographic Em**ployment Mismatches** in **U.S.** and West German Cities, " *Research in the Sociology of Work, No, 3, 1985,* pp. 1-30.

[112] R. Cervero, 1987, op. cit., footnote 99.

[113] U.S. Congress, Office of Technology Assessment, *Technology, Trade and the U.S. Residential Construction Industry-Special Report,* OTA-TET-315 (Washington, DC: U.S. Government Printing Office, September 1986).

Table 3-10.—Commuting Distances and Times

	1983			1969
	Men	Women	Total	Total
Trip length (miles)	11.2	8.3	9.9	9.7
Trip time (minutes)	21.6	18,8	20,4	23.1
Average speed (mph)	31.1	26,5	29,1	25,2

By occupation:

	Distance (miles)		Time (minutes)	
	Commute 1983	Increase from 1977 to 1983	Commute 1983	Increase from 1977 to 1983
Professionals	9.8	–0.9	20,0	– 1.8
Managers	12.5	2.4	24,2	3.5
Clerks	9.1	1.0	19.8	0.8
Laborers	11,8	0.3	22,8	1.0
Unskilled	11.0	1,0	21.4	1.1
Services	6.7	0.2	16.1	0.0
Total	9.9	0.6	20.4	0.6

SOURCE U S Department of Transportation, Federal Highway Administration, 1983-1984 *Nationwide Personal Transportation Study*, volume 1, Washington, OC, August 1986. pp 7-6 to 7-10

tential resale value. A variety of gadgets ranging from microwave ovens to improved security systems are available and may add to the value of housing in the future.

New materials, clever use of microelectronic control technologies, and application of competent architectural and engineering in housing design are becoming more common and can reduce energy consumption in homes by factors of two or more. The efficiency of most home appliances can be more than doubled using technology already on the market or under advanced development (see table 3-1 1). Advances in lighting technology permit graceful integration of day lighting and artificial lighting, better color quality and lack of flicker with high frequency fluorescent, and 200- to 500-percent reduction in energy use by lighting. ' 14 Even the window is undergoing radical changes in design. It is possible to develop windows with thermal insulation equivalent to 3 inches of fiberglass.ll[s] Other designs envision windows whose transparency can be altered under direct control, to let solar energy pass in the winter, and to reflect heat in the summer.

The combination of enlightened energy pricing policy with new communications technologies can also help. A 200-house experiment in Roswell, Georgia, uses new "packet switching" technology, along with a small computer in each house, to run air conditioning in a way that minimizes energy costs. The customer simply selects the room temperature desired when electricity rates reach different levels; she may decide, for example, that during the 4 hours a day when prices reach 25 cents/kWh, temperatures should remain at 85 degrees, but during the long periods when electricity costs 2 cents/kWh, temperatures of 65 degrees are preferable. The thermostat adjusts automatically, using signals received through standard telephone lines. The customer is free to override the utility setting at any time, but must pay the going rate for electricity for the privilege. The system saves the utility enough for it to finance the full cost of the system.

A number of studies have tried to determine the number of these technologies likely to make economic sense given perfectly rational decisionmaking by consumers, and the probable investments that will be made under markets likely to exist in the

[114] S. Berman, "Energy and Lighting," D. Hafemeister, H. Kelly and B. Levi (eds.), *Energy Sources:* Conservation *and Renewables (New* York, NY: American Institute of Physics, 1985).

[115] S. Selkowitz, "Window Performance and Building **Energy Use: Some Technical Options** for Increasing **Energy Efficiency," D. Hafemeister, et al., op. cit., footnote 114**.

Table 3-il.—Energy Consumption and Conservation Potential With Residential Appliances

		(KWh/yr or therms/yr)				
	Primary energy use (Q)[a]	Fraction of residential total (%)	1985 stock UEC[b]	1985 new UEC[c]	1985 best UEC[d]	Advanced technology for 1990s*
Refrigerator	1,17	7.1	1,500	1,100	750	200-400
Freezer	0.44	2.7	1,100	800	500	150-250
Electric space heating	1.58	9.6		—	—	—
Central air conditioning.	1.47	9.0	3,600	2,900	1,800	900-1,200
Room air conditioning	0,38	2.3	900	750	500	300-400
Electric water heating	1.35	8.2	4,000	3,500	1600	1,000-1,500
Electric range	0.54	3.3	800	750	700	400-500
Electric clothes dryer.	0.45	2.7	1,000	900	800	250-500
Lighting	1.00	6.1	1,000	1,000	650	350-500
Electric other.	0.87	5.3	—	—	—	—
Gas space heating	3.36	20.5	730	620	500	300-500
Gas water heating	0.85	5.2	270	250	200	100-150
Gas range	0.31	1.9	70	50	40	25-30
Gas clothes dryer.	0.07	0.4	50	40	35	30-35
Gas other.	0.41	2.5	—	—	—	—
Total	14.25	86.8				

NOTES:
[a] Applies to 1980.
b unit energy consumption per installation in the 1985 housing stock.
c unit energy consumption for the typical model sold in 1985.
d unit energy consumption for the best available modei sold in 1985
e unit energy consumption possible in new models by the mid-1990's if further cost-effective advances in energy efficiency are made,

SOURCE: Howard Geiler, American Councii for an Energy-Efficient Economy, January 1986.

United States during the next two decades.[116] While techniques differ, all show the potential for reducing energy use in housing by large factors. Studies conducted in 1987 provide an example. A recent study conducted by the State of Michigan indicated that residential electricity use could be cut in half by the year 2005 even accounting for expected growth in the housing stock.[117] An analysis of the technical potential of housing design and equipment available on the U.S. market (and the international market) in 1982 suggested that energy use could be one-fifth of the energy used by an average U.S. house in 1980.[118]

Choices and Consequences

Housing costs in the future will hinge critically on the following factors:

- policy affecting speculation in real estate (principally tax policy);
- changes in the geography of economic development, which either encourage geographic concentration (thereby increasing competition for scarce land resources) or result in greater decentralization;
- policy affecting the cost of mortgage financing;
- technical improvements in structures that reduce maintenance and operating costs (principally energy costs);
- policy affecting the housing available for those lacking adequate income; and
- technical improvements in the construction process that reduce construction costs (improvements that could be made more rapid by increased investment in research).

It is impossible to adequately reflect all of these variables 'in the scenarios' selected. An attempt has been made to show what might happen to aggregate demand if no major changes are made in the way Americans invest in housing, and what might happen if policies succeed in arresting the rapid growth in spending in this area. The Trend scenarios, shown in table 3-12,[119] are based on the extrapolation techniques described in chapter 2, which link spending to demographic factors, prices, and income. Independent estimates were made for household utilities to incorporate improvements in efficiency (see

[116] J.H. Gibbons and W.U. **Chandler,** *Energy.' The Conservation Revolution (New* York, NY: Plenum Press, 1981); Solar Energy Research Institute, *A New Prosperity, Building a Sustainable Energy Future* (Andover, MA: **Brickhouse, 1981);** M.H. Ross **and R.H.** Williams, *Our Energy: Regaining Control (New* York, NY: McGraw Hill, 1980); National Audubon Society, *The Audubon Energy Plan 1984 (New* York, NY: National Audubon Society, 1984); A. Meyer, J. Wright, and A.H. Rosenfeld, *Supplying Energy Through Greater Efficiency* (Berkeley, CA: University of California Press, 1983); E. Hirst, et al., *Energy Efficiency in Buildings: Progress& Promise* (Washington, DC: American Council for and Energy Efficient Economy, 1986); J. Goldenberg, et al., *Energy for Development* (Washington, DC: World Resources Institute, 1987).

[117] State of Michigan, "Michigan Energy Options Study," 1987. The study defined "technical potential" to be investments that competed with the short-run marginal costs of existing Michigan electric generation—3.27 cents per kWh—assuming a 3 percent discount rate on incremental capital. The reductions consisted entirely of improved efficiency in air conditioning, lighting, water and space heating equipment, refrigerators and freezers.

[118] Goldenberg, et al., op. cit., footnote 116, p. 59.

[119] Three components of household expenditures are distinguished: 1) rents, which includes not only rents paid but also imputed rents received by owner-occupiers; 2) household operations, which include such items as insurance, furnishings, and appliances; and 3) utilities, which include expenditures on energy and water.

Table 3-12.—Consumption Scenarios for Housing (billions of 1983 dollars)

		2005			
	1983	Trend 3%	Trend 1.5%	ALT 3%	ALT 1.5%
Mortgages & rents[a]	331	587[a]	465[a]	565[a]	429[a]
Household operations	139	307[b]	221[b]	302[f]	201[f]
Utilities	111	164	138	95	80
All PCE housing	581	1,058	824	962	710
Residential structures	152	224	202	224	202
Government	14	26	19	26*	19[e]
Total	747	1,336	1,063	1,240	949
Percent share of GNP	21.9	20.5	22.5	19.0	20.1

ABBREVIATIONS: PCE = personal consumption expenditure, ALT = alternative scenario, GNp = gross national product

[a] Does not include increase in housing equity. Real increases in total U.S. housing appears in the row labeled "residential Structures".

[b] Calculated using extrapolative techniques described in ch. 2.

[c] Assumes that the growth in mortgages and rents as a fraction of all consumption can be reversed and the ratio of spending in this category to total PCE spending falls to 1970 levels.

[d] Same as (c) except that the ratio remains frozen at 1983 levels.

[e] Includes maintenance services and commodities, tenant's insurance, house furnishings, and appliances.

[f] Same as spending in the Trend cases with an increase for assumed additional spending fOr high efficiency appliances (see table 3-13).

[g] Utilities include natural gas, electricity, household fuels, and water and sewer.

[h] See discussion of spending for gross private fixed investment.

SOURCE: Office of Technology Assessment, 1987.

table 3-1 3). The Trend projections for energy use are based on a U.S. Department of Energy forecast.[120] The Alternative scenarios assume rapid adoption of technology in building design and appliance design.

[120] U.S. Department of **Energy,** *National Energy Policy Plan Projection 2010* (Washington, DC: U.S. Government Printing Office, 1985).

Table 3-13.—Consumption Scenarios for Household Utilities

		2005			
	1983	Trend 3%	Trend 1.5%	ALT 3%	ALT 1.5%
Electricity	51	87[a]	69[b]	44[e]	36[f]
Natural Gas . .	29	26[a]	26[c]	14[e]	1If
Other Fuels . .	18	26[a]	18[c]	14[e]	8[f]
Water & Sewer.	13	25[d]	23[d]	25[d]	25[d]
Total ., ., .,111		164	136	97	81

ABBREVIATIONS: ALT = alternative scenario

a Based on National *Energy Policy Plan Projections to 2010, U.S. Department* of Energy (DOE), Washington, DC, 1985. Midrange forecast for the year 2005 increased to reflect the higher GNP growth rates used In the 30/0 Trend scenario. Electricity consumption was increased by 30/. to allow for an assumed increase in the size of housing units and an increase In appliance purchases and fuel switching.

b 1983 consumption increased in proportion to 2005/1983 increase in consumer units. Electric use per household assumed to decline by 8°A as the result of efficiency improvements (far below optimal levels given available technology). Electricity use increases because of an assumed shift from "other fuels." See next note.

c 1983 natural gas and "other fuel" use increased by 2005/1983 increase in number of consumer units. No efficiency improvements assumed. 25% of "other fuel" use shifted to electricity.

d Projected using CES consumption data (see ch. 2).

e 1983 consumption scaled by growth in consumer units. Efficiency improvements computed separately for units in 2005 that were standing in 1983 and units built between 1983 and 2005. The proportion of new and old units is calculated using the assumption that 1.5% of the 1983 stock is removed annually (following recent trends). For existing units, It is assumed that fuel use per unit can be reduced by 35°/0 (primarily through appliance replacement). A combination of improved construction and better appliances is assumed to reduce consumption per new unit by 500/..

f Same as (e) except that new units are assumed to have consumption reduced to.3 average 1983 levels and existing units 0.58. It Is further assumed that 25°/0 of the "other fuel" consumption is shifted to electricic demand with a net improvement of 0.75.

SOURCE: Office of Technology Assessment, 1987.

TRANSPORTATION

America's need for transportation is as diverse as the U.S. population. There can be no objective measures of progress in transportation, but most Americans are likely to agree that a successful system is one that:

- provides as much freedom of movement as possible—allowing individuals to go where they want, when they want, at the lowest possible cost in time and money;
- provides mobility to the widest possible range of individuals—including the young, the elderly, and the physically handicapped;
- enables efficient supply of the varied goods and services consumed by households;
- increases the number of attractive areas for locating homes and businesses, thereby reducing pressures to increase the price of scarce land while increasing access to needed outdoor recreation areas; and
- has few unattractive "externalities," such as making the Nation vulnerable to foreign oil suppliers, degrading air quality, contributing to deaths and injuries, or creating unattractive landscapes.

For three generations, American criteria for quality transportation have translated into a love affair

with the automobile. In 1983, 94 percent of all personal spending for transportation and 87 percent of all government spending for transportation was spent on automobile travel and highways. About 77 percent of all trips (and person-miles) are taken in automobiles or light trucks.[2] An ability to drive is as necessary for a comfortable life in most suburban areas as an ability to walk. Women, particularly those needing to work, are now comparable to men in the proportion of licensed drivers. While only 74 percent of working women had licenses in 1969, 91 percent had them in 1983 (see table 3-14).

The spending estimates actually underestimate the real cost of automobiles, if only because the opportunity cost of extensive "free" parking spaces provided by businesses is not counted in this total; nor are the costs of garages that are included in home prices. In some areas, these parking costs may be nearly as high as the total cost of purchasing automobiles.

Transportation "needs" are dictated by neighborhood and city design, and by the physical relationships between residential areas, areas of employment, schools, and shopping areas—as well as by the details of transportation hardware. A well-designed community may provide access to a multitude of goods and services with few or no vehicle trips. Yet it is obvious that the great appeal of the American system of transportation is that it allows an individual mobility even if she lives in such a community. Attempts to develop self-contained, planned communities lacking this type of freedom and mobility are not likely to do well in American markets. Retirement communities are an exception created by necessity. One of the challenges of transportation technology should be to find a way to maintain the greatest possible freedom of mobility for the elderly and other disadvantaged groups.

The Nation's personal transportation system is mature and surprisingly stable. In spite of radical swings in the price of gasoline, the real cost of operating an automobile has not changed significantly in a generation. At the same time, increased vehicle ownership has meant that auto travel has captured a growing fraction of personal income. The system obviously serves the country well.

There have, of course, been many improvements. Compared with the system that operated in the 1950s, the existing automobile fleet is more differentiated, more reliable, more efficient, and safer. While emissions per vehicle have been reduced by law, the rapid growth in driving has made it difficult for many regions to meet goals established for air quality. Sharp increases in the percentage of adults licensed to drive, and in the number of vehicles per driver (the ratio is now 98 vehicles per 100 drivers) have allowed Americans enormous freedom in personal movement—used to adapt to changing job and housing locations. The "personalization" of transport services has increased to a point where two-thirds of all trips (and 86 percent of all commuting trips) are made alone.

Many of the externalities associated with conventional automobile transportation remain unresolved. A system so completely dominated by automobile travel can leave the elderly, the handicapped, and other groups without acceptable transportation alternatives. More than 13 percent of all U.S. households still own no personal vehicle, greatly limiting their access to an economy dependent on automobile transport.

Heavy dependence on petroleum could place the entire economy at risk in the mid- 1990s and beyond. In spite of the fact that the energy efficiency of transport has increased sharply since the early 1970s,

[2] U.S. Energy Information Administration, Residential Transportation Energy Consumption Survey, "Consumption Patterns of Household Vehicles. 1983, "

Table 3-14.–Personal Transportation, 1969.83

Categories	1969	1977	1983
Licensed drivers/persorr	0.52	0.60	0.64
Licensed drivers/employed adults:			
Females ., ...	0.741	0.875	0.911
Males	0.935	0.954	0.958
Licensed drivers/unernployed adults':			
Females ., . .	0.549	0.629	0.642
Males, : : : :	0.648	0.736	0.760
Miles driven per driver (thousands of milw/year)			
Females.	5.41	5.94	6.38
Males. ., ., : : : : :	11.35	13.40	13.96
Vehicles/licensed driver	0.70	0.94	0.98
Vehicles/person	0.37	0.56	0.63
Person-trips/person	740.00	990.00	980.00
Person-miles/person (000s)	7,12	8.82	8.48
Miles/trip ., : :	9,67	8.87	8.68

SOURCE: U.S Department of Transportation, Federal Highway Administration, *1983-1984 Personal Transportation Study Nationwide,* Volume 1, August 19aa, p 11

other parts of the economy have either done a better job of improving efficiency or have managed to shift to other energy sources. Transport consumed about half of all petroleum used in the United States in 1960. In 1986, transportation used 63 percent of all U.S. petroleum consumed—more oil than the United States produced in that year. Automobiles and light trucks alone are responsible for 40 percent of U.S. petroleum consumption.[122]

Without some fundamental change in automobile petroleum use, demand can be met only by increasing imports to levels higher than they were during the peak period of the 1970s, at a time when Middle East producers will have a much higher fraction of all producing capacity than they did when OPEC (Organization of Petroleum Exporting Countries) was formed. Progress will need to begin soon if any reform is to have an effect in 15 years.

Apart from dangerous dependence on foreign oil imports, transportation presents the economy with a series of problems that have proven difficult to resolve. In most areas, automobiles and other vehicles are responsible for the bulk of air quality problems, At least 30 major cities are not likely to meet 1988 air quality goals established in a 1977 congressional amendment to the Clean Air Act.

Fatalities and injuries resulting from automobile and other forms of transport have fallen, but not as rapidly as other forms of-accidental death. Motor vehicle accidents accounted for more than 45,000 fatalities in 1985, and are the third largest cause of death in the United States and the leading cause of death for young males. The greater differentiation of vehicles on the road may have contributed to the problem of safety. Rule changes permit increasingly large trucks on public highways at the same time that automobiles are decreasing in size.

Trends in Personal Transport

The average American (man, woman, and child) now travels about 13,500 miles a year (see table 3-15). The average adult male spends 90 minutes a day traveling and women spend more than an hour a day (see table 3-16). The amount of travel depends on the region and the type of household. Distances and time in travel are increasing slowly.123 Measured as a percentage of nondefense purchases, public and private spending for transportation has remained surprisingly constant for more than a generation. The mix of spending for transportation services has, however, changed slowly over time (see table 3-17). A slow increase in spending for personal transport has offset a decline in government spending resulting primarily from the steady drop in new State and local highway construction.

But do these changes indicate progress or the lack there of? While transport can be an end in itself, it is mostly a means to an end. Does increasing per capita spending for transportation mean that additional or qualitatively new services are being provided and that Americans are enjoying more mobility, or does it mean that more time and money are being spent to procure the same set of transportation services?

Table 3.15.—U.S. Per Capita Passenger Travel in 1984

Mode/vehicle type	Miles per person
All modes	**13,566**
Personal transport	**10,815**
Automobiles	**8,884**
Motorcycles	**58**
Personal light trucks	**1,873**
Buses	**517**
Transit	**79**
Intercity	**113**
School	**325**
Air	**1,065**
Certified route air carrier	**1,013**
Other	**52**
Rail	**61**
Intercity	**18**
Transit	**43**

SOURCE: Calculated from U.S. Department of Energy, Office of Transportation Systems, *Transportation Energy Data Book,* Oak Ridge National Laboratory, ORNL-6325, edition, April 1967, table 1.16.

Table 3-16.-Minutes Per Day Spent in Travel

	Men		Women	
	1975	1985	1975	1985
Work Travel	25	31	9	17
Family Travel	33	31	33	33
Leisure Travel	27	33	21	23
Total	85	94	63	73

SOURCE: John P. Robinson, "Trends in Americans' Use of Time: Some Preliminary 1975.1965 Comparisons," Survey Research Center, University of Maryland, December 1966.

[122] P.D. Patterson, "Analysis of Future Transportation Petroleum Demand and Efficiency Improvements," paper delivered at the IEA Energy Demand Analysis Symposium, Paris, Oct. 12-14, 1987.

[123] L.D. Burns, *Transportation, Temporal, and Spatial Components of Accessibility* (Lexington, MA: Lexington Books, 1979).

Changing demographics, such as the decline in family size, the growth of multiple-worker families, the suburbanization of job location, and changing lifestyles all translate into different transportation needs. Shrinking household sizes and an increase in the percentage of women in the work force (women tend to work closer to their homes than men) has actually led to a decline in miles of commuting per household (see table 3-18).

The harried life of many families is reflected in changed use of personal transportation. Table 3-18 shows a sharp increase in family travel for shopping and other purposes and a decline in recreational travel distances.

Continued suburban development also shapes travel needs. Even in 1970, less than 4 percent of all commuting went from suburban areas to the central business district.[124] By 1980, 60 percent of the 31 million commuters in the Nation's 25 largest urban areas lived in suburban areas and traveled to jobs outside the central business district. About half of all commutes in other metropolitan areas involved such trips. There are, of course, significant regional differences. While older cities such as San Francisco and Minneapolis still have vigorous downtown areas, many cities that have expanded rapidly in the past decade have several centers rather than one.

Table 3-17.—U.S. Consumption of Transportation (in biiiions of current doiiars)

Type of purchase	1955	1965	1985
Personai transport	35.8	62.8	357.7
Household spending	31.9	55.3	329.8
New autos	13.8	21.4	86.9
Used autos	1.9	3.8	34.5
Other motor vehicles	0.5	1.3	31.3
Tires, accessories	1.6	3.5	25.0
Repair, washing	3.9	7.6	48.3
Gas and oil	8.6	14.8	92.6
Bridge, tunnel fees	0.2	0.5	1.3
Insurance	1.4	2.4	9.9
Public spending	3.9	7.5	27.9
Highways[a]	3.9	7.5	27.9
Urban public transport	1.9	2.1	8.7
Household spending	1.9	2.0	7.1
Transit	1.3	1.3	3.5
Taxicab	0.5	0,6	3.1
Commuter rail	0.1	0.1	0.5
Public spending	0.0	0.1	1.6
Transit	0.0	0.1	1.6
Other transport	1.1	2.5	26.2
Household spending	1.0	2.0	20.1
Other rail	0.4	0.3	0.6
Bus	0.3	0.4	1.2
Airline	0.3	1.3	18.3
Travel agents, airport, bus, etc.	0.0	0.1	1.9
Public spending	0.1	0.5	6.1
Water & air[a]	0.1	0.5	5.9
Rail[a]		0.0	0.2
Total transportation	38.9	67.4	392.6
Household	34.8	59.3	357.0
Public	4.1	8.1	35.6
Percentage distribution of spending:			
Personal transport	92.O%	93.2%	91.I%
Household	82.0	82.0	84.0
Public	10.0	11.1	
Urban public transport	4.9	3.1	2.2
Household	4.9	3.0	1.8
Public	0.0	0.1	0.4
Other transport	2.8	3.7	6.7
Household	2.6	3.0	5.1
Public	0.2	0.7	1.6
Total	100.0	100.0	100.0

[a]Spending in these categories has been allocated between finaldemand(shown here)andspending bygovernment that supports intermediate use oftransportation. The support of intermediate transportation is counted in the "government not elsewhere classified" amenity category.Spending is partitioned by the ratio between final commodity demandandtotal commodity output shown for air, water, and rail in the 1977 *input/output* tables (U.S. Department of Commerce, Bureauof Economic Analysis). Highway spending attributed to final demandwaa calculated by taking total highway spending and multiplying bythe ratio between user fees collected from private automobiles to all highway user fees,

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," Survey of Current *Business,* historical diskettes, tables 2.4, 3.15 and 3.16.

[124]Urban Mass Transportation **Administration Technical Assistance Program, Joint Center** for Policy Studies, *Demographic Change and Recent Work(rip Travel Trends* (UMTA-DC-09-7009), **Washington, DC,** February 1985.

Table 3-18.—Vehicle Miles of Travel Per Household in Personal Vehicles

	Miles traveled in 1983 (thousands)	Percent of 1983 total	Percent change 1969-1983
Work	4.03	34,4	–22,0
To or from work	3.54	30.1	–15.4
Work related business	0.50	4.2	–49.8
Family and personal	3.56	30.3	47.9
Shopping	1.57	13.3	68.7
Other	1.99	16.9	34.9
Civic, educational, and religious	0.48	4,1	–20,9
Social and recreational	3.53	30.1	– 13.7
Vacation	0.25	2.1	–22.1
Visit friends/relatives	1.59	13.5	6.1
Pleasure driving	0.13	1.1	–65.4
Other	1.56	13.3	– 17,4
Other	0.14	1.2	–8.7
Total	11.74	100.0	–5.5

SOURCE: U.S. Department of Transportation, Federal Highway Administration, 1983-1964 *Nationwide* Personal *Transportation Study,* vol. 1, Washington, DC, August 1966, table 5-2.

Table 3-19 shows how different commuting needs translate into commuting times. The time people are willing to invest in commuting seems to have changed relatively little in a hundred years. Commuters appear to put a comparatively low value on commuting time for the first 20 minutes and approach psychological limits after 45 minutes. The availability of car telephones, sound equipment, and other amenities in vehicles does not appear to have changed the basic formula. In 1980, only 10 percent of all workers commuted more than 44 minutes. [125] Ironically, higher income workers have slightly greater average commuting times and travel longer distances to work.

On average, commuting distances have increased somewhat, while commuting times have decreased. Severe congestion problems plague many major cities. Commuting times increased in metropolitan areas with populations over 3 million between 1969 and 1983. Congestion was identified as a major problem by residents polled in San Francisco, Atlanta, Phoenix, Washington, DC, and a dozen other urbanized areas.[126] Undoubtedly, some of the difficulty results from the growing reluctance of Federal or State governments to pay for highway improvements.

[125] U.S. Departments of Commerce and of Housing and Urban Development, *Annual Housing Survey: 1980, Part F—Energy Related Housing Characteristics* (Washington, DC: U.S. Government Printing Office, 1983), p. 76, in Anthony Downs, "Impacts of Rising Traffic Congestion on the Location of Activities within Metropolitan Areas, " April 1985.

[126] R. Cervero, op. cit., footnote 99; Robert Dunphy, "Urban Traffic Congestion: A National Crisis?" *Urban Land, vol. 44, No. 10, 1985,* pp. 2-7.

Table 3-19.—Commuting Times by Home and Job Location in 1980

Type of trip	Average travel time (minutes)
Living in a central city and commuting to:	
CBD [a] of central city	**24.9**
Central city outside the CBD	**20,0**
Outside central city	26.4
Living in the urban fringe and commuting to:	
CBD of central city	**35.1**
Central city outside the CBD	27.2
Outside central city	18,8

a CBD-Central Business District,

SOURCE: U.S. Department of Transportation, Urban Mass Transportation Administration, *Demographic Change and Recent Worktrip Travel Trends (UMTA-DC-09-7009),* Washington, DC, February, 1985, p. 36.

New freeway construction has all but disappeared. User fees no longer cover highway construction and maintenance costs. 127 Between 1930 and 1950, the length of paved highways per person in the United States climbed from 30 feet to 70 feet, but highway length has scarcely matched population growth since the 1960s.128 Between 1970 and 1985, the number of automobiles in the United States increased 54 percent but the number of miles of roads and highways increased only 4 percent.129

Not surprisingly, the longest commutes were made by those living in an urban fringe and working in a central business district (35.1 minutes in 1980) while the shortest trips involved the growing number of individuals living in the urban fringe and commuting outside a central city (see again see table 3-19). The longer trips associated with shopping and other personal business (again see figure 3-18) are undoubtedly also traceable to the longer trips required for such purposes in suburban areas. Denver, for example, has six shopping centers that have more retail sales than the downtown area.

Commuting patterns are also becoming complex as women enter the work force. Many of the differences between male and female driving habits are beginning to disappear. Women, particularly younger women, are getting driver's licenses in nearly the same percentages as men (again see table 3-14) and are driving greater distances. Working women make "chained" trips, involving a trip to a child care center and perhaps a shopping area before and after work.130 Women who both work and live in suburbs have a 75 percent higher probability of handling shopping and child care than men. In spite of the increased travel for working women, women still drive half as many miles as men.

[127] " Automobile Facts and Figures," in U.S. Congress, Office of Technology Assessment, "Transportation, " sector study, Washington, DC, 1987.

[128] Calculated from data in the U.S. Bureau of the Census, *Historical Statistics of the United States, 1776-1970* and the *Statistical Abstract of the United States 1987,* op. cit., footnote 39.

[129] *Statistical Abstract of the United States 1987,* op. cit., footnote 39.

[130] William M. Michelson, "The impact of Changing Women's Roles on Translation Needs and Usage," prepared for the U.S. Department of Transportation, Washington, DC, September 1983; Julio Perez-Cerezo, *Women Commuting to Work in the Suburbs* (Berkeley, CA: University of California, Department of City and Regional Planning, 1985).

With the need for individual transport increasing, the number of cars added in the United States has far exceeded population growth for nearly a generation. There is nearly one personal vehicle for every licensed driver in the United States, and 0.63 personal vehicles for every American. The average American goes on nearly 1,000 trips and travels 8,480 miles in some kind of personal vehicle each year. There does, however, seem to be some saturation. Between 1969 and 1977, trips became somewhat shorter even though both trips per person and miles per person increased. Some of this was attributable to an increase in the number of vehicles available to each family. Since 1977, however, there has not been a significant increase in either trips or miles traveled per person.

The preeminence of the automobile is challenged only by air travel for very long trips; interestingly, however, trips by air have grown largely as a substitute for rail and bus journeys. Nearly 84 percent of all trips longer than 100 miles were still made in cars in 1982—down surprisingly little from a 90 percent share in 1960.

Air travel (including business as well as private passenger travel) has grown steadily, from about 4 percent of all miles traveled in 1960 to nearly 15 percent in 1984.[131] The growth in share of trips has come largely at the expense of trips made by rail, bus, and other forms of public transport. The share of land-based public transport for inter-city and intracity trips has declined steadily in recent decades; in some cases, travel by these modes has declined in absolute terms. Deregulation of air travel has reduced services to many smaller towns and cities, with the effect that some trips by air are now taken by other means or, at a minimum, involve a highway trip to a neighboring airport. The effect is important since many of these relatively small centers have experienced rapid population growth in recent years. Future growth in air travel may depend on techniques to reduce total travel time, including the time needed to reach the airport.

While air travel costs have declined and productivity has increased, the air transport system also appears to be headed for stagnation. The performance of the air transport system cannot be decoupled from that of the highway system, since the efficiency of air travel is reduced significantly by delays and congestion encountered reaching an airport by automobile or other means. Including travel time to an airport, travel time between cities less than 500 miles apart has not changed significantly in a generation. Travel time between New York and Philadelphia, for example, required an hour and fifty minutes by train and an hour and thirty minutes by air in 1986 (including travel time to the airport).

Studies indicate that 6 to 10 major U.S. airports either already face severe bottlenecks due to lack of "curbside" for connecting highway to air travel networks, or will face such problems in the future. This lack of progress is ironic, given the extremely high value that air travelers apparently place on their time. Other reports suggest that a large group of air travelers are willing to pay $30 to $60 per hour of time saved in bus travel to or from an airport. 132

Looking to the Future

Virtually all attempts to make improvements in the performance of the transportation system have met with failure. Public transportation has lost ground in spite of massive subsidies and a growth of urban workers during the past decade.

New technologies can help in a variety of ways. The near doubling of automobile fuel economy between 1974 and 1984 had a major effect on world oil markets. With fuel economy at 1974 levels, the United States would now be importing approximately $40 billion more oil each year. Innovations in vehicle designs could triple fuel economy by the end of the century.

A variety of other technologies could work to improve real system performance. Methanol, made from natural gas, coal, urban waste, or biological materials, could provide an acceptable substitute for petroleum by the next century if steps to plan for the conversion are taken in the near future.

Significant improvements in the net performance of the system, however, require attention not just to the technology of vehicles but to the entire transportation network. Fuel efficiency improvements can

131 U.S. Bureau of the Census, *Statistic/ Abstract of the United States 1986* (106th cd.), **Washington, DC, pp.** 26 and 591.

132 Greg W. Harvey, "A **Study of Airport** Access Mode Choice," *Journal of Transportation Engineering, vol.* 112, *No. 5,* September 1986, pp. 525-545.

easily be offset by heavy congestion and long commutes. New vehicles may require new kinds of guideways. Real productivity changes in transportation may require zoning permits and other mechanisms influencing the design of communities. Communication technologies could provide better traffic control, and possibly give drivers better guidance about which routes are least congested. Progress in these areas depends on a skillful mix of public and private decisions.

Conventional public transit systems do not appear to offer much hope as an alternative to private vehicles. Even in the best of circumstances, the systems work well only during periods when there is a high demand for movement along a well defined corridor. But with the complex patterns of living and working emerging in today's suburban society, such corridors are increasingly rare. Uncertainty about patterns of economic growth increases the risk of investments in relatively inflexible systems along fixed routes.

The American distaste for the comparative inflexibilities and inconveniences of public transit is obvious. Between 1970 and 1980, real family income declined, the number of workers living in urban areas increased by 15 million, large new public transit investments were made in Washington DC, Atlanta, and San Francisco, and large operating subsidies meant that cost of public transit rose only 44 percent while the cost of owning and operating an auto increased 250 percent (gasoline prices tripled). Nonetheless, public transit ridership fell from 8.9 percent to 6.4 percent of journey to work, while the use of personal vehicles for the journey to work increased from 80.2 to 85.7 percent.

With the exception of systems like BART (the Bay Area Rapid Transit system in and around San Francisco), designed primarily to relieve congestion in areas where incomes are high, mass transit remains the option of last resort, and its use is virtually a measure of the extent to which groups are disadvantaged by the U.S. transportation system. The exceptions are those using the system to commute to a central business district, and people living in areas of the northeast (particularly New York) traditionally served with good transit. The average one-way travel time for workers using public transportation (42.2 minutes in 1980) was more than twice that of workers using automobiles (20.8 minutes). Nationwide, in 1980:

- 36 percent of transit riders lived in households with no auto available;
- blacks were three times as likely as whites to use public transit;
- 31 percent commuted into a central business district;
- 25 percent of workers living in a building with 50 or more housing units used public transport, while only 7,1 percent of workers living in detached single-family dwellings used public transport; and
- minorities, older workers, women, and the working poor were more likely to use public transit than other groups.

People with other options leave the transit system rapidly. Ridership has fallen as even the poor are able to purchase vehicles. The number of households with no vehicles fell from 20.6 to 13.5 percent between 1969 and 1983 (see table 3-20). Teenagers (sometimes considered a group disadvantaged by the auto-based transport system) actually reduced usage of public transport between 1970 and 1980.

Moreover, the labor problems associated with operating a system with morning and evening peaks, separated by very low densities, makes traditional transit systems uneconomical in many areas—particularly those experiencing the most rapid growth. Between 1960 and 1983, private spending on public transport other than air travel actually fell by 1.3 percent per year. Government spending for public transportation projects, however, increased rapidly during the period, even though the use of most public transit systems declined,

In many areas the bulk of these subsidies have benefited middle and upper income groups rather than the poor, though the poor tend to pay a greater

Table 3-20. -Vehicie Ownership by Households

Percent owning:	1969	1983	Percent Change
No vehicle.	20.6	13.5	–34.5
One vehicle	48.4	33.7	–30.3
Two vehicles.	26.4	33.5	26.9
Three or more vehicles.	4.6	19.3	319.5

SOURCE: ''Automobile Facts and Figures," U.S. Congress, Office of Technology Assessment, "Transportation," sector study, Washington, DC, 1987.

fraction of their incomes to subsidize the systems since most systems are paid for through non-progressive taxes.[133] Subsidies for transit systems have been justified by a desire to generate growth at suburban sub-centers. While this has worked in some areas, in others desired growth either has not occurred or has actually been opposed by local residents.[134]

There has, however, been a dramatic if poorly documented increase in alternative forms of public transport. Some are private systems serving specialized markets, such as limousines and vans serving hotels and airports. Others are supported at public expense. The State of California provides coupons to low-income and elderly people that can be used to purchase trips to shopping areas or health centers in their community; taxi companies offer the State volume discounts. It must be recognized, of course, that one of the advantages of para-transit alternatives to conventional public systems is the difference in wage rates. Traditional bus and transit jobs, at least in larger cities, tend to be unionized and pay an average of $11 to $13 per hour ($18,000 to $25,000 per year). Para-transit operators average $4 to $6 per hour ($12,000 to $15,000 per year).[135]

Choices and Consequences

Is it then possible to envision a transport system, based primarily on personal vehicles, that could offer greater flexibility, diversity, and freedom of choice to the American public? The answer appears to be "yes, but . . . ." Changes permitting real improvement in mobility through greater differentiation, cost reduction, or speed will require basic changes in the design of guideways, control systems, and parking strategies. Where feasible, they may require new strategies of community design to minimize travel needs and integrate pedestrian and non-pedestrian travel.

The emergence of such systems will obviously require a mixture of public and private investments. They will also require coordinated planning and a long time to implement. Highway and air travel are particularly dependent on Federal, State, and local investments in infrastructure, signaling and traffic control, and terminals; fundamental change can be undertaken only through a combination of public and private decisions.

The future seems to belong to a personal transportation system capable of providing the personal and flexible service demanded by a rapidly shifting economy. Table 3-21 illustrates the difference between car ownership and car usage patterns. While there has been some differentiation in car size in recent years, a large mismatch between vehicle capacity and vehicle use remains. Less than 3 percent of all cars on the road are designed for two passengers (mostly Corvettes, Fieros, and other sports cars). More than 96 percent of all work trips, 87 percent of car trips of all kinds, and 83 percent of all vehicle miles traveled could have been taken in a two-passenger vehicle in 1983. Six-passenger cars are full on 0.5 percent of all trips. The increased individual mobility resulting from greater vehicle ownership has lead to a steady decline in vehicle oc-

Table 3-21 .—Use and Ownership Patterns of Personal Vehicles in the U.S. Fleet, 1983 (in percent)

	Number of trips				Vehicle miles traveled	
Number of occupants	Earning a living 1977	1983	All purposes 1977	1983	All purposes 1977	1983
One ., 81	*.2%*	*86.4%*	*59.6%*	*65.7%*	51 .7%	57.4%
Two. 94.6	96.2	84.3	872	79.4	83.1	
Three ., ... 98.0	98,8	92.6	94.6	89.1	91.4	
Four 99.2	99.5	97.0	98.0	95.3	96.6	
Five. 99.6	99.7	98.8	99.2	98.1	98.7	
Six & up. .. .100,0	100.0	100.0	100.0	100.0	100,0	

How to Read the Above: Of all U.S. automobile trips to work made in 1977, 81.2 percent were made with one person in the car, 94.6 percent were made with two people, etc. In the same year, 51.7 percent of all vehicle miles traveled were made with one person in the car.

Size of U.S. automobiles by size (in percent):

Size class	1985 stock	1985 sales	1986 sales
Two-seater	**2.1 %**	**3.3%**	**2.5%**
Minicompact	**4.8**	**1.0**	**1.7**
Subcompact	**...22.7**	**22,0**	**22.4**
Compact	**.....17.1**	**32.7**	**33.2**
Midsize.	**..28.4**	**28.0**	**26.9**
Large ., ...	**.24.8**	**13.0**	**13.2**

SOURCE: For type of trip, see U.S. Congress, Office of Technology Assessment, "Transportation, " sector study, Washington, DC, 1987. For stock and sales, see U.S. Department of Energy, Office of Transportation Systems, *Transportation Energy Data Book,* Oak Ridge National Laboratory (ORNL-6325), edition 9, April 1987, pp. xvii and 2-29.

[133] M. Weber, "The BART Experience—What Have We Learned, " Monograph No. 26, Institute of Urban and Regional Development, University of California, Berkeley, CA, 1976.

[134] Ibid.

[135] "Top Hourly Wage Rate Summaries Update," American Public Transit Association, various years; reports of various State public utilities commissions.

cupancy. On average, more than two people ride in vehicles only for trips longer than 20 miles, when families with two adults and young children travel for religious, social, or recreational purposes, for families with young children, or for family business. '36

There appears to be a large potential market for vehicles designed to serve the needs of those traveling alone or in pairs. Actual purchasing decisions, of course, are based on the assumption that the vehicle may need to be used occasionally to carry large luggage loads or a large number of people. With many cars available, however, large families use large cars primarily for "surge" capacity. Given alternatives, or faced with problems resulting from fuel costs or congestion, many individuals might elect to purchase vehicles better matched to their dominant transportation needs and simply rent trucks or larger automobiles for the rare occasions when they are needed.

Travel in pick-up trucks is an extreme example of poor capacity utilization, since most are driven as personal vehicles with no loads. Pick-ups accounted for 14 percent of all personal vehicles in 1983 and slightly more than 14 percent of all vehicle miles.1[37] Nearly 57 percent of the 33.8 million trucks on the road in 1982 were used principally for personal trips.[138] Measured in vehicle miles traveled, use of light trucks is growing 3.4 times faster than use of automobiles.lsg

Considering the Possibilities

Scenarios for the future presented here are all built on the assumption that autos will continue to dominate personal transportation markets in the United States. The Trend scenarios differ from the Alternative scenarios principally by assuming that in the Alternatives, there will be greater product differentiation and higher fuel efficiencies, and there will be a rationalization of the location of airports and systems for transferring from aircraft to other forms of transport.

Automobile travel today depends exclusively on a large, general purpose vehicle operated on highway lanes up to 12 feet in width and requiring parking spaces sized to the vehicle at all destinations. A future system might seek to tailor vehicles more closely to trip functions. Work trips could be undertaken in a small, high velocity vehicle designed for one person but with room for one other person or some baggage. The vehicle could be inexpensive (as little as $2,000), run at 100 miles per gallon, and be parked in a small space. The vehicle could be designed to have good ride characteristics and handling. General Motors has such a vehicle in an advanced stage of development and several foreign producers are considering alternatives.

While the vehicle could operate on standard highways with special lanes and parking spaces carved out of existing facilities—increasing capacity because of the smaller vehicle size—it would be preferable to develop special roads for these small vehicles. Separate lanes and fly-overs could be much less expensive to construct than standard highways, since the lanes could be half the width of lanes built for conventional traffic and would require significantly less structural strength if they did not need to carry heavy trucks.

Even with the conventional car fleet, fuel efficiency can be improved substantially within acceptable cost ranges if a market for efficiency develops. Table 3-22 indicates the kinds of vehicles in testing. Fuel economies as high as 98 miles per gallon are possible even for comparatively roomy vehicles capable of carrying 4 to 5 passengers. '40

A "neighborhood car" with associated infrastructure could be developed for trips that did not require high speed travel. An inexpensive vehicle, designed for low-speed operation over relatively short distances, could improve the attractiveness of neighborhoods and could significantly increase the mobility of the elderly, the very young, and households not able to afford a conventional vehicle. Protected operating environments could be fitted into local street networks to permit safe operation. The vehicles could be highly efficient, use a variety of non-petroleum based fuels, and be relatively non-polluting.

An illustration of some alternatives for future car transport is given in table 3-23. This table explores

[136] "Transportation," op. cit., footnote 127.

[137] Ibid. pickups traveled an average of 10,550 miles per year, while automobiles average 10,055 miles per year.

[138] U.S. Department of Commerce, Bureau of the Census, 1982 Census of Transportation, "Truck Inventory and Use Survey."

[139] Patterson, op. cit., footnote 122.

[140] See Debby Blevis, *Preparing for the 1990s: The World Automotive Industry and Prospects for Future Fuel Economy Innovation in Light Vehicles*, Federation of American Scientists, January 1987,

Table 3=22.—Fuel Economy of Test and Prototype Vehicles

	Fuel economy (miles/gallon)	Maximum power (HP)	Curb weight (pounds)	Capacity (persons)
Commercial:				
1986 Honda CRX	54	60	1,700	2
1986 Chevy/Suzuki Sprint	57	48	1,500	4
1985 Ford Escort[d]	55	52	2,100	5
Prototype:				
VW Auto 2,000 [d]	66	60	1,700	4-5
Volvo LCP 2,000[M]	69	60/90	1,600	2-4
Renault EVE[d]	70	50	1,900	4-5
Toyota Compact[d]	98	56	1,400	4-5

NOTES: For **U.S. vehicles, efficiencies use EPA combined fuel economy. European and Japanese prototype data were converted to EPA test values using conversion factors recommended by the International Energy Agency. Unless otherwise indicated, the vehicles use gasoline as a fuel, (D) indicates a diesel vehicle, (M) indicates a multi-fuel vehicle.**

SOURCE: Robert H. Williams, "A Major Role for Developing Countries in Promoting Super Efficient Cars," paper presented at San Palo Workshop, November 1985.

the cost implications of different types of car fleets and car ownership rates, and the implications for gasoline consumption.

Alternatives to conventional public transit can be developed that are more suited to the practicalities of modern commuting, and that provide improved mobility for transportation of the handicapped. It is likely that many of these alternatives would require lower social subsidies than systems built along traditional rail and bus systems. A key to the system would be the use of modern communication systems to dispatch a variety of vehicles to neighborhood stops, homes, or businesses on demand. Customers could choose from a variety of vehicles, ranging from demand-responsive taxis to para-transit services. Some of these options would offer subsidized fares to those needing assistance.

Jet aircraft are not well designed for short flights, and service for long-haul flights is becoming increasingly concentrated at hubs not easily accessible to many towns. Systemic performance could be improved with a better system of hubs, designed to provide service to a wide region through improved land vehicle and high-speed rail links as well as short-haul aircraft. The system's performance can be optimized only by considering all elements of the transportation link.

While these strategies could radically improve the performance of the transportation system, few of them depend on the development of radically new technologies. However, their introduction requires solutions to political and institutional problems that can be much more difficult to resolve than sophisti-

Table 3-23.—Background Assumptions for Transportation Scenarios

A. Use and Distribution of Vehicles

	Two person	Four person	Six person	Cars per adult[a]	Miles per adult
1983	2	38	60	0.65	8.6
2005:					
Baseline [c]	2	38	60	0.65	10.0[b] 8*6C
Case #I[d]	18	32	50	0.65	
Case #2[e]	44	28	28	o.75f	10.09
Case #3[h]	35	25	40	0.85[i]	10.0

B. Cost of *Vehicles*

	Total vehicle purchases (millions)	Average price/ vehicle ($1,000)	Total spending on new vehicles (1983=1)
1983	7.4	9.6	1.00
2005:			
Baseline	11 .3j	14.6[k]	2.32
Case #l	8.5[l]	8.5[m]	1.02
Case #2	10.8[l]	9.8[m]	1.49
Case #3	17.0	7.4[k]	1.77

C. Fuel *Efficiency of Vehicles*

	Total vehicle miles (billions)	Average miles per gallon"	Spending on gasoline (1983= 1)
1983	1,465	16.5	1.00
2005:			
Baseline	2,140	26.7	0.90
Case #1	1,840	44	0.47
Case #2	2,140	59	0.40
Case #3	2,140	53	0.45

[a] For these calculations, an adult is a person aged 16 to 75.
[b] Assumes that car miles per adult will increase at the rate prevailing from 1960 to 1984.
[c] Unchanged from 1983.
[d] Mi, changed to reflect the "extensive downsizing" case used by Melvyn Cheslow, *The Effect of Changing Household Composition on the Size Mix of New Automobile Sales: 1979-2000*, Evaluation Research Corp., Vienna, VA, May 1980.
[e] Following Cheslow, it is assumed that half of all single-person households and half of all children of driving age living at home use two-passenger cars, while the rest drive four-passenger cars.
[f] Assumes that cars per adult will increase at half the average rate of the period 1960 through 1975.
[g] Assumes that car miles per adult will increase at the rate prevailing from 1960 to 1984.
[h] Same mix assumptions as case #1, but assumes that 30 percent of households will also purchase a two-passenger car.
[i] Assumes that cars per adult will increase at the rate of the 1960s.
[j] Calculated assuming cars per adult shown above, and using mid-range forecast showing 214 adults and a 7 percent annual scrap rate per year.
[k] Assumes that new car prices increase at about 1970-1980 rate (recent price increases have been much higher).
[l] Calculated as in (j) above, only using a 5 percent scrap rate.
[m] Assumes that the real price of four- and six-passenger CarS do not change, and that a two-passenger car can be purchased for S3,000.
[n] Assumes that a two-passenger car can be built to achieve 90 mpg, a four-passenger car to achieve 40 mpg, and a six-passenger car to achieve 30 mpg

SOURCE: Office of Technology Assessment.

cated technical problems. Admittedly, building any of these systems would require fundamental changes in traditional design protocols and standards as well as extensive public investment.

New technologies could make significant contributions to conventional transportation systems, as well as facilitate the emergence of changes in transport strategies such as those outlined above. Information technology could play a critical role by optimizing the routing and dispatch of aircraft, public vehicles, and perhaps even personal vehicles, and by optimizing the performance of the vehicles themselves. Advanced control technologies could contrib ute to improved intercity automobile transportation, and many of the monotonous tasks of driving could thereby be simplified. The driver could be given information on speed limits, distances to exit ramps, and details about road conditions. Car status systems could warn the driver when there are problems in the car that need attention. Electronic safety systems could include night vision equipment, automatic braking, and collision avoidance systems.

Traffic data systems could provide information on traffic situations such as construction and accidents. Local highway departments could also benefit from such services since they could anticipate traffic patterns and demand. The data could be used to improve traffic signaling, and to suggest alternate routes that would distribute traffic more evenly. More effective integration of vehicles and the roadway would make driving easier and safer, and would also reduce travel times and costs. Technology could also play a key role by improving the energy efficiency of vehicles, increasing the safety of vehicles of all sizes, facilitating the development of low-cost and reliable sources of methanol or other non-petroleum fuels, and reducing emissions,

Constructing Scenarios

Expenditures on the Transportation amenity for several different scenarios are illustrated in table 3-24. In most cases, the Trends are derived using methods described in the previous chapter.

A departure from the projection of existing patterns is made for gasoline expenditures, to take into account the increasing share of the post-1973 higher fuel efficiency automobiles in the total vehicle fleet. For the 3 percent Trend scenario (the 2005 baseline case), it was assumed that miles per gallon rose to 27 compared with 17 in 1983, and that miles driven per adult rose by 16 percent over 1983 levels—roughly a continuation of an historical trend. The same fuel efficiencies are assumed for the 1.5 percent Trend case. Because of the lower growth rate, miles per adult are assumed to remain at the 1983 level.

The main difference between the Alternative high and low growth scenarios is the extent to which personal vehicles are purchased as a replacement for existing vehicles or in addition to them. These two scenarios are constructed from cases 2 and 3 of table 3-23, respectively. That is, the 3 percent Alternative scenario provides for a higher vehicle ownership, a car fleet with more large cars, and rather lower fuel efficiencies than the 1.5 percent case. Vehicle miles are similar in both cases. A comparison between the Trend and the Alternative scenarios suggests that increased mobility could be achieved in both the 1.5 and 3 percent cases at a minimal increase in vehicle expenditure and a reduction in gasoline costs.

Table 3-24.—Consumption Scenarios for Transportation (billions of 1983 dollars)

		2005			
	1983	Trend 3%	Trend 1,5%	ALT 3%	ALT 1.5%
Vehicles 109		192[a]	14oa	192[e]	162[f]
Vehicle maintenance . . 72		134[a]	98[a]	135[b]	114b
Gas and oil 90		81[c]	75[d]	41[g]	36[i]
Air fares 15		42[a]	22[a]	52g	23g
Other public transport 9		13[a]	10[a]	10h	7[h]
Total 295		462	346	430	346
Government purchases 48	91	66	130	94	
Total 343		553	412	560	440
Percent share of GNP. 10.1	8.5	8.7	8.6	9.3	

ABBREVIATIONS: ALT = alternative scenarlo, GNP - gross national product
a computed using extrapolative techniques described In ch. 2.
b scaled to vehicle purchase amount using the ratios calculated for the Trend case.
c Baseline cage in table 3-23
d Baseline efficiency from table 3-23 with an assumption that miles/adult increases at half the rate shown in the case where economic growth doubled.
e Based on case #3 in table 3-23
f Based on case #2 in table 3-23
g Assumed increase in expenditure due to a If) percent fall in airline prices, in contraat to stable prices assumed for Trend scenarios.
h $E_{xpen}dit_{ure}$ on public transport arbitrarily reduced by 10 Percent because of greater private mobility.
i Assumed to be 10 percent of total government purchases following trend of past decade.

SOURCE: Off Ice of Technology Assessment, 1987.

For air fares, it is assumed in the Alternative case that fares decline by 10 percent in real terms instead of staying constant as in the Trend scenarios, and that expenditures on air travel consequently increase. This higher level of expenditure in the 3 percent Alternative case is in line with historical trends. The relatively small expenditure on "other public transport" is assumed to be 10 percent lower in the Alternative case, in recognition of the greater private mobility that this scenario envisages. Government purchases of transport—roads, waterways, etc.—are assumed to rise in all cases due to the need to provide infrastructure for increased mobility. The increase in the Alternative cases is sharper, as special guideways for the new vehicles would be needed.

Total expenditures on Transportation under the 3 percent Alternative would therefore be about the same as in the 3 percent Trend scenario, but the Alternative allows for increased mobility. Greater mobility is also incorporated in the 1.5 percent Alternative case, but here expenditure would be some 7 percent higher than in the 1.5 percent Trend scenario. The income distribution scenarios suggest that people place a high priority on increased mobility as incomes rise.

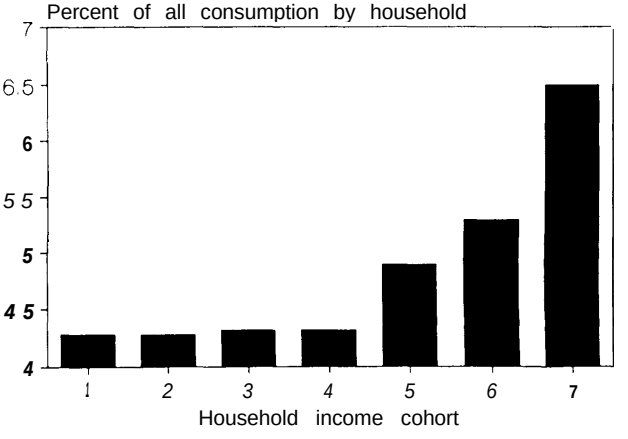
CLOTHING AND PERSONAL CARE

The category "Clothing and Personal Care" includes clothing and shoes, jewelry and toiletries, and the services associated with these commodities. This section focuses primarily on apparel, which represents roughly three-quarters of consumer expenditures in this area.

Both men and women demonstrate strong interest in the communicative quality of their clothing, and its ability to influence image, career advancement, and self-esteem. Personal spending on high-priced fashion products—which generally remain popular for only ten weeks before being replaced by another style—is increasing rapidly. [141]

Apparel retailers face the challenging opportunity of the coming of age of those born during the baby boom. With the oldest of this group now approaching 40 and the youngest just leaving college, this generation is entering its prime years of earning and spending, and it will have an enormous influence on apparel markets for the next 20 to 40 years.[142] Households headed by individuals between the ages of 35 and 54 have, on average, the highest household income, and spend more on apparel (and textiles) as a percentage of total expenditures than other households. As figure 3-7 demonstrates, the portion of household spending that goes to apparel increases with rising household income.[143]

Figure 3-7.-Apparel Consumption



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "'Consumer Expenditure Survey, 1982/83," unpublished data, 1988.

In constructing the different scenarios, two developments were taken into account. The first is price. Past prices fell in real terms, largely due to competition from low-cost producers abroad. Thus, import penetration ratios[144] rose from 8 to 14 percent between 1974 and 1982. If this trend continues, prices can be expected to remain low. If, on the other hand,

[141] U.S. Congress, Office of Technology Assessment, *The U.S. Textile and Apparel Industry: A Revolution in Progress—Special Report,* OTA-TET-332 (Washington, DC: U.S. Government Printing Office, April 1987), p. 16.

[142] U.S. Bureau of the Census, **Current Population** Reports, Series p-25, No. 986, *Projections of the Number of Households and Families: 1986 to 2000* **(Washington, DC: U.S. Government Printing** Office, 1986), **Table 2,** Series B.

[143] OTA, collected from "Consumer Expenditure **Survey, 1982/83, " U.S.** Department of Labor, Bureau of Labor Statistics, unpublished data, 1986.

[144] The ratio of imports to new supply (domestic product shipments plus imports); *Statistical Abstract of the United States 1987,* **op. cit., footnote** 39, **Table 1350.**

additional protection measures are introduced, a powerful stimulus to low prices will be removed.

The second development is technology, which could a have significant impact on clothing in two ways (see ch. 6 for more on this subject):

1. Information technologies in the clothing distribution chain could lower costs by reducing inventories and paperwork, improving productivity of the retail end and cutting the time from order to delivery. This is particularly relevant for domestic producers, whose comparative advantage lies in rapid responsiveness to market changes.
2. Production technologies—including computer-controlled apparel assembly, computer-assisted design and manufacturing techniques, and auto mated transfer of fabrics—could improve quality, provide a wider range of choice in fabrics and sizes at no extra cost, and enhance flexibility in response to consumer demand. It may soon be possible to use computer-generated images of customers wearing a wide variety of styles and fabrics and have the article made to exact individual measurements (in effect a return to individual tailoring) without a significant increase in cost or production time.

Table 3-25.—Consumption Scenarios for Clothing and Personal Care (billions of 1983 dollars)

		2005			
	1983	Trend 3%	Trend 1.5%	ALT 3%	ALT 1.5%
Clothing 167.4		378.9	238.7	446.0	281.0
Personal care commodities and services.	34.4	72.2	51.5	72.0	52.0
Total	201,8	451.1	290.2	518.0	333.0
Percent share of GNP	5.9	6.9	6.2	8.0	7.1

ABBREVIATIONS: ALT = Alternative scenario, GNP = gross national product.
NOTES: Trend scenarios use extrapolative techniques described in ch. 2. In the alternative scenarios, personal care goods and services are as in the Trend scenarios; for clothing, an increase in expenditure is assumed due to declining prices of about 15 percent.

SOURCE: Office of Technology Assessment, 1987.

For these reasons, there is considerable uncertainty about future trends in prices. Scenarios are described in table 3-25. In the Trend scenarios, spending was assumed to follow extrapolative techniques discussed in the previous chapter. In the Alternative scenarios, it is assumed that prices fall by about 15 percent, which is still less than in the past. As a result, expenditures on clothing rise substantially above the trend levels. Total Clothing and Personal Care expenditures in the Alternatives would reach 7 and 8 percent of GNP, compared with 6 and 7 percent in the Trend scenarios.

EDUCATION

Defining Demand for Education

If there is anything certain about the future of the U.S. economy, it is that the demands on the Nation's educational system will increase. While it is flatly impossible to predict precisely which skills will be needed in a successful future economy, all evidence suggests that a nation whose wealth depends increasingly on the ability to develop and exploit technical innovations, and on its ability to respond quickly to changing market conditions, will need a workforce that is itself adaptable and flexible. This flexibility requires workers capable of identifying what it is that they need to know in confusing circumstances, and quickly teaching themselves what needs to be learned. Continuous learning is already a major part of the job description of many Americans, and the demand for learning can only increase. Ironically, increased use of information technology is also likely to increase rather than decrease the need for people that can work as a member of a team assembled from individuals with diverse backgrounds and skills.

A system of education designed to provide the economy with the skills needed to prosper in the emerging world economy can be perfectly consistent with a broader set of objectives for the Nation's educational system: the development of a system that could allow all citizens to discover and enjoy the potential of their own intelligence, to have practical access to all knowledge, and to understand and celebrate the accomplishments of the human mind and spirit. This means much more than being able to design a better robot. It means being able to learn about how things work. It means being able to have

fun with the wit, the music, the images, or the ideas of people they will never meet. It means having an opportunity to understand the struggles and the compromises that produce free governments. It means increasing each person's freedom and capacity to grow and change. It means increasing each person's capacity for enjoying leisure and retirement.

The correlation between education and an ability to prosper in modern American society go far beyond an ability to get a good job. The strong correlation between education and measures taken to promote good health was noted earlier. Education is strongly correlated with an ability to avoid personal disasters (such as divorce, major unemployment, disability, eviction, or a sharp decline in family income) and an ability to recover from disasters once they occur. The effect is measurable even when adjustments are made to account for the effects of income, IQ, age, region, and race.[145]

America has, of course, always understood the links between education and national wealth and security. Concern about the quality of public education has always been a key part of the long-standing consensus about equal opportunity. Education translates an individual's theoretical right to political and economic freedom into practical powers. Changes in the structure of the national economy are likely to increase the burden on the Nation's educational system for all of these purposes. The burst of industrial expansion following the Civil War was paralleled by unprecedented national legislation establishing the Land Grant College system and setting aside "school sections" for homesteaders. In the 1950s, the Nation responded to the growing technological prowess of the Soviet Union with a massive National Defense Education program. The challenge faced today may be no less critical. The terms of international trade hinge increasingly on an ability to generate and capitalize on ideas, and on a work force trained well enough to adapt quickly to new requirements.

A fundamental difficulty in measuring progress—or the lack of progress—in education is the extraordinary difficulty of measuring the output in any useful way. The complex list of objectives stated above defy precise measurement. If anything, the problem is compounded as the kinds of skills required by the workforce become more abstract. A "skill" today means an ability to translate complex problems into solvable ones, an ability to find out what needs to be learned and to learn it, and an ability to absorb complex and often inconsistent information quickly. These skills are much more difficult to measure than basic bookkeeping, arithmetic, or memory skills. The perpetual problem of management in education is that the system tends to reward results that can be measured (and therefore make progress in what can be measured) while the most important products may go unmeasured. Developing adequate measurement techniques therefore becomes a critical priority for making progress in an educational system.

Developing a consensus on priorities is a difficult process and will require care and leadership. At present, there appears to be a significant gap between the expectations of the teaching profession and that of their clients. Schools are expected to cure social problems ranging from drug abuse to the shortage of babysitters—roles that professional educators do not always find comfortable. Statistics reveal a sharp increase in student interest in practical, job-related skills, and a declining interest in training not directly related to employment objectives. Job-related bachelor's degrees increased from 50 percent of all degrees granted in 1970/71 to 64 percent of degrees granted in 1982/83, while there were sharp declines in degrees granted in the humanities and basic physical and biological sciences.[146] Only 6 percent of the elementary and secondary teachers polled in 1984 thought that helping "students get good\ high-paying jobs" deserved the highest rating when given a list of objectives for education, while 46 percent of parents surveyed gave it the highest rating. '47

Trends in Inputs and Outputs

In 1985, the United States spent between 8 percent of its GNP on education (13 percent if corporate training costs are included). One American in three engaged in some kind of training or educational ex-

[145] G.J. Duncan, *Years of poverty Years of Plenty* (Ann Arbor, MI: Institute for Social Research, The University of Michigan, 1984), p. 26.

[146] U.S. Department of Education, Center for Education Statistics, *Digest of Education Statistics 1987* (Washington, DC: U.S. Government Printing Office, May 1987).

[147] Phi Delta Kappan, "The Gallup Poll of Teachers' Attitudes Toward the Public Schools" cited in U.S. Department of Education, *The Condition of Education* (Washington, DC: U.S. Government Printing Office, 1986).

perience during the year (see table 3-26). Education is not considered to be a form of investment or savings, yet it plainly serves a role as important as investment in plant and equipment. Table 3-26 also shows that spending for education may represent 40 to 80 percent of gross national investment in new plant and equipment, and perhaps twice an large an investment after depreciation (it is difficult to know how to depreciate an investment in education).

Spending patterns in education have shifted rapidly during the past few decades. A large increase in public spending for education during the 1960s and early 1970s was reversed in the mid 1970s as the baby boom generation left public schools. While statistics are poor, it appears that expenditure on other forms of education increased rapidly.[148] Approximately 23 million people over the age of 17, or 13.5 percent of all adults, took some kind of part-time adult education in 1983—nearly double the rate reported in 1957, Sixty percent of the courses were related to employment. Most adult students were relatively affluent, white-collar workers who had already received a good education. Adult education is paid for by individuals, the Federal Government, and private industry; government and industry expenditures could rise significantly, since more Americans will need to be retrained as new technologies enter the marketplace.

Despite these large expenditures, the record of the U.S. educational system is mixed. While it is undoubtedly possible to obtain a better education in the United States than virtually any other place in the world, the United States appears to let a larger fraction of its population fall through cracks in the system than many of its key trading partners. There are three different ways of measuring progress.

The first involves examining changes in achievement over time. The past 20 years have witnessed a steady increase in time spent in school. Thus the fraction of the school age population that received a high school degree grew steadily during the 1970s, and the number of people seeking higher education also grew quite rapidly. 149 With the decline in available financial support, the correlation between income and education is likely to grow. The percentage of young blacks enrolling in institutions of higher education actually fell between 1984 and 1985.150

It is much more difficult to measure the qualify of the education provided by the American system. Scores in the Scholastic Aptitude Test, designed to predict performance in college, suggest a decline in the educational achievement of high school graduates. Verbal scores fell steadily from 478 in 1963 to a low of 424 in 1981, but rose to 431 in 1985. Mathematical scores fell from 502 in 1963 to 466 in 1981, and are now at 475.[151] Part of the decline and subsequent increase in test scores may be due to changes in the number and type of students taking the tests.

Attempts to measure the quality of "literacy" among U.S. graduates has constantly been frustrated by an inability to define the term with any precision. The number of illiterate Americans is estimated to be between 20 and 60 million. This number increases by 1 to 2 million per year. [152] The growth results primarily from people dropping out of school (15 percent of Americans aged 20 to 24 had not completed high school in 1985), and from large numbers of immigrants. A recent survey of 3,600 young American adults aged 21 to 25 showed a striking range of practical competence (see table 3-27). Approximately 80 percent of all whites and 40 percent of all blacks were abIe to do simple sums if the problem was presented in a form familiar from school arithmetic tests. Only about 30 of the whites and 2 percent of the blacks taking the test, however, succeeded in solving problems that required taking a simple percentage. Very few people were able to translate a practical problem into quantitative terms.

[148]See, for example, ch. 6 of U.S. Congress, Office of Technology Assessment, *Information Technology and Its Impact on American Education*, OTA-CIT-187 (Washington, DC: U.S. Government Printing Office, November 1982).

[149]In 1980, only 17 percent of Americans 65-70 years of age had completed a year of college, compared with nearly 45 percent of the 25-29 year olds. The increased numbers participating in higher education in recent years is, however, the result of a rapid growth in the numbers of people entering two-year (rather than four-year) courses of study, with the aim of upgrading job skills rather than receiving a broad liberal education.

[150]*Digest of Education Statistics*, op. cit., footnote 146.

[151]College Entrance Examination Board, "National Report: College Bound Seniors," various years, reported in U.S. Department of Education, Center for Education Statistics, *The Condition of Education* (Washington, DC: U.S. Government Printing Office, 1986).

[152]The lower estimate is based on a 1982 U.S. Department of Census survey of the ability of Americans to understand information describing social services. The higher estimate was produced by Jonathan Kozol in his book *Illiterate America*. The material is cited in R. Deigh, "Curse it, Count it, Cure it. The Arithmetic of Illiteracy," *Insight*, Sept. 29, 1986, pp. 10-14.

Another sign of defects in literacy can be found in the growing need for remedial programs conducted both by employers and by universities. In 1983 to 1984, remedial math courses were taken by 25 percent of all students entering colleges and universities, remedial writing by 21 percent, and reme-

Table 3-26.—The U.S. Education System in 1985

	Spending (billions)	Enrollment (millions)
Primary & secondary	**157**	**46.6**[b]
Household	**14**	
Government	**143**	
Higher education	**65**	**12.3**[b]
Household	**16**	
Government	49	
Other	41	23.0'
Personal spending on education & research	14	
Public libraries & other	9	
Labor training & services	5	
Department of Defense[d]	18[e]	2.0[e]
Business & government training[f]	30-210	
Formal government training	59	
Formal corporate training	259	
Informal training	50-180[h]	
Total	293-472	81.9
Household	43	
Government	232-254	
Corporate	66-175	
For comparison:		
Gross national product	$4,010	
Gross private domestic investment	642	
Net private domestic investment	205	
U.S. population		239

[a]U.S.Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," *Survey of Current Business*, July 1987.

[b]U.S. Department of Education, Center for Education Statistics, *Digest of Education Statistics* **1967 (Washington, DC: US Government Printing Office, May 1987).**

[c]Enrollment statistics for primary, secondary, and higher education from adult training Participation from Office of Educational Research and improvement, U.S. Census Bureau, cited in U.S. Congress, Office of Technology Assessment, *Technology and Structural Unemployment—Reemploying Displaced Adults*, OTA-ITE-250 (Washington, DC: U.S.Government Printing Office, February 1986) See also Training *Magazine*, October 1984. The figure includes corporate training. There are probably 8 million studentsin formal learning programs incorporations; see N.P. Eurich, *Corporate Classrooms (New York, NY:The* Carnegie Foundation for the Advancement of Teaching, 1985).

[d]Counted as defense spending in the amenity accounts used in this analysis.

[e]Th, statistic shown here, based on Orlansky (see below), is higher than the $14 billion shown in the National Income and Product Accounts presumably because Orlansky was able to include training costs otherwise hlddenin otherDoDaccounts. Orlansky'sdatafor 1985 show 469,000 recruitsin initial training ($1.7 billion), 1.4 million students obtaining specialized skills including flight training (S6.7 billion, of which flight training Is $2.3 billion), and 69,000 associated with officer acquisition and professional development ($1.3 billion); support and other costs account for most of the remaining costs. J.Orlansky, "The Cost Effectiveness of Military Training," *Proceedings of the Symposium on the Military Value and Cost% Effectiveness of Training* (DS/A/DR(85)167), Brussels, Belgium, NATO headquarters, Defense Research Group on the Defense Applications of Research, January 1985, p. 4.

[f]Education and training costs in these categories include training of government and private employees undertaken at the employer's expense. They include formal classroom instruction and informai training that is often difficult to disentangle from routine work—i.e., learning a new word-processing software, or learning a new bureaucratic protocol. They are not considered as a part of "final demand" because they are treated as a part of government spending in other areas, or because they are purchased by private businesses and therefore considered to be "intermediate input. " Data in this large and important part of education and training are very poor.

[g]R. L, Craig and C. Evers, "Employers as Educators: The Shedow Education System," G. Gold, cd., *Business and Higher Education: Toward New Alliances* (San Francisco, CA: Jossey-Bass, 1981). The $30 billion estimate for formal training is approximately the same as that derived by applying a cost model to the Survey of Participation in Adult Education or SPAE (US Census), adjusting the results for underreporting that can be estimated when the SPAE participation rates for enrollment are compared with known enrollment statistics in institutions where enrollment is well known (e.g., universities). See A.P. Carnevale and H. Goldstein, "Employee Training: its Changing Role and An Analysis of New Data," American Society for Training and Development Press, Washington, DC, 1963, in A.P. Carnevale, testimony before the Subcommittee on Taxation and Debt Management of the U.S. Senate Finance Committee, Washington, DC, Nov. 30, 1987. Eurich (see note C) suggests that formai corporate training costs at least $40 billion. A more recent estimate places the corporate training budget in the range of $50-70 billion (R. Neff, "Videos are Starring in More and More Training," *Business Week*, Sept. 7, 1987, p. 110.

[h]Th, amount paid for traihing that does not occur in a formal setting is simply not known. Even definitions are difficult since it is often difficult to distinguish between work and iearning. (See Carnevale testimony, cited in above note). In 1985, U.S. employers paid approximately $2.5 trillion for employee compensation. Anecdotal evidence suggests that 2-4°/0 of an average employee's time is devoted to some kind of informai learning. This would yield $50-100 billion in informal training costs. Government and corporate shares of total spending in this category are allocated in proportion to spending to formal training.

Table 3=27.—Percent of Young U.S. Adults Able to Perform Tasks Requiring Different Levels of Literacy

Percent[a]	Prose tasks	Document tasks	Quantitative tasks
90-100	Locate information in a sports article	Enter date on a deposit slip	Total bank deposit entry
50-75	Locate information in a news article	Follow directions to travel from one location to another using a map	Enter and calculate checkbook balance
20-30	State in writing argument made in lengthy news article	[b]	Determine tip given as 10% of bill
5-15	Generate unfamiliar theme from a short poem	Use bus schedule to select appropriate bus for given departures & arrivals	Estimate cost using grocery unit price labels

How To Read This Table: Only 10°/0 of the young adults (aged 21-25) taking the test were able to generate an unfamiliar theme from a short poem. 90°/0 were able to total a bank deposit entry.
a See the source for precise percentages.
b No document task had a % in this range.

SOURCE: National Assessment of Educational Progress, "Literacy: Profiles of America's Young Adults, " Educational Testing Service, Princeton NJ, 1986.

dial reading by 16 percent; 82 percent of all colleges and universities are forced to offer such courses. 153 It is reasonable to ask why such resources could not have been spent teaching the students better in the first place.

Another way of gauging quality in American education is to compare U.S. and foreign systems. The U.S. education system no longer has a clear lead over systems elsewhere in the world. The quality of the K-12 education received in the United States may be lower than that delivered by some of our major trading partners. '54 The United States of course has a much more heterogeneous population than most nations, U.S. primary and secondary students regularly score below average in standardized tests. But even U.S. elementary students in a middle class suburb of Minneapolis scored far lower on standardized tests than comparable classes in Japan and Taiwan.[155] The United States does remain ahead of most nations in the fraction of its population receiving some college education.

Still another way to measure quality is to see how efficiently the traditional educational system provides the skills needed for a growing and changing economy. It is not clear that the priorities of the primary and secondary school system are well tuned to the needs of U.S. businesses. While school officials have often cited vocational skills as the most important factor in youth employability, the business view has been that if the schools provided adequately educated youth, business would provide—indeed, overwhelmingly does provide—technical training. What business decidedly indicated it did not want to do, but is in fact doing, is to educate its employees in ninth and tenth grade skills. Of greater importance, there are a number of reports that suggest that the educational system is not geared to producing the skills that will be needed in the future if the Nation is to become fully competitive in a "new-technology" world. [156] In sum, what is known about the productivity of the traditional education system is not reassuring.

Choices and Consequences

Spending levels for education hinge on a variety of factors:

- the number of people in "school age" population groups,
- the fraction of these people who will be enrolled,
- the fraction of the adult population requiring retraining,

[153] Digest of Education Statistics, op. cit., footnote 146, P. 48.
[154] *The Condition* 01 *Education*, **op.** cit., footnote 151, 1985 edition; *Digest* 01 *Educational Statistics,* **op.** cit., footnote 146, p. 303.
[155] Harold W. Stevenson, Shin-ying Lee, James W. Stigler, "Mathematics Achievement of Chinese, Japanese, and American Children," *Science,* vol. **231, No. 4739,** Feb. 14, 1986, p. 693.
[156] Report of conference on **Potential** Funders of Education in Mathematics, Science and Technology, Carnegie Corporation, New York, 1985.

- the fraction of adult training that will be purchased by individuals and government agencies and the fraction that will be purchased by private businesses (and therefore not counted as "final consumption" using standard accounting procedures), and
- the techniques employed in teaching at different levels.

The last question is clearly critical. The discussions presented in chapter 6 suggest that it is possible to use innovations in pedagogy, innovations in instructional technology, and improved management to enhance the rate of learning and to make learning more useful and fun. There are two principle innovations:

1. tailoring instruction to the learning styles, interests, and abilities of individuals rather than attempting to force a comparatively homogeneous system on a diverse population, and
2. freeing teachers of routine work so that they can spend more time with individuals.

It is also possible, of course, that pressures to reduce costs will result in more uniform curricula and reduced student access to instructors. The contrasts are stark.

The demographic model described earlier indicates that in the year 2005, the population aged 5 to 24 will be roughly the same as it is today. Many more Americans will be middle-aged by the year 2005, and these individuals are likely to demand more of the Nations's educational system than middle-aged peopIe today. Table 3-28 provides some basic statistics on the number of people in each age group participating in education (not including those engaged in trade schools or correspondence courses). Rates increased for both the youngest and the oldest age groups during the period from 1965 to 1985. A hypothesis about future participation rates is also shown.

Estimates of the number of people requiring education and training are combined with estimates of teaching methods (measured by "intensity" or spending per student) in table 3-29. The assumptions are shown in the notes to the table. The Trend case assumes that teacher salaries will be increased and that increased training will be provided for older age groups. It also assumes that teaching methods remain comparatively unchanged. The Alternative cases, on the other hand, are built around an assumption that teaching strategies are changed in fundamental ways. In K-12 teaching, instruction is divided into three kinds of activities:

1. working with computers and other new technology in away that requires a minimum amount of direct teacher supervision,
2. participating in tutorial sessions where a single teacher works full time with a small number of students, and
3. standard lectures in which students would listen to an instructor talk and lead group discussions.

Table 3=28.-Factors Affecting Enrollment in Schools

	Pormulation (in millions) by age cohort						
Year	o-4	5-17	18-21	22-24	25-29	30-34	35-44
1983	18.3	45.4	16.7	13.6	21.7	19.6	30.1
1985	18.6	45.4	15.9	13.0	22.5	20.6	32.9
2005	18.7	49.9	16.2	12.2	19.1	19.4	43.9
Percent change (1983-2005)	2.2	9.9	–3.1	– 10.3	–11.9	– 1.0	45.8

	Participation rates by age cohort								
Year	3&4	5-6	7-13	14-17	18-19	20-21	22-24	25-29	30-44
1965	0.106	0.849	0.994	0.932	0.463	0.276	0.132	0.061	
1985	0.389	0.961	0.992	0.949	0.516	0.353	0.169	0.092	0.025
2005	0.389	0.961'	0.992	0.949	0.543	0.391	0.188	0.130	0.100

SOURCE: Participation rates for 1985 and 1985 from U.S. Department of Education, Center for Education Statistics, *Digest of Education Statistics* 1987 (Washington, DC: U.S. Government Printing Office, May 1987), p. 12; population computed from demographic model described inch. 2 using Social Security Administration midrange assumptions—for ages 3-17 participation rates are assumed to be the same in the year 2005 as they were in 1985, for ages 17-24 participation rates grow at approximately half historic rates (with some adjustments), and assumptions for older age groups are speculations based on a rapid growth in demand for retraining.

Table 3-29.—Consumption Scenarios for Education
(billions of 1983 dollars, except where noted)

		2005			
	1963	Trend	3% Trend	1.5% ALT	3% ALT 1.5%
Primary & secondary	134	164[a]	155[c]	206[f]	206[f]
Private	12	14b	14b	18[b]	18[b]
Government	123	150b	142[b]	188b	188b
$/student	2,963	3,311	3,132	4,150	4,150
Higher education	56	59[c]	59[c]	68g	5g9
Private	13	14b	14b	16[b]	14[b]
Government	42	45b	45b	52[b]	45b
$/student	4,461	5,131	4,664	5,131	4,461
Other	23	42	32	52	37
Private education & research	11	14d	15[c]	14d	15[c]
Public libraries & other	8	15[c]	1IC	15C	1IC
Labor training & services	4	13[e]	6[c]	23[h]	I I[h]
Total	**213**	**265**	**246**	**326**	**302**
Private	**36**	**43**	**43**	**49**	**47**
Government	**177**	**222**	**203**	**277**	**255**
Percent share of gross national Product	**6.2**	**4.1**	**5.2**	5.0	7.1

ABBREVIATIONS: ALT - alternative scenario, GNP - gross national product

[a]Assumes no change in enrollment rates for ages 5-17 and a 16% increase in the "intensity" of education which could result from a 23% increase in teaching salaries (salaries are 47% of total costs) The population in age cohort 5-17 years old increases by 9.9% between ISS3and 2005.

[b]Assumes private/public ratios remain unchanged following long-standing trends.

[c]Assumes no changes in participation rates for cohorts aged 18-2$. Spending assumed to chang in Proportion to enrolled students aged 16-28 (a decline of 0.750A) with Intensity Increased 15%.

[d]Assumes no decline (equivalent to an assumption that spending in this area increases as the participating school Population aged 16-30 increases, offset by a 1O°/. increase in intensity).

[e]Assumes new participation rates for cohorts aged 30-44. Spending is assumed proportional to enrolled Population with a 15% increase in intensity.

[f]Assumes a 9.9o/, growth because of increase in school age population. intensity Increases to 4,000 per student. This could be achieved with a $500/year per student charge for capital equipment, a student teacher ratio of 30 and students spending 25% of their time on computers or other equipment. It could aiso be achieved with a student teacher ratio of 20 and students spending 50°A of their time on computers or other equipment. See U.S. Congress, Office of Technology Assessment, "Education," sector study, 1967.

[g]Spending scales with population aged 16-29 with assumption of higher participation rates. Intensity increases 15% as the result of growing use of computer beeed equipment in the 3% growth case but doas not increase in the case of 1.5°/0 growth.

[h]Assumed t. scale with population aged 30-44 with high participation rates. In the 3% growth case, intensity is assumed to doubie.

SOURCES: 1963 data on spending In major categories from U.S. department of Commerce, Bureau of Economic Analysis, "National income and Product Accounts," *Survey of Current Business*, Juiy 1967; teaching costs for 1963 are computed by dividing the totei expenditures for 1963 shown in the National income end Product Accounts by total enrollment in elementary and secondary schools and higher education provided by the Office of Educational Research and improvement, U.S. Department of Education, in *Digest of Education Statistics 1987,* Washington DC, 1987.

In addition to these three categories of instructional staff, there is a group of teachers who at present specialize in various activities such as teaching the handicapped, or providing special tutoring in music, art, or library assistance, perhaps in one school but sometimes in a number. These specialized teachers would be integrated in the above categories. It is assumed that information technology can be made available at an amortized cost of $500 per year per work station.[157] Obviously, there area large number of ways to allocate student and teacher time given the alternatives suggested here. These new strategies are consistent with a significant increase in staff salaries. (see the appendix for details).

[157]This estimate is derived from the informal consensus of the group participating in OTA's workshop; see *Information Technology and Its Impact on American Education*, op. cit., footnote 148.

PERSONAL BUSINESS AND COMMUNICATION

The category "Personal Business and Communication" combines two related activities. The first, communication, involves the transfer of messages now accomplished through telephone and mail. The second, personal business, covers insurance, legal assistance, banking, and a variety of other activities that rely heavily on these message services. Both activities center on the processing of information,

and improvements in information technology are having a profound effect on both.

Demand for Communications and Information

In general, new communication technologies like the telephone have come in addition to, and not as substitutes for, existing communication channels. News and information received on television complements rather than replaces information in magazines and newspapers. New technologies, however, are confusing the situation by creating a number of intermediate steps between "broadcasting" a message to a broad audience, and communicating a specially tailored message "point-to-point."

Anticipating the way consumers will react to the myriad of new communication products and services likely to be offered during the next few years is virtually impossible, if only because very little is actually known about what individuals need information for or how much they are willing to pay for it. This is partly because much of the information available to individuals is provided by advertisers at little or no monetary cost, although the cost in terms of the time needed to absorb such information can be high. The uncertainties have led some very sophisticated companies into some disastrous investments. The following paragraphs sketch out a few basic facts about residential information markets.

Table 3-30, for example, shows how first class mail is used. Of all 1986-87 first class mail received by households, 80 percent involved a transaction of some kind, and nearly 50 percent involved bills, invoices, and payments. The remaining 20 percent involved personal correspondence. First class mail is responsible for roughly two-thirds of U.S. Post Office revenues.

Demand for first class mail is quite inelastic. A 10 percent price increase in the first class rate is likely to have a negligible effect on volume, and therefore is likely to produce a 10 percent increase in revenue. The other mail classes, even though subsidized by first class, are subject to competition and sensitive to price increases.

Telephone prices have fallen in real terms for more than 30 years. Between 1950 and 1982, for example, the cost of telephone and telegraph services measured in current dollars increased by 213 percent while the cost of all products in the economy increased by more than 350 percent. There is no reason to expect that this pattern will be broken, since a variety of new technologies are available for reducing communication costs. And because the elasticity of demand for telephone service is high, new technologies can be expected to lead to significant increases in the volume of telephone traffic. Enhanced services, however, are likely to change the nature of telephone service in qualitative ways, and prices may increase to cover these enhancements. The question of whether the cost of the basic service will also increase depends on the extent to which regulatory authorities permit regional holding companies to include the cost of enhanced service in their basic rates.

Market fragmentation is clearly having a major effect on telephone service. At the end of the 1970s, virtually every household in the country had the same "plain old telephone service" (known as POTS). Today there is a proliferation of home telephone devices and a slowly growing range of services (most now marketed to the home through 900- or 979-services, providing everything from stock market information to dirty jokes). Portable telephones, redial features, and cellular telephones are entering markets once limited to the standard handsets available from AT&T. At least 10 percent of American homes

Table 3.30.—The Distribution of First Class Mail, 1986-87 (received by households)

Mail by type	Percent
Personal correspondence from a friend or relative	17.9
Personal letter	(6.3)
Holiday/season's greeting card	(6.5)
Other greeting card, invitation, announcement	(5.2)
Business	80.9
Bills, invoices, receipts	(46.4)
Advertisement, notices, etc.	(18.1)
Other	(16.4)
Don't know/no answer	1.2
Total	100.0

NOTE: The category of "other" includes such items received from private businesses, government, or social, charitable, political, or nonprofit groups that are not elsewhere classified (as well as educational acceptances and report cards). Annual totals compiled by adding totals for the first three quarters of postal year 1986/87, and approximating data from the fourth quarter (6/8/87-9/28487) by doubling the totals of the third (3/16/67-617/87). Sample size over three quarters-20,713 weighted pieces.

SOURCE: US. Postal Service, Demand Research Division, September 1967, unpublished.

now have answering machines, sales of which increased at a compound rate of 34 percent between 1980 and 1984. [158]

Future competition for the point-to-point message service is likely to be dominated more by improvements in quality than by reduction in the price of basic services. There is no good vocabulary for measuring the "quality" of communication, but at least four categories suggest themselves: timeliness, accessibility and convenience, presence, and the maintenance of an archival record.

The situation will become more complex as the new technologies introduce a range of intermediate services between "point-to-point" communication and broadcasting. Consumers are already being besieged by computer-generated "broadcast" telephone calls. Catalogues and even the editorial content of magazines are being tailored to specific regions, demographic groups, and marketing groups. Many businesses and universities are experimenting with "narrowcasting" training sessions, announcements about policy changes, and other business communications. Cable television and VCR rentals are fragmenting the broadcast of television programming, allowing access to more specialized and narrower markets.

Countering this trend toward geographic and demographic targeting is the growth of "national" newspapers. *The Wall Street Journal* and Gannett's *USA Today,* transmitted by satellite to distribution points throughout the country, reached a circulation of two million in 1985. 159 Direct marketing is thriving on a system in which data about products is broadcast through television, and catalogues are sent by third class mail with customers making purchases through 800-number telephone calls. Rather than broadcast data through publications, database systems permit users access to highly specific data.

There are a large number of potential applications for new kinds of point-to~point communication services. However, few of them can be realized with the existing state of technology available in the home, and few can by themselves justify the introduction of advanced technology-although increased use of home satellite dishes and cellular telephones has in part resulted from demand for such services. High-speed communications will continue to enter individual residences because of a market for broadcast or narrowcast entertainment and news programming.

If a significant fraction of the cost of the system can be attributed to this function, point-to~point services available to the home can be delivered at a lower marginal cost than that of services of equivalent quality, and growing markets can be discovered. Financial, technical, regulatory, and marketing problems have prevented these systems from offering anything but the most basic re-broadcast services, and it is unlikely that existing cable networks can evolve into a multi-purpose information system capable of delivering point-to~point communication services in the form of voice or data communications.

Sophisticated residential communication services will almost certainly be provided by an organization associated with existing telephone companies. Applications might include:

- Home Banking and Bill Paying. To date, there has been more talk than action in home banking. At the end of 1986, there were about 100,000 home banking installations. Most of them are operated by individuals who have already invested the time and money needed to become familiar with home computers, and who are willing to pay $5 to $20 a month for the privilege of instant access to transactions. But demand could increase rapidly. In addition to simple checkbook accounting, the systems could be given a variety of features such as sorting and documentation for home records and tax purposes. Still more sophisticated systems could offer complex financial services and ready access to financial information. A recent survey by the insurance industry concluded that most households would be pleased to order insurance at home over computer lines and to make claims through electronic mechanisms, instead of filling out tedious forms.
- Home Health Care. Increasing pressures to get patients out of hospitals lead to a growing need for communication between homes and health care facilities. Microprocessors can provide assistance in scheduling the administration

[158] Pacific Telesis Group Voice Storage and Retrieval (VSR) Information Services, July 11, 1986, cited in P.W. Huber, *The Geodesic Network* (Washington, DC: U.S. Government Printing Office, 1987).

[159] Arlene K. Fleming and Robert S. November of LINK, Inc., "The Impact of Technology on Home Information, Transactions, and Entertainment," contract report prepared for the Office of Technology Assessment, June 1985.

of drugs at home, and can also monitor dosage to eliminate undesired combinations of medication. Physicians, acting with the assistance of visiting nurses, nursing home staff, and the patients themselves, can use equipment located in a patient's home and even devices implanted in the patient's body, such as pacemakers and implantable pumps, to monitor the progress of a patient.

- Residential Controls. Home energy systems capable of scheduling residential electric demands to minimize system costs have already been described. Other systems that could be coupled with the network include security systems, pay-per-view television ordering, and other applications.
- Information Services. Systems creating an easily accessible, nationwide database have already been instituted in France, Japan, and several other nations. The absence of a government supported program, coupled with a ban preventing the Bell Operating companies from offering information services, is at least partly responsible for the fact that home information systems have moved much more slowly in U.S. markets than they have elsewhere.
- Home Shopping Services. The growing volume of catalogue shopping resulting in part from a decline in available time, suggests that a market may exist for electronic shopping at home. A variety of projects are under consideration including the ambitious Trintex system conducted as a consortium of Sears, CBS, and IBM.

The French national telephone company appears to have succeeded in introducing a nationwide information network in that country by distributing inexpensive terminals to their customers. The system provides access to the 23 million listings of the French telephone system as well as more than 4,000 privately offered information services billed through the telephone system.[160] Services include an electronic newspaper, classified ads, bulletin boards, home shopping, a dating service, etc. About half of the subscribers reportedly use home banking and 24 percent use the home shopping service on a regular basis.[161] The information services are billed at rates varying from 5 to 10 cents per minute of use. There were 2.24 million "Minitel" terminals operating at the end of 1986, with an average rate of use of 97 minutes per year per terminal.[162] The total number of terminals has doubled in the past year.

The French claim that the system is now profitable. Telephone information services provide approximately 17 percent of total revenue. The remainder coming from private service firms using the Minitel system as a vehicle for reaching residences.

Japan, Germany, Canada, and England have had similar experiments with much less spectacular results. The Japanese are experimenting with a 3.5-inch floppy disc now available with the entire four-volume Tokyo telephone directory. In one second, this disc can provide listings for 9,170 sushi restaurants in Tokyo, and can then narrow the choice based on geographic vicinity.

Keytron, Viewtron, and other efforts to introduce videotext services in American markets resulted in expensive failures. In contrast to the centrally planned experiences abroad, however, the regionalization of American industry makes it likely that locally arranged formulas, which accord to the specifics of local markets, could be more successful than a single national program.

Demand for Business Services

Demand for personal business services is being reshaped by increasing consumer sophistication and a rapidly changing regulatory environment. Demand is becoming more fragmented as technology and affluence permit greater choice; it is also becoming more homogeneous in areas where technology permits economies of scale in the sale of standardized products. Changes under way in life insurance provide a vivid example.

Traditional whole life polices combined three kinds of products: investment, risk coverage, and financial service. In the parlance of the industry, these products have become "unbundled." Higher-income individuals interested in investments now look to other financial instruments, which offer greater liquidity, more flexibility, and higher returns. They also look elsewhere for more comprehensive

[160] *Telematique News*, Paris, spring 1987.

[161] P.W. Huber, *The Geodesic Network*, report prepared for the U.S. Department of Justice, Antitrust Division (Washington, DC: U.S. Government Printing Office, January 1987).

[162] J. Grenier and G. Nahon, "France Wins Big With Its Minitel Videotext System," *Telephony*, July 27, 1987, pp. 46-49.

financial services. Low- and middle-income individuals interested primarily in risk coverage now look increasingly to standardized, simple, and inexpensive insurance that provides no "thrift" or savings value.

As a result of these changes, premiums for whole life policies fell from 76 percent of all premiums in 1950 to 42 percent in 1982, while cheaper term insurance, providing no savings, grew from 41 percent of all life purchases in 1960 to 59 percent in 1981.163 Comparatively inexpensive group products, which represented 30 percent of insurance in force in 1960, grew to 46 percent by 1982. Consumer savings have moved sharply away from life insurance, commanding only 3.4 percent of individual assets in 1980 as opposed to 5.9 percent in 1960.164

Demand for property/casualty insurance grows roughly in proportion to the number of things to be covered—primarily houses and automobiles. These businesses have become highly competitive and offer highly standardized products inexpensively. Some are sold through "financial supermarkets," offered by companies as diverse as Citicorp and Sears. The conversion of a product to a commodity does not necessarily reduce the quality of services offered. Clerks in local offices now have access to semi-automatic underwriting and claim review systems, allowing them to enter information directly from a local office or even the field, where a portable computer can be used in claims examination. The time required to process applications and process claims can be greatly reduced. The price of policies can be expected to decrease as automation substitutes for the current inefficiencies of the insurance system, which are being eliminated rapidly as intense competition forces an unprecedented examination of costs.

163 American Council of Life Insurance, "Life Insurance Fact Book," 1983.
164 Ibid.

Choices and Consequences

Spending on communications for home use will be highly sensitive to technical developments throughout the economy and to programs designed to facilitate high-quality communication to the home. Table 3-31 explores some scenarios. The Alternatives assume a continuation of the rapid decline in prices and improvements in the range of service quality and variety.

Table 3-31.—Consumption Scenarios for Personal Business and Communication (billions of 1983 dollars)

		2005			
	1983	Trend 3%	Trend 1.5%/0	ALT 3%/0	ALT 1.5%
Telephone	37.9	78.7[a]	66.2[a]	111[b]	92[b]
Stationery	5.8	11.1[c]	8.0[c]	11[c]	8[c]
Personal Business	132.5	282.9[a]	171.3[a]	333[d]	201[d]
Total PCE	176.2	372,7	245.5	455	301
Government	0.7	1.3	1.0	1.3[b]	1[b]
Total	176.9	374.0	246.5	456	302.0
Percent Share of gross national product	5.2	5.7	5.2	7.0	6.4

ABBREVIATIONS: ALT = alternative scenario, PCE = personal consumption expenditure
a Follows extrapolative technique described in Chapter 2.
b The trend scenario assumed a 20% decline in the real cost of telephone communication and a price elasticity of -1.12. The ALT 3% case assumes a 40%/0 decline in costs following a trend in communication equipment. It is also taken to be the reduction in cost of Information processing equipment likely to constitute a major part of spending in the "telephone" category during the next 20 years.
c Assumes that spending in this category is the same proportion of total Personal Consumption as it was in 1983 for all scenarios.
d Arbitrarily increased by 150/o to include charges of a variety of home information and business Services ranging from consumer marketing to financial services.

SOURCE: Office of Technology Assessment, 1988.

RECREATION AND LEISURE

Increased household income, coupled with decreasing amounts of free time, have reshaped American leisure habits. Many of the changes are difficult to document with precision. For the purposes of this discussion, recreational and leisure spending include:

1. use of the media (now largely within the home) —this includes reading books, newspapers, and magazines; listening to the radio, records, and tapes; and watching television;
2. participatory sports, spectator sports, and club functions (including welfare and religious activities), which usually take place away from home;
3. traveling for pleasure and vacations–spending for domestic transportation is included in the transportation amenity discussion, but all other expenses (such as hotels and amusements) as well as foreign travel are included in these accounts.

The definitions are thus guided by expenditure categories. But it is obviously a mistake to conclude that demand for recreation can be reduced to spending on related products and services. Recreation and Leisure also includes considerable non-market activity—participation in certain religious, professional, political, or athletic activities, for example, and informal social visiting among family and friends. Changes in the way Americans use their leisure time were discussed in the previous chapter. Having more money to spend on recreational activities does not necessarily mean that free time is being better used; and it certainly does not mean that there is more free time available.

Recent Trend#

A number of often paradoxical trends are notable in this complex economic sector, one in which changing demographic factors and social trends makes the past an unreliable guide to the future. These include:

- a squeeze between decreasing usable leisure time and increasing costs of recreational activities;
- partial displacement of mass-production leisure products and services by more differentiated (and more expensive) specialized ones, resulting in parallel mass and differentiated economies in some fields;
- a lack of clear movement from outdoor to indoor recreation; in fact, media and participatory activities in some ways reinforce each other as well as competing for time and money;
- a growing diversity of activities with a high degree of specialization, each involving its own media, equipment, clothing, and social organizations;
- burgeoning demand for convenient, close-to-home, or short-term recreations, which fit into increasingly complex personal schedules;
- growing competition for mass media as targeted advertising and pay-per-view media drain revenues that currently subsidize inexpensive or "free" media like newspapers and broadcast television—alternatively, the "new" media could complement the old in another parallel mass/ differentiated dichotomy;
- a potential split between overcrowded, deteriorating public recreational facilities and expensive, specialized private ones. (The pressure for "user fees" to replace public funding of facilities—including parks and public libraries—could widen the existing economic/educational gaps in enjoyment of recreational variety.);
- keen competition in some recreational fields, producing superior products and service with better employment opportunities at only slightly increased cost to the consumer—for instance, formerly exotic cuisines are increasingly available to all, just as more customized travel opportunities abound;
- growth in recreational businesses catering largely to childless couples and young singles as well as to seniors who are healthier, more affluent, and more knowledgeable than in the past, and fuller participation by minorities and handicapped Americans in the whole range of recreation available;
- the difficulty of single-parent families and less

educated people to have full access to recreational opportunities. The entry of more and more women into the labor market particularly alters the nature of recreational demand;
- a need for greater "leisure literacy" to enable the whole population to take best advantage of multiplying opportunities the way many of the most affluent and educated do now, in spite of tightly scheduled personal lives; and
- opportunities for the United States to exploit its domestic advantage in the Recreation and Leisure sector while increasing its export revenues.

There has been a rapid increase-more than 5 percent per annum—in spending on Recreation and Leisure over the past 23 years. This general rise conceals several contrasting developments. Expenditure on books, newspapers and magazines, and spectator amusements (such as the movies, theater, and sports events) rose moderately (between 1 and 2 percent a year), while expenditures on sports equipment and other entertainment services (such as sports clubs and golf courses) rose rapidly (between 6 and 7 percent annually). There was a particularly sharp rise in purchases of radio, television, and other electronic devices (more than 10 percent), whereas expenditures on repairs rose slowly—testifying to improved quality and reliability. The two vacation items—hotels and overseas travel—rose at 4 percent annually, faster than total personal consumption expenditures but not so fast as some other elements of Recreation and Leisure (see figure 3-8 for more detail on these trends).

The trends suggest that demand in this sector is primarily for goods rather than services, Americans are devoting more of their Recreation and Leisure dollars to new media technologies. Much of this development has been driven by electronics technology. To the degree that most Americans enjoy spectator sports, theater, concerts, and other forms of art and entertainment, they are increasingly able to do so by means of the mass media.

This is confirmed by patterns of expenditures on spectator amusements. The share of these amusements in the total, while never large, dropped from 10 percent in 1960 to about 4 percent in 1983. Expenditures on movie theaters actually declined in certain years, reaching a low in 1975 that was 65 percent of the 1960 level. While there has been some later recovery-many movie theaters have adapted to rapidly changing consumer demand by increasing the number of films shown at any one time or serving refreshments at one's seat—spending at movie theaters grew a miniscule 5.1 percent between 1960 and 1983.

In contrast, there has been spectacular growth in spending on television and home electronics. According to one survey, the percentage of consumer media spending allocated to new electronic media—cable and pay TV, video cassette recorders (VCRs), video games, and home computers—rose from 7.5 percent in 1978 to 30.8 percent in 1982.165 In the late 1970s, growth was concentrated in cable television; by 1984, cable television revenues had reached $7.5 billion.166

The early 1980s were also the era of the video game. In 1981, video game arcade users spent $5 billion—equal to the combined revenues of the Las Vegas gambling industry and the U.S. film industry, or the total television revenues and gate receipts of major league baseball, football, and basketball. 167 In 1982, this figure rose to $7 billion—greater than the combined revenues of the movie and record industries. Demand for video games began to slacken in 1983, but electronic media spending was buoyed by yet another enormously popular product—the VCR.

So far, the VCR has followed the classic growth curve of innovative home electronic products; the first eight years of VCR sales parallel almost exactly the growth years of color television.168 In 1985, consumers spent between $2.3 and $4.5 billion to rent and purchase video tapes.169 By 1986, movie industry revenues from video-cassette sales equaled revenues

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165 Ronald Rice, "Development of New Media Research, " in Ronald Rice and Associates, *The New Media: Communication, Research, and Technology* (Beverly Hills, CA: Sage Publications, 1984), p. 16.

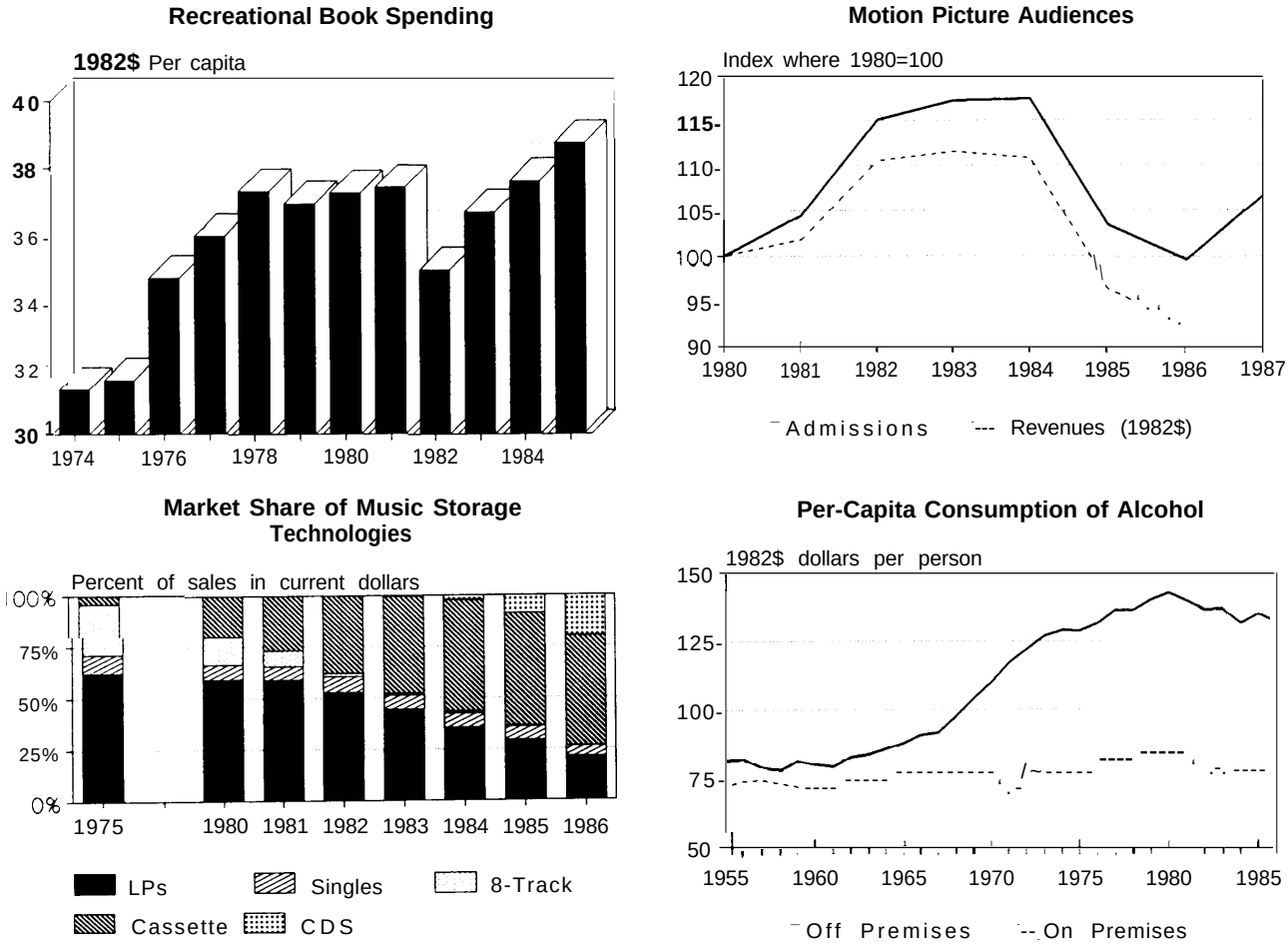
166 Rushworth M. Kidder, "Videoculture: TV—for Better or Worse, a Window on the World," *Christian Science Monitor,* **June 10, 1985, p. 20.**

167 Ronald Rice, "New Media Technology: **Growth and Integration, "** in Rice and Associates, op. cit., footnote 165, p. 66.

168 David Lachenbruch, "Home Video: Home Is Where the Action 15, " *Channels of Communication—1984 Field Guide To the Electronic Media,* p. *42.*

169 Aljean Harmetz, "Studios Woo Cassette Mass Market, " **New** *York Times,* Feb. 27, 1986, p. C26.

Figure 3-8.-The Leisure Industry, 1986



NOTE: Deflator for "'admissions to specified spectator events" used to convert motion picture admissions to $1982.

SOURCES: U.S. Bureau of the Census, *Statistical Abstract of the United States.' 1987* (107th edition), Washington, DC, 1988, tables 388 (recreational books) and 372 (music technologies); U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," historical diskettes, tables 2.4 (motion picture revenues) and 2.5 (alcohol consumption); Motion Picture Association of America, New York, NY for admissions. Motion Picture revenues and recreational book spending converted to 1982 dollars using table 7.10 of the "National Income and Product Accounts. " Categorization based on "Leisure Statistics," *The Wall Street Journal,* Apr. 21, 1988, p. 13D.

from box office movie sales. Approximately one-third of American households already own a VCR, and estimates suggest that VCR penetration will reach 50 percent by 1990.

These developments owe much to increases in income coupled with falling prices. Over the past 23 years, prices for television and audio entertainment have declined 60 percent in constant dollars. Moreover, the most recent forms of electronic equipment have entered the market at relatively low prices, ensuring rapid market penetration. Prices of sporting equipment have also declined sharply, accounting for part of the particularly rapid increase in purchases of these items.

Changes in disposable time have interacted with these developments. Studies of the way people use their time show a sharp decline in the amount of free time available, especially in the past 10 years. This places a premium on home entertainment, such as running a movie on the VCR or seeing a *sport*-ing event on a large screen, rather than on spending extra hours in transportation to entertainment centers outside the home. This, in turn, further diversifies demand for recreational activities that can serve

the particular tastes and needs of individual consumers—activities being improved by technologies that permit greater flexibility in response to consumer demand.

Choices and Consequences

In the area of electronic entertainment, there seems every reason to believe that market penetration by some of the more recent technologies, such as compact discs, cable television, and VCRs, will continue. The development of such new technologies as video discs and high-definition television will also improve the quality and range of entertainment (and other information activities) within the home. New developments will combine the telephone and personal computer—at present, mainly designed for social contact and personal business—to provide a variety of information and entertainment services. The development of such new technologies as video discs and high-definition television will also improve the quality and range of entertainment (and other information activities) within the home entertainment centers; there is every reason to believe that these innovations will eventually become available to consumers at reasonable cost. The French ‘‘Minitel” hookup, originally designed to give consumers more efficient telephone service and buy them time through efficient transaction of business, has won widespread acceptance through its adaptation as a recreational device. Despite regulatory differences, an American system or systems could take advantage of similar consumer demand.

A substantial part of Recreation and Leisure activities, such as ski centers, golf courses, sightseeing buses, and hotels are still labor intensive. This fact has accounted for a past increase in relative costs. If new information technologies permit improvements in labor productivity, these costs could decline in the future. Yet demand for better services could produce a generation of recreation or hospitality professionals to enhance the consumer’s experience.

Two related factors, demographic trends and available time, will also influence expenditure. The ability to enjoy leisure and recreation needs a combination of time and money. If time is in short supply, leisure may be curtailed regardless of money, or at least recreation expenditures may be channeled into directions that save time. The growing complexity of family schedules fuels demand for convenient, close-to-home recreation and shorter—though perhaps more frequent—vacations.

The time budget data referred to in chapter 2 serve as a basis for a rough estimate of future trends in leisure time. It is first assumed that disposition of time for both men and women in 2005 will be the same as in 1985. In this case, free time—time which is not spent on work, traveling to work, housework, personal care, and eating—will increase by about 25 percent between 1985 and 2005. The largest portion of this increase, 21 percent, is due to the rise in population, and the balance to an older population that will include a greater share of retired people. Individuals, however, may find themselves more pressed for time than ever.

On the other hand, there may be changes in the way time is spent. Time budgets of 2005 may well be different than those of 1986. A IO-percent reduction in the work week occasioned by improved technology could increase the hours of free time available by 6 percent, while a halving of the time devoted to shopping due to improved information technology could increase free time by 5 percent. If, in contrast, the rising participation in the labor force—which caused the reduction in leisure time between 1975 to 1985—continued, the amount of time available for leisure and recreation would fall.

Household formation is also of importance. The share of young single people, who spend more of their income (and higher absolute amounts) on recreation, will decline, thus tending to depress Recreation and Leisure expenditures. A countervailing factor, however, is the expected increase in childless households, traditionally high spenders on recreation. Furthermore, the “new” elderly, a rising share of the population, may spend more on Recreation and Leisure than their present day equivalent.

The future, therefore, offers mixed prospects, On the one hand, the abundance of leisure activities and cultural opportunities potentially available is the greatest in history. There will be an unprecedented selection of destinations, books, entertainment, sports, media, and cuisine. As new technologies enhance flexibility in consumer choice while helping to reduce prices, the information necessary to per-

sonalize fulfillment of leisure needs and opportunities may soon be within the reach of all.

On the other hand, not all Americans maybe able to share in these riches. Household expenditure data suggest that there are many families too poor to take advantage of recreational activities. Single parents, for example, spend virtually nothing on travel or entertainment. Emerging fee-for-service media may drain advertising revenue from traditional publishing and broadcasting, depriving the less affluent of much affordable or free information and entertainment.

Scenarios are described in table 3-32.

Table 3.32.—Consumption Scenarios for Recreation and Leisure (billions of 1983 dollars)

		2005			
	1983	Trend 3%	Trend 1.5°/0	ALT 3°10	ALT 1.5°/0
Entertainment services	58.2	1 54.3[a]	81.1[a]	183[b]	97b
Entertainment commodities	62.4	149.8[a]	104.9[a]	165[b]	115b
TV and sound	31.4	87.6[a]	61[a]	106[b]	78[b]
Lodging and foreign travel[c]	22.2	64.9	37.7	84[b]	51b
Religious and welfare[d]	47.6	91.2	65	119	86
Total PCE on recreation and leisure	221.8	547.8	349.7	657	427
Government purchases of recreation and leisure[e]	8.6	16.5	11.9	20	13
Total	**230.4**	**564.3**	**361.6**	**677.0**	**440.0**
Percent share of GNP	**6.8**	8.7	7.7	10.4	8.3

ABBREVIATIONS: ALT = alternative scenario, GNP = gross national product, PCE = personal consumption expenditure

[a] Follows Extrapolative technique described in ch. 2.

[b] Alternative estimates of demand for entertainment services, entertainment commodities, and tv and sound equipment are above those computed in the trend analysis for reasons discussed in the text. The increases are constructed by assuming a price reduction in the items that is more rapid than the one used in the trend case. The price of entertainment services is assumed to fall 150/.. entertainment commodities 300A. and TV and sound equipment 400/..

[c] In th. period 1960-72 real expenditures on foreign travel increased 48% faster than all PCE. After 1972 there were wide variations in spending reflecting swings in exchange rates. Extrapolation is clearly difficult. In the estimates shown it has been assumed that foreign travel will continue to grow at roughly the 1980-72 rates. It has therefore been assumed that spending in this category would increase 4.44%/year if GNP grows 3%/year and that spending would increase 2.2%/year if GNP grows 1.5 %/year.

[d] Ass... s that spending in this category is the same proportion of total PCE ss it was in 1983 for all Scenarios,

[e] Government purchases assumed to be in proportion to personal consumption.

SOURCE: Office of Technology Assessment, 1987