PROJECTIONS OF CONSUMER INCOME AND EXPENDITURES FOR 1985

Roger A. Herriot and Herman P. Miller*
U.S. Bureau of the Census

Introduction

This paper summarizes some recent work being done at the Bureau of the Census. Our concern here is with the development of graphical techniques for projections of consumer income and expenditures. In addition, an attempt is made to separate the contributions of population growth and economic growth (increase in average family income) on the expected increase in expenditures for major categories of consumption between now and 1985.

Development of Control Totals and "Corrected" Size Distribution

Due to the income underreporting in the CPS, the money income of families and unrelated individuals was adjusted to control totals using data supplied by the Office of Business Economics (OBE). Beginning with the OBE's "personal income total," we subtracted out those types of "personal income" which are not included in the Census's (BC) "money income" and added those sources which are included in Bureau of the Census "money income" but are excluded from "personal income." The major items subtracted from "personal income" are all types of imputed income, income of nonprofit institutions, medicare payments to beneficiaries, and various types of lump sum payments. The major items which were added to "personal income" are employees contributions to social insurance and periodic payments for life insurance.

After computing control totals for each source of income, these income source control totals were then distributed to the income intervals using the preadjustment percentages. For example: if the BC $8,000 to $8,999 income interval had 5.6 percent of the total wage and salary income before adjustment, this interval is then given 5.6 percent of the OBE wage and salary control aggregate. Within each income interval, we then added together the aggregate amount for each source to arrive at a total money income aggregate for each income interval. These "new" total money income aggregates were then divided by the number of families and unrelated individuals in the intervals before any adjustments were made. This yields a set of new interval means which were then plotted directly above the preadjustment interval means using lognormal graph paper. The "corrected" income distribution based on OBE control totals is obtained by connecting the new interval means and reading from the graph, the number of families and unrelated individuals within each income interval. While this type of "raking" adjustment, which assumes an equiproportional underreporting of income, leaves much to be desired, it was found to yield a distribution very close to that developed by Dr. Budd at OBE for 1964.[1]

The Projection of the 1985 Aggregate Income

To project aggregate total money income for 1985, we used the following model:

$$TMY = GNP^*$$

$$GNP^* = \frac{GNP^*}{MH} \times \frac{MH}{E} \times \frac{E}{LF} \times LF$$

$$LF = \left(\frac{LF_{mi}}{P_{mi}}\right)\left(P_{mi}\right) + \left(\frac{LF_{fi}}{P_{fi}}\right)\left(P_{fi}\right)$$

Where

GNP^*	=	Constant dollar GNP with average productivity increase inputed to government workers.
MH	=	Manhours worked per year
E	=	Employed labor force
LF	=	Total labor force
LF_{mi}	=	Male labor force in the i th age group
LF_{fi}	=	Female labor force in the i th age group
P_{mi}	=	Male population in the i th age group
P_{fi}	=	Female population in the i th age group

Below are presented the assumed relationships between the variables for 1985 along with their 1968 values. In addition we have presented the magnitude of the variables for 1968 and 1985 along with the implicit average annual rate of change for each variable for this period. We used the "C" population series and 3.0% increase in output per manhour which was applied to government workers as well as those in the private economy in order to maintain a reasonably constant relationship between constant dollar output and constant dollar money income. The average labor force participation rates for males and females were estimated using the weighted average of the estimated labor force participation rates for each age group for each sex.

* The views presented here are not necessarily those of the Census Bureau or any other governmental agency.

Description		1968	1985
$\frac{TMY}{GNP^*}$ = Money income to output ratio.....		.72	.72
$\frac{GNP^*}{MH}$ = Output per man-hour @ 3.0% average annual increase...		$5.54	$ 9.16
$\frac{MH}{E}$ = Average hours worked per year per worker.....		1,966	1,851.2
$\frac{E}{LF}$ = Employment rate.....		.966	.960
$\frac{LF_m}{P_m}$ = Male average labor force participation rate.....		.813	.804
$\frac{LF_f}{P_f}$ = Female average labor force participation rate.....		.411	.433
TMY = Total Money Income.....	Billions in 1968 $..	622.3	1,263.4
	% change--av. an. rate..	—	4.3
MH = Total Man-Hours Worked.....	Billions..	156.2	191.4
	% change--av. an. rate..	—	1.2
E = Employed Labor Force.....	Thousands..	79,455	103,382
	% change--av. an. rate..	—	1.6
LF_m = Male Labor Force (Age 16+)...	Thousands..	53,030	68,051
	% change--av. an. rate..	—	1.5
LF_f = Female Labor Force (Age 16+).	Thousands..	29,242	39,639
	% change--av. an. rate..	—	1.8
P_m = Male Population (Age 16+)....	Thousands..	65,238	84,692
	% change--av. an. rate..	—	1.6
P_f = Female Population (Age 16+)..	Thousands..	71,117	91,464
	% change--av. an. rate..	—	1.5

Projection of the 1985-Income Size Distribution

The projected income size distribution, shown in table 1, is based on the assumption that in the next 15 years, the Lorenz Curve (that is the cumulative percent distribution of families and of income) will be constant. On a lognormal graph this assumption results in a parallel upward shift of the cumulative frequency distribution of families receiving less than a certain level of income.

The procedure used to project the size distribution is as follows: we first calculated the 1985 aggregate income assuming no population growth using the 1968 number of families and unrelated individuals and the projected 1985 mean income. This 1985 aggregate is then distributed to the income intervals using the 1968 percentages. Thus if the $4,000 to $5,000 income interval had 2.8 percent of the total income in 1968, this interval is then given 2.8 percent of the estimated 1985 aggregate. These interval aggregates are then divided by the number of families and unrelated individuals in that interval in 1968. This yields a set of new interval means which are then plotted directly above the 1968 interval means on lognormal graph. When these new means are connected using a French curve, we have the projected 1985 distribution. From this new distribution we can then read off the percentage of all families and unrelated individuals which have income below any particular level of income. By applying these family and unrelated individuals percentages against the projected number of families and unrelated individuals in 1985, we can calculate the estimated number of families and unrelated individuals in each income interval.

Based on our assumptions, real incomes would grow by over 100 percent during the next 17 years. In 1968 the money income of families and unrelated individuals totaled about 629 billion dollars. It is expected to reach about $1.3 trillion by 1985. The average (mean) income of families and unrelated individuals is expected to increase from about $9,800 in 1968 to about $14,700 in 1985 measured in constant purchasing power. At present about 17 percent of all families and unrelated individuals receive incomes over $15,000 and account for about 39 percent of the income. By 1985 about 44 percent of families and unrelated individuals are expected to have incomes above $15,000 at constant 1968 prices, and will account for over 3/4 of the total income. Moreover, because of the combined impact of both income and population growth, the total amount of purchasing power, in constant dollars, at this upper income level will be over four times as great as in 1968.

Projection of Consumer Expenditures in 1985

Given the above configuration of purchasing power in 1985, our next concern is to examine how it will be spent. We have projected the major types of consumer expenditure using the procedures outlined below.

We adjusted each category of consumer expenditures for price changes and calculated, for a number of the postwar years, each category's proportion of total personal consumption expenditures in constant dollars. For each type of consumer expenditure, we then plotted the proportions on semi-log paper and by fitting a linear trend line, we calculated an average rate of change in its proportion of total consumer expenditures. For example, the proportions of total consumer expenditure which goes for food has been declining during the postwar period. We fitted a linear trend line to this series and projected the proportion to be spent on food in 1985 (relative to total consumption expenditures). When this was done for each major type of expenditures, the sum of these percentages for 1985 added to more than 100 percent. The percentages were then proportionately reduced so that their sum would equal 100 percent. The net result was a slight reduction in longrun rate of increase of those expenditure types which have been increasing, and a slight increase in the longrun rate of change of those consumer types which have been falling. Estimates were made for 1980 using this procedure, and the estimated percentage for each expenditure type came to within one half of one percent of the Bureau of Labor Statistics (BLS) 1980 personal consumption forecasts.

For the 1985 expenditure projections, shown in table 2, we adjusted OBE's Personal Consumption Expenditure (PCE) so that they reflected, as much as possible, only the money expenditure of families and unrelated individuals.

Consequently, we excluded the expenditures of nonprofit foundations, net imputed rent on owner-occupied nonfarm dwellings, imputed proprietors income from owner-occupied farm dwellings, space rental values of institutional buildings, food and fuel produced and consumed on farms, services furnished without payment by financial intermediaries, and employees food, lodging, and clothing furnished by employers. By subtracting the above items from their respective expenditure type, we obtained an estimate of the money expenditure of families and unrelated individuals. It should be noted that an imputed amount covering capital consumption allowances, taxes and interest expenses on owner-occupied dwellings are included in our figure for housing expenditure.

We also developed a technique which is useful in allocating the proportion of the increase in each type of consumer expenditure that can be attributed to population growth and an overall measure including factors which result in increasing affluence. This procedure rests on the following two identities:

$$x_o = \left(\frac{x_o}{P_o}\right)\left(P_o\right)$$

and

$$x_1 = \left(\frac{x_1}{P_1}\right)\left(P_1\right)$$

where

x_o = Total expenditure on x in 1968

x_1 = Total expenditure on x in 1985

P_o = Number of families and unrelated individuals in 1968

P_1 = Number of families and unrelated individuals in 1985

The change in expenditure on x between 1968 and 1985 is then equal to:

$$x_1 - x_o = \left(\frac{x_1}{p_1}\, p_1\right) - \left(\frac{x_o}{p_o}\, p_o\right)$$

By adding the following terms:

$$p_o \frac{x_1}{p_1} - p_o \frac{x_1}{p_1} + p_1 \frac{x_o}{p_o} - p_1 \frac{x_o}{p_o} + p_o \frac{x_o}{p_o} - p_o \frac{x_o}{p_o}$$

and factoring the result, we obtain:

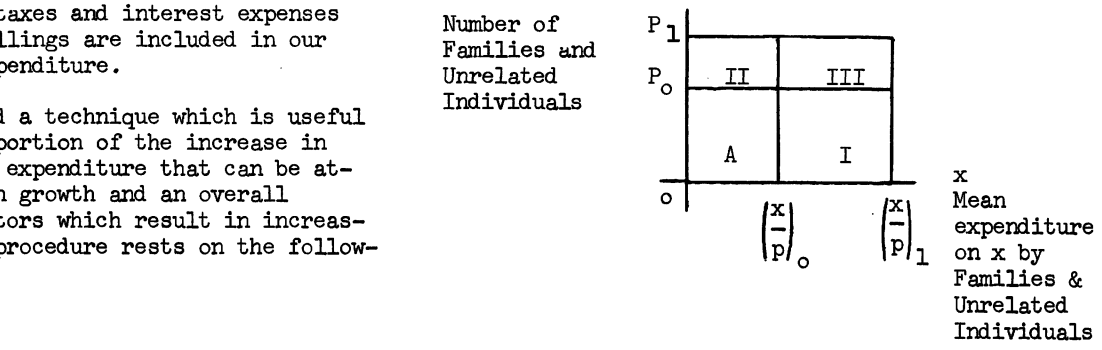
$$\left(x_1 - x_o\right) =$$

$$\left(p_o\right)\left(\frac{x_1}{p_1} - \frac{x_o}{p_o}\right) + \left(\frac{x_o}{p_o}\right)\left(p_1 - p_o\right) + \left(p_1 - p_o\right)\left(\frac{x_1}{p_1} - \frac{x_o}{p_o}\right)$$

Thus:

$$\Delta x = p_o\, \Delta\left(\frac{x}{p}\right) + \left(\frac{x}{p}\right)_o \Delta p + \Delta p\, \Delta\left(\frac{x}{p}\right)$$

The first term shows the "pure" income effect (i.e., the change in average expenditure on x times a constant population); the second term shows the "pure" population effect (i.e., the change in population times a constant average consumption of x); and the final term shows the combined effect of the change in population times the change in average consumption of x. The following box diagram is useful in showing the magnitude of the above effects.



On the "x" axis we measure the average expenditure on x, and on the "p" axis we measure the number of families and unrelated individuals. The area of box A then measures the aggregate expenditure on x for period zero $p_o\left(\frac{x}{p}\right)_o$. The area of box I shows the increase in expenditure for x attributable to the "pure" income effect, box II

shows the increase effect of the increases in the income and population factors. For our analysis we partitioned box III into separate population and income effects. The rule we used to allocate box III was to prorate it according to the relative magnitude of the "pure" population effect (box II) and the "pure" income effect (box I). Thus if the area of box I is twice as large as box II, then 2/3 of box III is attributed to income factors and 1/3 is attributed to population factors.

Using the above procedure we have estimated the proportion of the projected increases in income and major categories of consumer expenditure, which can be attributed to population and to income factors. The estimates are shown in table 2. About 60-percent of the increase in aggregate income can be attributed to increasing affluence and the remaining 40-percent of the increase is attributable to population growth. Increasing affluence is also the more important factor in the projected increase in all the major categories of consumer expenditure except for food and clothing. Of the remaining categories, increases in income account for almost three-fourths of the increase for housing and recreation and from 51 to 61-percent of the increase for the remaining categories.

Table 1.--DISTRIBUTION OF FAMILIES AND UNRELATED INDIVIDUALS AND AGGREGATE INCOME, BY INCOME LEVELS: 1968 AND 1985

(All figures in 1968 dollars)

Income levels	1968 1/	1985 estimate
FAMILIES AND UNRELATED INDIVIDUALS		
Number (millions)	64.3	85.9
Percent distribution		
Total	100.0	100.0
Under $3,000	14.5	8.6
$3,000 to $4,999	12.7	8.1
$5,000 to $9,999	32.8	21.4
$10,000 to $14,999	23.0	21.9
$15,000 to $24,999	13.1	26.8
$25,000 and over	3.9	13.2
Median Income	$8,470	$12,600
AGGREGATE INCOME		
Amount (billions)	$629	$1263.4
Percent distribution		
Total	100.0	100.0
Under $3,000	2.5	1.0
$3,000 to $4,999	5.1	2.2
$5,000 to $9,999	25.0	11.0
$10,000 to $14,999	28.2	17.9
$15,000 to $24,999	24.3	33.1
$25,000 and over	14.9	34.8
Mean Income	$9,779	$14,700

1/ Amounts adjusted to compare with OBE control totals.

Table 2.--AGGREGATE CURRENT CONSUMPTION EXPENDITURES OF ALL FAMILIES AND UNRELATED INDIVIDUALS: 1968 AND 1985

(In billions of 1968-dollars except percents)

Income levels	1968	1985	Percent increase	
			Attributable to population change	Attributable to income change
Total aggregate income....	$628.9	$1,263.4	40.0	60.0
Taxes, Savings.....	117.1	277.9	30.4	69.6
Expenditures for current consumption.....	511.8	985.5	43.1	56.9
Food, beverage, tobacco....	124.7	183.3	77.2	22.8
Housing (shelter).....	49.1	128.1	26.1	73.9
Household operation and furnishings.....	75.9	141.9	45.4	54.6
Clothing and clothing materials.....	55.5	95.6	53.3	46.7
Personal and medical care..	47.7	96.6	39.2	60.8
Transportation.....	72.2	130.1	49.0	51.0
Recreation, education, contributions, and other.....	86.7	209.9	29.2	70.8

1/ Edward C. Budd and Daniel B. Radner, "The OBE Size Distribution Series: Methods and Tenative Results for 1964," American Economic Review, May 1969, Vol. LIX, No. 2, pp. 435-449.