Volume Title: Demographic and Economic Change in Developed Countries

Volume Author/Editor: Universities-National Bureau

Volume Publisher: UMI

Volume ISBN: 0-87014-302-6

Volume URL: http://www.nber.org/books/univ60-2

Publication Date: 1960

Chapter Title: Population Change and the Demand for Services

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Chapter URL: http://www.nber.org/chapters/c2397

Chapter pages in book: (p. 512 - 542)

Population Change and the Demand for Services

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THE objective of this paper is to evaluate the extent to which changes in the size and distribution of the population are able to account for changes in consumer outlays on services between 1936 and 1956. These dates were chosen because cross-section as well as time series data on consumer expenditures are available for those years on a national basis. Two facets of the problem are investigated:

1. The extent to which changes in total outlays for specific services during 1936–1956 are accounted for by the growth in the size of the total population.

2. The extent to which these changes are accounted for by: (*a*) Shifts in relevant population characteristics, and, (*b*) Changes in outlay per consumer unit.

Before embarking upon the empirical analysis, it would seem desirable to consider some of the problems involved in an empirical study of this sort.

Measurement Problems

Theoretically the effect of any given change in population numbers or composition can be evaluated in terms of its impact on the amount and distribution of consumer expenditures. Putting this theory into practice, however, reveals numerous obstacles to the attainment of such a goal. For one thing, changes in population are not self-limiting. In most instances, a chain-reaction effect sets in whereby one change leads to a number of other population changes. Thus, an increase in population, which is commonly brought about either by more births or a reduced death rate, implicitly alters the age distribution of the population and varies other distributional characteristics as well. Similarly, a change in, say, the educational distribution serves to bring about changes in the distribution of the population by other characteristics as well.

Second, considerable time may be required both for a particular population change to take place and for its full effect on expenditures to be

Note: The author would like to express his appreciation to Fadil Zuwaylif for assistance with the statistical analysis. He is also indebted to V Lewis Bassie of the University of Illinois and to Philip Golden of *Life* Magazine for reading the manuscript and for helpful suggestions.

apparent. Thus, an increase in birth rates in any one year will alter any number of population distributions for years to come, and many of these will in turn influence expenditure patterns, in part right away and in part with a certain lag.

Third, population changes are not discrete. Before one change has had time to work itself out, others are already under way. Some of these other changes may be brought about in part because of the initial change, while others may be the result of entirely independent phenomena. As a result, the effects of population change tend to become confounded with each other, particularly if two different changes are exerting the same effect on consumer expenditures.

Then there is the perennial chicken-or-the-egg question. Is a particular change in consumer outlays really attributable to a change in population, even if statistical analysis confirms the existence of a relationship, or is it attributable to other, more basic factors which may account for the population change as well? A definitive answer to such a question is not generally possible, in view of the complex interrelationship of demographic and economic events. Population changes are invariably brought about by changes in economic and political conditions which in turn give rise to further shifts in population. The dimensions of the analysis therefore become an important consideration. At the same time, it is clear that only the most intensive type of analysis would permit the tracing of events back to the ultimate causes.

Since resources do not permit such an approach in the present case, we shall content ourselves with an examination of the extent to which changes in consumer service expenditures are associated with population changes. We cannot infer from the results that such net effects as are detected can be attributed solely to a change in the total population, since no attempt is made to evaluate the degree to which the population changes themselves are brought about by nondemographic causes. Similarly, we can measure the extent to which a change in family outlays is associated with a shift in certain relevant population characteristics, but we cannot ascertain the extent to which this shift is brought about by economic or other forces.

For much the same reason, it is much more difficult than appears at first sight to distinguish between effects due to changes in population numbers and effects due to shifts in population characteristics. Not only is there the problem of eliminating the interacting influences of other factors but it is still not clear how much of what remains is truly demographic in nature. In particular, shifts in population characteristics are

likely to be brought about by changes in economic and cultural conditions, the influence of some of which is not even measurable. Hence, such demographic effects as are uncovered, though "net" in a statistical sense, are likely to be "gross" in a broader sense.

Both facets of our empirical analysis are subject to these limitations. The population effects which are brought out by the analysis are primarily gross, or apparent, effects. Although the results of both parts of the analysis are based on definitional concepts, this does not remove the inherent limitation noted above. With the results of the cross-section analysis, the difficulty is resolved to the extent that changes in expenditures are attributable to differences in unit outlays of the same population groups. Differences ascribable to shifts in relevant population characteristics, however, only serve to set the stage for more intensive analysis to uncover the factors underlying the observed population shifts.

Effect of Growth in Total Population

The total population of the United States increased by 31 per cent between 1936 and 1956, with almost two-thirds of the increase taking place during the last six years of this period. During the two decades,

TABLE 1

Increase in Service and Total Consumption Expenditures and Allocation of Increase to Components, 1936–1956

Per Cent Increase in	*1936–50*		*1950–56*		*1936–56*	
A. Extent of Increase						
All consumption expenditures, current prices	209.9		38.1		330.2	
All service expenditures, current prices		177.0		53.6		324.5
Population		18.3		10.9		31.1
Price of consumer goods and services	83.1		13.7		108.1	
Price of consumer services		65.5		21.3		100.8
Deflated consumption expenditures	43.5		9.7		57.4	
Deflated service expenditures		41.1		14.5		60.9
B. Allocation of Increase to Components						
Component and category:						
Population, all consumption	15.2		32.0		19.2	
Population, services		16.9		24.2		19.4
Prices, all consumption	52.7		39.5		49.3	
Prices, services		49.0		44.9		47.4
"Real" change, all consumption	*32.1*		*28.5*		*31.5*	
"Real" change, services		*34.1*		*30.9*		*33.2*
Total	100.0		100.0		100.0	
		100.0		100.0		100.0

Sources: Population: *Business Statistics*, Department of Commerce, 1957, p. 56. Prices and consumption expenditures: *Survey of Current Business*, July, 1958.

dollar outlays on service expenditures as well as on all consumption goods and services more than quadrupled (Table 1). Much of this increase in outlays on both goods and services is accounted for by the rise in prices, which for goods more than doubled and for services nearly doubled. Nevertheless, the "real" value of outlays per consumer rose by almost 60 per cent.

As a result of these substantial increases in prices and in real consumption per capita, the contribution of the growth in population to increased expenditures on consumer goods or services during this period was relatively small, about 20 per cent.[1] The population effect was much larger during the 1950's, accounting for almost one-fourth of the increase in service outlays and for almost one-third of the rise in expenditures on goods. Increases in price or in "real" consumption were generally not as pronounced during these six years as during the preceding fourteen.

Estimates of the direct contribution of population growth to outlays on the major categories of services indicate a fair degree of variation in the importance of this effect both between categories and between time periods (Table 2). These estimates were derived in the same manner as those for the aggregates in Table 1, with the exception that the number of *households* was used instead of the number of people in obtaining the population effect on increased expenditures for housing, household utilities, and domestic service.[2]

[1] To maintain comparability with the analysis of survey data in the next section, the allocation of increased outlays among components may be interpreted within the following framework:

Let: C and C' represent consumer expenditures in period 0 and 1, respectively.
M and M' represent population in periods 0 and 1, respectively.
P and P' represent the consumer goods price level in periods 0 and 1, respectively.
X and X' represent real consumption per capita in periods 0 and 1, respectively.

Define $M' = M + N$, $P' = P + Q$, $X' = X + Y$, N, Q, and Y representing the arithmetic incremental changes in population, price and real consumption, respectively, between periods 0 and 1.

Then:

$$C' = M'P'X' = (M + N)(P + Q)(X + Y)$$

and:

$$C' - C = NPX + MQX + MPY + NQX + NPY + MQY + NQY$$

The first three terms represent the "direct" effects of each factor on increased consumption, and the remaining terms represent indirect (interaction) effects. The allocation to components is, then:

Effect of population $= NPX + 1/2NQX + 1/2NPY + (1/3)NQY$
Effect of price $= MQX + 1/2NQX + 1/2MQY + (1/3)NQY$
Effect of "real" consumption $= MPY + 1/2NPY + 1/2MQY + (1/3)NQY$

[2] Another exception is that the price indexes for the different service categories underlying the calculations for Table 2 were derived by the author based on methods described in another paper. "A Statistical Study of Factors Influencing Temporal Variations in

TABLE 2

Allocation of Increase in Outlays for Main Categories of Services to Components, 1936–1956
(per cent)

Service Category	*Component*	*1936–50*	*1950–56*	*1936–56*
Housing	Households	28.4	26.4	28.0
	Price	31.1	46.0	35.4
	"Real" increase	40.5	27.6	36.6
	Total	100.0	100.0	100.0
	Over-all increase	169.5	53.6	314.0
Household utilities	Households	27.5	20.1	25.7
	Price	8.7	14.8	11.4
	"Real" increase	63.8	65.1	62.9
	Total	100.0	100.0	100.0
	Over-all increase	182.6	76.2	398.1
Domestic service	Households	31.5	32.5	34.1
	Price	110.6	63.4	100.5
	"Real" increase	−42.1	4.1	−34.6
	Total	100.0	100.0	100.0
	Over-all increase	163.0	41.7	262.3
User-operated transportation	Population	12.7	22.2	15.6
	Price	27.1	52.2	33.5
	"Real" increase	60.2	25.6	50.9
	Total	100.0	100.0	100.0
	Over-all increase	303.3	59.4	541.9
Purchased transportation	Population	17.9	126.7	26.6
	Price	41.5	295.4	60.8
	"Real" increase	40.5	−322.1	12.5
	Total	99.9	100.0	99.9
	Over-all increase	158.8	108.7	181.1
Foreign travel	Population	19.4	17.4	18.8
	Price	61.5	17.1	43.4
	"Real" increase	19.1	65.5	37.7
	Total	100.0	100.0	99.9
	Over-all increase	142.4	82.2	341.4

Aggregate Service Expenditures" in *Consumer Reactions*, Lincoln Clark, ed., Harper & Bros., 1958, pp. 394–420. This was necessitated by the refusal once again of the National Income Division of the U.S. Department of Commerce to make available their price indexes on the subject. Since the author does not have the resources of the National Income Division—only a more open-minded attitude—the price indexes must be treated as rough approximations, particularly for such services as personal business, religious and welfare activities, and foreign travel.

TABLE 2, concluded

Service Category	*Component*	*1936–50*	*1950–56*	*1936–56*
Recreation	Population	16.8	30.3	21.9
	Price	54.0	59.9	58.6
	"Real" increase	29.2	9.9	19.5
	Total	100.0	100.0	100.0
	Over-all increase	176.7	40.7	263.6
Personal care	Population	21.5	18.4	20.9
	Price	94.1	42.3	71.9
	"Real" increase	−15.6	39.4	7.2
	Total	100.0	100.1	100.0
	Over-all increase	126.3	76.2	293.8
Clothing and jewelry service	Population	14.2	26.2	19.6
	Price	43.0	51.7	50.1
	"Real" increase	42.7	22.1	30.3
	Total	99.9	100.0	100.0
	Over-all increase	237.9	48.5	317.9
Medical care	Population	15.0	26.5	18.2
	Price	37.7	62.0	43.3
	"Real" increase	47.3	11.5	38.5
	Total	100.0	100.0	100.0
	Over-all increase	215.8	47.9	367.0
Private education	Population	14.7	15.1	15.5
	Price	58.9	39.3	50.8
	"Real increase"	26.4	45.6	33.8
	Total	100.0	100.0	100.1
	Over-all increase	227.8	99.2	552.8
Personal business	Population	19.4	19.4	19.7
	Price	44.2	8.6	31.1
	"Real" increase	36.4	72.0	49.2
	Total	100.0	100.0	100.0
	Over-all increase	140.4	71.1	311.1
Religious and welfare	Population	17.4	23.9	20.4
	Price	76.1	75.8	75.8
	"Real" increase	6.5	0.4	3.8
	Total	100.0	100.1	100.0
	Over-all increase	173.3	54.9	316.9

The increase in total population contributed a relatively small proportion of the expansion in outlays for these services. The population effect seems to have been more important in the postwar period, due in part to the more rapid growth in population during this period and in part to the reduced, and at times, negative, expansion in "real" consumption of services. Even then, however, population growth generally did not account for more than one-third of the total increase in specific service expenditures.

For the two decades combined, the contribution of the total population effect was of the order of 15 to 25 per cent. As a general rule, services for which the population effect was relatively more important were not the ones that exhibited the largest increases in outlays. This is only to be expected when we consider that the relative increase in population was considerably less than the increase in either the price or "real" outlay for such rapidly expanding services as education, medical care, and user-operated transportation. In fact, although population contributed in all instances to the increase in expenditures, in no instance was it the dominant effect.

In interpreting these findings, it must be kept in mind that they measure only that part of the population effect brought about by the over-all (net) change in the *size* of the population. The findings do not necessarily reflect the effect on expenditures of changes in the *composition* of the population, which can be especially important for services or goods used primarily by particular segments of the population, as has been true until recently of private education and foreign travel. To obtain estimates of such effects, however, requires the use of cross-section data, as is attempted in the next section.

These findings possess the further limitation that they do not, and can not, allow for changes in population not associated with any corresponding change in outlays. Thus, the fact that population rose 10 per cent between 1936 and 1946 does not of itself mean that outlays should have risen 10 per cent as a result, distribution effects aside. For these reasons, the figures in Tables 1 and 2 have to be interpreted as rough approximations of the true effect of population, but it is doubtful if the estimates are so rough as to negate the principal inferences drawn from them.

Effect of Population Shifts

METHOD USED

The effect on service outlays of population shifts was determined by a segmental approach roughly similar to that used with the aggregative

data, though adapted to the distinctive nature of the cross-section data required for this type of analysis. The approach was based on the premise that the change in aggregate outlays for a particular good or service between any two periods can be compartmentalized, with the aid of cross-section data, into three effects, as follows:

1. The numbers effect—the change attributable to a change in the total number of people, or consuming units.

2. The distribution effect—the change attributable to shifts in the distribution of the population by "relevant" population characteristics.

3. The consumption effect—the change attributable to shifts in the outlay per consumer unit over time.

Because of the absence of price information with the cross-section data, the consumption effect now encompasses both the "real" and price effects of the preceding section.

It can be shown that these effects interact with each other and that, in general, each effect is composed of three sub-effects, or components.[3] These components, which are additive, are:

(*a*) Direct influence of that effect, that is, the zero-order interaction.

(*b*) The interaction of that effect with each of the other (two) effects separately, the first-order interactions.

(*c*) The interaction of that effect with both of the other effects simultaneously, the second-order interaction.

[3] The algebraic framework is as follows:

Let: C and C' be aggregate outlays in periods 0 and 1, respectively, not necessarily consecutive.
M and M' be the total number of consumer units in each of those periods.
r_i and r_i' be the proportion of consumer units in each period having the population characteristic, i.
x_i and x_i' be the average outlay per consumer unit of those possessing population characteristic, i, in each period.

Define:

$$(1) \qquad M' = M + N, \quad r_i' = r_i + s_i, \quad x_i' = x_i + y_i$$

Then, aggregate outlays in the two periods are:

$$(2) \qquad C = M\Sigma r_i x_i \quad \text{and} \quad C' = M'\Sigma r_i' x_i' = (M + N)\Sigma(r_i + s_i)(x_i + y_i)$$

and the change in outlays is, with a little algebra:

$$(3) \qquad C' = C = \underbrace{N\Sigma r_i x_i + M\Sigma s_i x_i + M\Sigma r_i y_i}_{\text{Direct influence}} + \underbrace{N\Sigma s_i x_i + N\Sigma r_i y_i + M\Sigma s_i y_i}_{\text{First-order interactions}} + \underbrace{N\Sigma s_i y_i}_{\text{Second-order interaction}}$$

Numbers effect	x			x	x	x
Dsn. effect		x		x	x	x
Cons. effect			x		x	x	x

The brackets and x's indicate the segregation of the terms by nature of the effect and of interactions.

Thus, given the necessary data, it is possible to compartmentalize a change in aggregate outlays not only by these three major effects, but also by the manner in which these forces interact with each other to affect outlays. There are, however, two principal problems involved in the application of this method. One problem, a perennial one in empirical work, is securing the necessary data on a comparable basis. In the present instance, this pretty well limited the analysis to the 1935–1936 Bureau of Labor Statistics Consumer Expenditures Study, the 1950 BLS-Wharton Study, and the 1955–1956 LIFE Study of Consumer Expenditures (LSCE). The comparability is not as complete as might be desired between these studies, particularly between the LIFE Study and the other two, but could be made sufficient for the purposes at hand by judicious selection of expenditure classifications.

The second, and somewhat interrelated, problem is the specification of "relevant" population characteristics. By the latter term is meant that population characteristic, or combination of population characteristics, which influences outlays for the particular goods or services under consideration. Ideally, population characteristics are sought which are relevant in a *net* sense—relevant after the influence of other population characteristics have been removed. Ideally, also, that combination of population characteristics is sought which is "most relevant" to the particular set of goods or services in the sense of accounting for the largest degree of variability in expenditures, though for certain purposes it will be at least of equal interest to ascertain the relative degrees of relevance of alternative combinations of population characteristics.

The specification of relevant population characteristics is of basic importance, for it governs the determination of the relative importance of the three effects. The greater the over-all (gross) relevance of a particular characteristic, the greater will be the importance of the distribution effect relative to the two other effects.

One approach to this specification problem is to seek for each category of services the "most relevant" combination of population characteristics. From a practical point of view, however, this approach is unfortunately not feasible, for to ascertain the "most relevant" combination is an undertaking not only far beyond the scope of this study but is also one which would require considerable time and resources.

The second approach is therefore the only practicable alternative. This approach involves selecting certain population characteristics which can be expected on a priori grounds to be relevant to the categories of services under study, and for which the necessary data are available, and

determining the importance of the distribution effect of each characteristic, or combination of characteristics in turn. Although esthetically not as satisfying as the "ideal" approach, this approach nevertheless should provide a general idea of the importance of the distribution effect, particularly of its lower limit. It is indeed not unlikely that results obtained in this manner may not be too far from the "true" state of affairs when we consider that, first, the characteristics by which expenditure data are presented tend (or are thought) to be the most relevant in general, and second, because of the intercorrelation between most socio-economic characteristics, the estimate of the distribution effect based on only one or two characteristics is likely to be not a net effect, but a larger, gross effect incorporating part of the influence of related characteristics. Though not desirable from a conceptual point of view, this "grossness" of the estimates derived in this manner undoubtedly contributes to securing a more accurate, over-all picture of the importance of the distribution effect.[4]

In practice, it turns out that there is no choice at all, for the only population characteristic for which reasonably comparable data are available at present on at least two surveys is income. The principal reasons for this are the following:

1. Breakdowns of the 1935–1936 data on a national basis are presented only by income. Tabulations are presented also by region, city size, occupation of head, family size, and family composition, in turn, but *only* for families of two or more.

2. The 1950 study contains a wealth of tabulations by population characteristics but deals only with urban areas.

3. Detailed tabulations of the 1955–1956 study are not yet available. Those that are available present data on expenditures by a host of characteristics (but not family size!) all dealing with the total United States, and only income is cross-tabulated with the other characteristics.

As a result, the present analysis deals only with the distribution effect of income. As noted previously, the results in all likelihood pertain to more than the effect of income alone—probably a good deal more, considering the positive intercorrelation between income and such other characteristics as education, occupation, family size, and location—but exactly how much more is difficult to judge.[5]

[4] The opposite is also possible, if negative intercorrelation is present, but on balance is not too likely.

[5] The little work that has been done on this subject indicates that the additional distribution effect on other socio-economic variables is likely to be almost negligible once shifts in income distribution have been taken into account. U.S. National Resources

TABLE 3

Data Used in Estimating Effect on Income Redistribution on Expenditures

Expenditure Category		*Major Differences in Coverage, if any; General Notes*
Early Period	Later Period	
1935–1936 and 1955–1956: Total U.S.		
Housing	Housing	Imputed values used for owned homes in 1935–36; mortgage payment in 1955–56.
Household operation	Home operation and improvement (excluding housing and home decoration materials)	Includes furnaces and heating equipment in 1955–56; excludes cleaning and stationery supplies.
Personal and medical care	Personal and medical care	—
Recreation	Recreation	Reading materials included in 1955–56.
1935–1936 and 1950: Urban U.S. Families of 2 or More		
Housing	Housing	Imputed values used for owned homes in 1935–36.
Fuel, light, and refrigeration	Fuel, light, and refrigeration	—
Medical care	Medical care	Excludes drugs and supplies.
Personal care services	Personal care services	—
Auto operation	Auto operation	Includes gas and oil.
Admissions	Admissions	—
Gifts and contributions	Gifts and contributions	—
Education, including supplies	Education, including supplies	—
Other transportation	Other transportation	—
1950 and 1955–1956: Urban U.S.		
Housing	Housing	—
Fuel, light, and refrigeration	Home heating utilities	1955–56 figure includes cost of furnaces and heating equipment.
Clothing services	Clothing and accessories care	—
Medical and personal care	Medical and personal care	Excludes drugs and medical and personal care supplies.
Auto operation	Auto operation	Includes gas, oil, and auto parts.
Admissions	Admissions	—

Committee, *Consumer Expenditures in the United States*, U.S. Government Printing Office, Washington, D.C., 1941, Appendix C, pp. 185–187. Although this does not imply that these other population characteristics possess negligible distribution effects by themselves, it serves to support that suggestion ventured above that income redistribution incorporates, in whole or in part, the bulk of the effect of shifts in the demographic variables of principal relevance to consumer expenditures.

A list of the tests carried out with these three sets of data is shown in Table 3. This table also highlights the main differences in coverage between the different studies. In addition, two major sources of non-comparability deserve special mention. They are:

1. The sampling unit for the 1955–1956 data was the household (all people residing in one dwelling unit *including* boarders, servants, and the like, though excluding dwelling units with 5 or more boarders), while the sampling unit in 1935–1936 and 1950 was the family or consumer unit (persons in the same dwelling unit dependent on a common or pooled income for major expenditures). Since the average household would be larger than the average family, both its income and expenditures would be correspondingly larger. This would manifest itself as an upward bias in the "family" income distribution taken from the 1955–1956 household data and in the consequent estimation of the distribution effect.[6] In a similar fashion, an upward bias would appear in the estimation of the consumption effect, and a relative downward bias in the numbers effect.

2. Expenditure categories differ in various ways between surveys. In particular, the 1955–1956 LIFE data do not cover outlays for education, domestic service, gifts, or purchased transportation, nor do they present separate tabulations on the service component of household operation, auto operation, or clothing services. Foreign travel and personal business expenditures are not covered, or shown separately, in any of the surveys. Hence, several service categories could not be included at all.

Aside from these, there are differences in the methods used to obtain the data, nature, and extent of validity checks made with individual questionnaires, and in a number of other aspects.[7] This discussion is sufficient to indicate that little choice exists in the specification of relevant characteristics and that the results obtained are useful primarily as general indicators of the relative importance of the different effects, given a particular population distribution.

RESULTS

The nature of the results obtained by this approach is illustrated by Table 4, which shows the breakdown of the increase in expenditures for

[6] On the other hand, understatement of incomes in the 1955–1956 study was apparently not infrequent, and seemingly more so than in the 1935–1936 and 1950 studies, which would have some compensatory effect.

[7] For a more complete discussion of these differences between the 1935–1936 and 1950 studies, see the Wharton School monograph by Helen Lamale. The distinctive aspects of the 1955–1956 Life study are reviewed in a general way in the "Objective" section of Volume 1 of the series of reports published by Time Inc., on this study.

TABLE 4

Allocation of Increase in Housing Expenditures from 1935–1936 to 1955–1956 by Different Effects
(dollar amounts in millions)

(1) Direction of Effect	(2) Numbers Effect	(3) Distribution Effect	(4) Consumption Effect	(5) Total	(6) Per Cent of Total
Direct	$2,327	$13,997	$−270	$16,054	130.9
First-order					
Numbers and distribution	1,717	1,717		3,434	28.0
Numbers and consumption	−33		−33	−66	−0.5
Distribution and consumption		2,873	−2,873	−5,746	−46.9
Second-order	−470	−470	−470	−1,410	−11.5
Total	$3,541	$12,371	$−3,646	$12,266	
Per cent of total	28.9	100.8	−29.7		100.0

housing between 1935–1936 and 1955–1956 by the type and direction of effect. The data in the body of the table are obtained by applying equation (3) in footnote 3 to the distribution of housing expenditures by income in 1935–1936 and in 1955–1956, as taken from the BLS and LSCE studies, respectively. The figures in the first line of columns 2–4 represent the direct influences of the three effects: $2,327 is $N\Sigma r_i x_i$, $13,997 is $M\Sigma s_i x_i$, and $−270 is $M\Sigma r_i y_i$. The figures in the next three lines represent the first-order interactions, allocated evenly in each case between the two effects involved. Thus, $3,434 represents $N\Sigma s_i x_i$, the first-order interaction between the numbers and distribution effects, and is allocated 50–50 to each effect individually. A similar procedure is followed for $−1,410, the second-order interaction ($N\Sigma s_i y_i$).

The summation of these effects horizontally shows, in column 5, the total importance of the direct and the various interaction effects, converted into percentages in column 6. The vertical summation of the figures in columns 2–4 indicates, in the "total" line, the net magnitude of the three types of effects, and, in the next line, the relative importance of each.

The over-all sum in the table, $12,266 millions, is the extent of increase in housing expenditures for the populations covered between these two dates according to the survey data. Examination of the components of this sum in Table 4 reveals that income redistribution is seen to account for by far the largest portion of the increase. The growth of population exerts a net positive effect also, whereas the consumption effect is negative. The latter indicates that, on balance, average family outlays for housing,

holding income and population constant, declined during these two decades.[8] This may be due in part to the failure of housing prices, particularly rentals, to rise as fast as income, though it is also not unlikely that at least part of these differences is due to lack of comparability between the two sets of data.

Table 4 also indicates that the direct effects are clearly the most important in accounting for the increase in housing outlays. At the same time, the interaction effects are seen to possess some importance, too. The first-order interaction between the numbers and distribution effects contribute $3.4 billion to the increase in outlays. Even more striking is the reduction of $5.7 billion brought about by the first-order interaction between the distribution and consumption effects. This is accounted for by the shift in the income distribution toward higher income levels coupled with the fact that the most pronounced reductions in average family housing outlays were at these levels. It is for this reason that the second-order interaction is also negative.

The results obtained in carrying out the same analysis on the other pairs of categories listed in Table 3 are presented in Table 5. The figures presented in this table correspond to the marginal totals in Table 4—the percentages in column 6 and in the last row of the table. Column 2 of Table 5 also indicates the magnitude of the change involved which, taken with the percentages in columns 4–11, provide a general summary picture of the importance of the different types and direction of effect.

It is important to note that the three main parts of Table 5—Parts A, B, and C—pertain to different segments of the total population, with only Part A referring to the entire population. For this reason, the results in the different parts of the table are not additive, even apart from noncomparabilities in the same category between any two periods, as noted in Table 3, and are not directly comparable with each other.

The results obtained in Table 5 vary substantially with the period under consideration. For both periods together, the distribution effect is by far the most important, accounting for half or all of the increase in each type of outlay. The rise in total population contributes between 20 and 30 per cent while the consumption effect is more erratic, serving to increase recreation and medical and personal care expenditures while reducing outlays for household operation and particularly for housing.

[8] Examination of the data indicates that this phenomenon varies substantially with income level and is due primarily to reduced housing expenditures at the higher income levels. Below incomes of $4,000, housing outlays increased between 1935–1936 and 1955–1956. Above this level, housing outlays decreased, with the relative margin increasing rapidly with rising income levels.

TABLE 5

Allocation of Increase in Expenditures for Selected Services by Different Effects

Expenditure Category (1)	*Total Net Change in Millions of Dollars* (base for percentages) (2)	*Total* (3)	*Type of Effect*			*Direction of Effect*				
			Nos. (4)	Dsn. (5)	Cons. (6)	*Direct* (7)	*First-order Interaction*			*Second-order Interaction* (11)
							Nos. and Dsn. (8)	Nos. and Cons. (9)	Dsn. and Cons. (10)	
A. 1935–1936 vs. 1955–1956: Total U.S.										
Housing*	$12,243	100.0%	28.9	100.8	−29.7	130.9	28.0	−0.5	−46.9	−11.5
Household operation*	10,495	100.0	22.2	83.7	−5.9	112.4	22.1	2.5	−29.7	−7.3
Medical and personal care	7,603	100.0	20.9	63.1	16.0	121.2	18.8	8.4	−38.9	−9.5
Recreation	8,962	100.0	14.0	51.8	34.2	83.5	11.6	7.8	−2.3	−0.6
B. 1935–1936 vs. 1950: Urban families of two or more										
Housing	$11,142	100.0%	43.7	54.1	2.2	84.3	28.9	4.6	−11.0	−7.0
Fuel, light, and refrigeration	2,988	100.0	50.6	28.2	21.2	96.0	19.7	16.5	−20.0	−12.2
Medical care	4,778	100.0	30.9	36.7	32.4	73.9	19.3	17.3	−6.5	−4.0
Personal care	792	100.0	38.5	51.1	10.5	79.6	26.7	7.7	−8.7	−5.3
Auto operation	4,661	100.0	30.7	54.6	14.7	62.2	23.6	5.0	5.8	3.5
Admissions	877	100.0	40.4	69.6	−10.0	86.9	37.5	0.5	−12.5	−9.4
Gifts and contributions	3,532	100.0	33.8	65.7	0.5	84.4	36.0	5.6	−16.2	−9.9
Education*	412	100.0	64.3	142.4	−106.7	185.4	102.0	−15.3	−106.9	−65.2
Other transportation*	1,492	100.0	31.4	41.0	27.6	61.9	17.1	10.8	6.3	3.9
C. 1950 vs. 1955–1956: All urban families										
Housing	$5,368	100.0%	46.5	33.8	19.7	102.0	6.0	3.9	−10.2	−1.7
Fuel, light, and refrigeration*	770	100.0	105.4	65.9	−71.3	112.2	11.1	−9.8	−11.6	−1.9
Clothing services	1,162	100.0	27.6	33.6	38.8	87.8	5.0	5.8	1.2	0.3
Medical and personal care	2,908	100.0	30.7	18.5	50.8	80.8	2.1	7.0	8.7	1.4
Auto operation	4,580	100.0	27.2	31.3	41.5	87.1	4.6	6.1	1.9	0.3
Admissions*	−162	100.0	122.0	128.9	−350.9	−22.0	−27.7	45.3	89.3	15.1

* Results for these categories are probably affected by differences in survey coverages (see pp. 512ff.) and may be of doubtful significance.

Basic sources: 1935–36: U.S. National Resources Committee, *Consumer Expenditures in the U.S.*, 1940. U.S. National Resources Committee, *Family Expenditures in the U.S.*, 1940.

1950: University of Pennsylvania, *Consumer Expenditures, Income and Savings*, 1950, Vol. 18.

1956: Unpublished tabulations from the Life Study of Consumer Expenditures made available through the courtesy of *Life* Magazine.

For the period between 1935–1936 and 1950, the contribution of each effect varies considerably by category, though the growth of population generally increases in importance. Thus, the numbers effect accounts for almost half of the increase in outlays for housing and for fuel, light, and refrigeration, and 30 to 40 per cent of the increase in expenditures on medical care, personal care, and on admissions—categories comparable to those in Part A of the table for which the relative effect of population growth was considerably less.

At the same time, the redistribution of income exerts substantial effect on most of the expenditure categories, and accounts for the bulk of the increase in outlays for such services as housing, auto operation, admissions, gifts and contributions, and education. Changes in consumption patterns, holding income redistribution and population growth constant, serve to increase greatly outlays for medical care and purchased transportation and to reduce sharply expenditures for education (though, as noted later, the latter may well be due to noncomparabilities in the underlying data).

Changes in consumption patterns appear to be considerably more important during the 1950's. These changes account for about 40 per cent or more of the increase in outlays for clothing services, medical and personal care, and auto operation, and apparently kept the increase in expenditures on household utilities substantially below what they otherwise would have been.

The results pertaining to direction of effect are fairly consistent from one period to another. The bulk of the increase in outlays—often more than 100 per cent of the net amount—is accounted for by the summation of the three direct effects, as one would expect. The interaction between population growth and income redistribution generally makes a strong positive contribution to the rise in expenditures, particularly if the 1950's are excluded—reflecting the relatively greater increase of consumer units at the higher-income levels.

The interaction between population growth and consumption tends to be low, reflecting the concomitantly low relationship between these two factors. On the other hand, the consumption-redistribution effect tends to be negative, particularly for both decades combined, as a result of outlays for medical and personal care, utilities, and recreation declining at upper income levels, which at the same time are rising most in importance, while outlays for these services were increasing at the lowest income levels. The second-order interaction exerts relatively little effect in most instances.

To what extent do these results reflect what actually happened and to

what extent do they reflect simply sampling errors and noncomparabilities between the three sets of data? Considering the diverse methods used in the three surveys, this is a question which merits serious consideration. Though a complete answer is beyond the scope of this study, useful general inferences nevertheless are possible. For this purpose, Table 6 presents rough comparisons of aggregate expenditures for the services categories and periods covered in Table 5 as derived from the survey data and from the United States Department of Commerce estimates of consumption expenditures. These estimates are rough in that no attempt has been made to correct the survey data for undercoverage of certain items and population groups (such as the highest income levels) nor has any attempt been made to correct for differences in survey and Commerce concepts other than to match corresponding categories of expenditure. The comparisons in this table therefore do *not* provide a basis for evaluating the relative accuracies of these two principal sources of data, particularly columns (4) and (7) which express the survey aggregates (C and C′ in each case, respectively) as percentages of the corresponding Commerce aggregates. This table, and these two columns in particular, are useful, however, for highlighting possible shifts in survey coverage between two surveys, taking the Commerce aggregates as the yardstick. Though the accuracy of the latter is at times not clear, the methods used are consistent over time so that the problem of comparability is relatively minor. Hence, to the extent that substantial differences (say, 25 percentage points or more) are apparent in the ratios for a particular expenditure category in columns (4) and (7), some presumption exists for re-examining the comparability of the survey data, though large differences of themselves do not provide conclusive evidence of noncomparability.

Such differences are immediately apparent for housing and household operation (or utilities) where 1955–1956 data are used. In the former case, imputed values were used for owner-occupied homes in 1935–1936 while mortgage payments were the basis in 1950 and in 1955–1956. By 1950, housing prices had probably not increased sufficiently to introduce a substantial error from substituting actual costs for imputed values. However, because of the housing boom in the 1950's, housing prices had risen by 1956 to the point where the imputed value would be substantially above the current cost of an owner-occupied house acquired as little as five years earlier. Hence, the large negative consumption effect for housing between 1935–1936 and 1955–1956, shown in Table 5, may well be spurious. Similarly, the very small consumption housing effect shown between 1935–1936 and 1950 may also be an underestimate; the 1950

TABLE 6

Comparison of Survey and Commerce Aggregative Estimates of Selected Services and Related Expenditures (dollar figures in millions)

Expenditure Category (1)	1935–1936 *Survey* (2)	1935–1936 *Commerce*[a] (3)	*Survey as Percentage of Commerce* (4)	1955–1956 *Survey* (5)	1955–1956 *Commerce*[a] (6)	*Survey as Percentage of Commerce* (7)
			A. Total U.S.			
Housing	$9,506	$7,789	122.0	$21,749	$29,199	74.5
Household operation	5,285	5,160	102.4	15,780	17,816	88.6
Medical and personal care	3,237	3,017	107.3	10,840	11,784	92.0
Recreation	1,643	2,058	79.8	10,605	13,432	79.0
	1935–1936		*B. Urban families of two or more*	1950		
Housing	$5,337	$4,645	114.9	$16,479	$16,919	97.4
Fuel, light, and refrigeration	1,796	1,529	117.5	4,784	4,584	104.3
Medical care	1,090	1,158	94.1	5,868	4,956	118.4
Personal care	300	238	126.0	1,092	713	153.1
Auto operation	1,168	1,318	88.6	5,829	5,324	109.5
Admissions	353	379	93.1	1,230	1,218	101.0
Education	290	279	103.9	702	1,177	59.6
Other transportation	398	532	74.8	1,890	1,881	100.5
	1950		*C. All urban families*	1955–1956		
Housing	$13,815	$16,754	82.5	$19,183	$25,054	76.6
Fuel, light, and refrigeration	4,983	5,123	97.3	5,753	7,623	75.5
Clothing services	1,577	1,509	104.5	2,739	3,325	82.3
Medical and personal care	4,562	5,009	91.1	7,470	7,582	98.5
Auto operation	6,077	5,950	102.1	10,657	9,693	109.9
Admissions	1,314	1,362	96.5	1,152	1,435	80.3

[a] Adjustment of Commerce data was based on the following percentages derived (for 1950, estimated) from population statistics and from the consumer expenditure studies:

	1935–36	*1950*	*1955–56*
Urban family expenditures as percentage of all families	66	76	81
Urban family expenditure as percentage of all nonfarm families	80	87	—
Expenditures of urban families of two or more as percentage of all urban families	81	90	—
Expenditures of urban families of two or more as percentage of all families	53	68	—

Sources: Commerce data: 1954 *National Income Supplement* and July 1957 *Survey of Current Business*, Table 30. Survey data: Same as Table 5.

to 1955–1956 comparison probably yields the most valid results for housing.

For household operation and utilities, the LSCE data seem to provide insufficient coverage, perhaps because these categories include various small items not easily collected in the type of interview used in the 1955–1956 study. Although this is another area in which price increases have lagged considerably behind income increases, the substantially negative consumption effect must be questioned, particularly for a period such as 1950 to 1955–1956, in view of the data in Table 6.

For similar reasons, it seems likely that education expenditures in 1950 are out of line with those in 1935–1936, that admissions in 1955–1956 were probably under-reported (though not recreation in general), and that other transportation expenditures were under-reported in 1935–1936. These various categories, six in all, have been labeled with asterisks in Table 5 to indicate the suspect nature of the results derived for them.

Omitting these suspect categories leaves us with a more consistent set of results—and with a considerably reduced base for drawing generalizations. Nevertheless, certain tendencies are clear:

1. The effect of population growth was most substantial, relatively as well as absolutely, between 1935–1936 and 1950, accounting at times for half or more of the rise in expenditures for selected services. Population growth also contributed strongly to the increases during the 1950's.

2. Population growth was relatively most important in increasing outlays for home-connected items and, to a lesser degree, for medical and personal care.

3. Increased outlays at given levels of income are of substantial importance in accounting for the sharp increases in outlays for medical and personal care and, in the 1950's, for the car owner and for clothing services.

4. The redistribution of population, particularly with regard to income, has been a major influence accounting for the rise in service outlays both from 1935–1936 to 1950 and from 1950 to 1955–1956. It appears to have exerted especially strong effects on the increase in expenditures for housing, medical and personal care, auto operation, and, of course, recreation.

Now, how do these results fit in with those obtained in the preceding section? The answer is, as noted earlier, that they cannot. In part this is because the two approaches explore the problem in different dimensions —the price aspects being covered in the first and population distribution in the second. Perhaps even more important are the differences in

coverage between the two sets of data, the Commerce series including institutional purchases as well as family expenditures and being derived in a different manner.

The first source of difference can be reconciled by extending the algebraic framework developed on pages 499–503 to include a price effect, even though data limitations require that one price be used for all income levels.[9] The results do not affect the relative importance of the numbers and distribution effects but do indicate that most of the consumption effect derived earlier is actually due to price increases. Once the effect of price is taken into account, virtually no "real" change in consumption is seen to have occurred during these decades for most services, holding constant population growth and income redistribution. Such modification as may be required in this conclusion because of possible differential price increases in services purchased at different income levels is in all probability relatively slight.

Thus, price is seen to exert major influence in accounting for the increase in survey-based expenditures, the exact proportions coming out to be very similar to, though generally somewhat lower than, the corresponding proportions for the aggregative results in Table 2. This is understandable, for the latter case includes no allowance for distribution effects.

Perhaps the most important reason for observed differences between the aggregative and survey-derived results lies in the inherent lack of comparability between the two types of data, at least as used in this study. The basic difficulty is that the survey data are restricted to certain segments of the consumer population, partly because of the original survey design and partly because of the necessity of reconciling the coverage of pairs of surveys to the type of analysis used here. In addition, the aggregative data include institutional expenditures for consumer goods and services, which are excluded from all the surveys. Then, too, methods generally used to derive the aggregative data are different from those used in consumer surveys.

All things considered, one would expect the aggregative results to ascribe less weight to population change as influencing consumer expenditures than the survey data. This is largely because the survey data

[9] Thus, let $x_i = pw_i$, where p is the average price paid by the ith group for the bundle of goods w_i in period O, and $x_i' = p'w_i'$ be the corresponding quantities in period 1. Then, let $p' = p + q$ and $w_i = w_i + v_i$, where q and v_i can be positive or negative. Making the appropriate substitutions in (2) on p. 503 and carrying out the algebra yields an expression analogous to (3) which permits segmentation of the price effect from the "real" consumption effect.

concentrate on the more dynamically changing population group, the urban population. With the urban population growing more rapidly than the total population, the population effect as derived from urban data is bound to be larger than a similar estimate based on total population growth. Then too, the use of the family, or household, rather than the individual as the population unit, tends to increase the effect of population growth by virtue of the faster rate of increase in family formation during the period studied, particularly between 1935–1936 and 1950.

Such an expectation is borne out by a comparison of the "numbers effect" percentages in Tables 2 and 5. The differences that are shown do not necessarily point to discrepancies in the various sets of estimates.[10] Rather they serve to highlight the varying effect of population change and of the other forces among different segments of the population.

Conclusions

The results of this exploratory investigation have to be interpreted with great care. In part, this is because of doubts regarding the reliability and comparability of the basic data used, not to mention that much of the essential data was not available—data on certain types of services and on changes in population distributions. In part, this is also because of the difficulty of interpreting empirical findings on population change.

Notwithstanding these limitations, it is apparent that the growth of population has played an important role in the sharp increase in expenditures for many services during the past two decades. Population growth was of particular importance in affecting the expansion of outlays for housing services and for medical and personal care. In addition there is little doubt that the growth of population and the consequent expansion of markets had a lot to do with the redistribution of incomes during this period, which is the most important single factor in bringing about the tremendous increase in consumer expenditures.

Given the circumstances of these two decades, population growth appears to have supplied a major stimulant to consumer expenditures. At the same time, it is also apparent that population growth does not of itself necessarily insure more expenditures. This is supported by the substantial difference in the relative contribution of population growth to particular outlays, and by the fact that substantial increases in certain

[10] Possible discrepancies are clearly not out of the question, however, particularly with regard to the comparability of the expenditure and consumer-unit estimates of the different sources.

expenditures, such as for recreation, can take place with population growth playing a minor role.

From a more general point of view, it should be remembered that the period covered by this study was one of great disturbances. Under such conditions, it is not surprising to find that population growth was of considerable importance on the upside, perhaps even as an independent catalyst. Whether population growth exerts a similar effect during a period of depression is another question.

COMMENT

RICHARD A. EASTERLIN, University of Pennsylvania

The stated aim of Robert Ferber's paper is "to evaluate the extent to which changes in the size and distribution of the population are able to account for changes in consumer outlays on services between 1936 and 1956." In line with this aim he presents several tables of numerical results. The underlying data are chiefly from the Department of Commerce *National Income Supplement*, and three cross-section surveys, the 1935–1936 BLS Consumer Expenditures Study, the 1950 BLS-Wharton Study, and the 1955–1956 *Life* Study of Consumer Expenditures. One can only voice admiration at Ferber's decision to expose himself to the inevitable problems of comparability involved in any attempt to utilize these diverse sources. On his success in overcoming these problems I am not qualified to speak, for lack of detailed familiarity with the basic sources. But the technique of analysis which he applies to these data in order to accomplish his stated objective does seem to raise some questions, for it is not made clear what relation, if any, this technique bears to the conceptual framework of economic analysis.

For expositional purposes, the technique can perhaps best be summarized as follows. The change in money expenditure on a particular category of services is partitioned into two segments, that associated with a change in prices and that attributable to a change in the real volume of consumption. The change in real consumption is, in turn, subdivided into two additional components, the change in the per capita volume of real consumption and the change in size of population. Finally, the population is subdivided into a number of income-size groups, each with its characteristic level of per capita real consumption, and the change in real per capita consumption for the population as a whole allocated between *inter*-group shifts in the relative distribution of population and *intra*-group changes in real per capita consumption levels. Population change is taken to influence total expenditure through two of the foregoing

components: the one relating to population size (the "numbers effect"), and that referring to shifts in the relative distribution of population by size of income (the "distribution effect"). The precise procedure followed in the paper differs somewhat, since limitations of the data necessitate the performance of two separate analyses—one in which the change in money expenditure is partitioned into price, population, and per capita real volume components; the other in which the change is allocated among change in population numbers, shifts in the relative distribution of population by income level, and the change in per capita money expenditures at given income levels.

In evaluating the paper, the basic question is: to what extent can the findings derived by this technique be taken as indicative of the influence of population change on service expenditures? Ferber's own answer to this question is not clear. At various points in the discussion he distinguishes between "direct" and "indirect" effects of population change, and also between "gross" and "net" effects. At no place is the meaning of these terms stated explicitly, nor does Ferber make clear to which group or groups of effects his calculations are intended to refer.[1] Suppose, therefore, we examine his procedures with this question in view, that is, to what extent do the findings indicate the influence of population change on service expenditures?

Consider the analysis given in the first part of the paper, where the growth in money expenditure on services is divided into three parts: that due to the change in (*a*) price, (*b*) population, and (*c*) per capita real consumption. Let us take a hypothetical example. Suppose we inject into an assumed initial stationary state a once-over increase in population size with all demographic aspects of population composition—age, sex, family size, and so on—constant. On the demand side, the population increase would make for a proportionate increase in consumption. On the supply side, the growth in labor force arising from the population increase would alter factor proportions. Factor productivity in different lines would be differently affected, as would aggregate productivity, and with relative product prices and the income level consequently changing, the per capita consumption of any given good would alter in an amount depending on the relevant price and income elasticities. For goods requiring relatively large amounts of labor, the over-all effect would presumably be a relative increase in consumption exceeding that in

[1] For example, in the discussion of Table 4, the magnitude of the "indirect effect" is identified with the size of the interaction term in contrast with the treatment in the preceding section where the "indirect effect" is said to be omitted in the calculations.

population; for goods requiring relatively little labor, the opposite would be true.

Comparison of the new with the old equilibrium for any given good would reveal a change in money expenditure. Suppose now we were to apply Ferber's technique to determine how much of this was attributable to the change in population. Ferber's analysis would show, I believe, that the change in population gave rise to a roughly proportionate change in expenditure. Whether or not the change would be exactly proportionate would depend on the assumptions used in allocating the interaction terms—and it should be noted they are no more than assumptions. The remainder would be allocated to the price and per capita components —a positive amount if total expenditure rose proportionately more than population, a negative amount if the opposite were true. Now in a very immediate sense one might argue this is quite appropriate—that the change in expenditure does reflect a change not only in population but also in the per capita consumption level and in price. But as one presses back into the underlying causal system, it becomes clear that the price and per capita changes were in turn traceable to the increase in total population, so that at bottom, it is the population change that accounts for the entire change in expenditure.

Stated more generally, one may say that Ferber's method fails to allow for any interdependence among the components distinguished. This is perhaps worth emphasizing since, while he appears to recognize this point in the first part of his paper, in the second part he mistakenly identifies the effect due to interdependence with the size of the interaction terms. In an analysis of the change in *service* expenditure due to population, this interdependence would seem to deserve exploration, since on a priori grounds one might argue that because a number of services tend to employ relatively more labor than the average, the expansion in service expenditures due to population change would be more than proportionate. As a practical matter, the possibility of tracing an effect of this sort seems limited, so that as a working proposition it is perhaps most reasonable to assume that the effect of a change in population numbers, other things, and especially composition, being equal, is a proportionate change in consumption. But if this position is adopted, as seems implicit in the present technique, one might as well recognize as an immediate implication rather than a "finding," that the numerical calculations will show that "services for which the population effect was relatively more important were not the ones that exhibited the largest increases in outlays" (p. 502). This must of course be the case since the population effect on

the assumption of proportionality is constant from one good to another, and will thus account for a larger share of the increase in total expenditure if that increase is small rather than large.

More fundamentally, acceptance of the assumption about the proportionate effect of a change in population numbers means that, with regard to the influence of population change on expenditure, the really interesting problems lie in the analysis of the change in the per capita consumption figure. It is here that the influence of the change in population by such demographic characteristics as family size, age, sex, color, residence, and so on, is to be found.

Let us turn then to the second part of Ferber's paper, since it is here that he considers the influence of change in population *composition* on service expenditure. It will be recalled that in this connection he divides the population into a number of income-size groups, each with its characteristic level of per capita service expenditure, and allocates the change in per capita expenditure between inter-group shifts in the relative distribution of population and intra-group changes in per capita expenditure levels. Now when one considers this procedure, it seems a rather strange way of establishing the effects of population change on expenditure, entirely aside from the question of possible interdependence among components. Consider for a moment a situation in which, other things unchanged, the income of all members of the population rises proportionately. To what would the resulting change in per capita expenditure be attributed? Under the present scheme, the answer would be that the population composition by size of income has changed. But the answer offered by economic analysis, and surely more direct, is simply that per capita incomes have risen. If we were to follow Ferber's procedure, I suppose virtually every cause of expenditure change could be encompassed under the heading of "population change." Thus we might talk about the influence of a change in relative prices as the effect of a change in the composition of population by price paid, or the effect of a change in tastes as the influence of a change in distribution of population by taste. This is not mere quibbling over the definitional question of demographic versus nondemographic variables. But it does seem that in any given analysis one must specify what is meant by the effect attributable to "population change," and in particular that this effect should not encompass the classic economic variables of income, or potentially, of relative prices and tastes.

If, then, the change in expenditure attributed by Ferber's analysis to a change in population composition is attributable to income growth

(though I do not think the analysis handles even this very well), could one perhaps conclude just the opposite of what Ferber's calculations purport to show, namely, that the influence of changes in population distribution, rather than being reflected under the Table 5 heading of "distribution effect," is included as a residual under that of "consumption effect," so that we do have after all some indication of the effects of change in demographic composition? Unfortunately the answer is no. There is first, of course, the question of the interdependence of components. And even if this is assumed unimportant, which is a big assumption, the category labeled "consumption effect" includes the influence of nondemographic factors such as tastes or price as well as demographic factors.

Our conclusion, then, on the question initially raised—the extent to which the analysis used in the paper succeeds in establishing the influence of population change on service expenditures—is largely negative. To the extent that the analysis does take account of the effect of population change, it is only the roughly proportionate effect on demand of a growth in numbers. The analysis fails to take account of the influence of a growth in numbers on supply, and, through this, on per capita consumption. Nor does it take account of the influence of changes in the typical demographic characteristics of population composition—age, sex, color, and so on. Finally, it mistakenly assigns the effect of income change to population composition.

REPLY by Mr. Ferber

Easterlin's principal criticisms can be classified under two headings: the specific framework used in the analysis, and the general approach taken to the problem.

With regard to the specific framework, I fully agree with Easterlin that the analysis fails to take account of the influence of a number of demographic factors in addition to other possible relevant variables. This point is brought out several times in the paper and the inherent limitations of the results resulting from these omissions are stressed. As is noted in the paper, these variables could not be included because of lack of data, not because of oversight. At the same time, it is worth mentioning once again that such previous work as has been done on this subject indicates that the income factor tends to include the bulk of the effect of shifts in a number of other demographic variables of principal relevance to consumer behavior.

With regard to the general approach, there is also no doubt that it

possesses certain major difficulties and that it will yield misleading results under certain conditions. This is only to be expected, for is this not true of any statistical technique if the results obtained from it are interpreted in a vacuum? Similar criticisms can be leveled against such widely used techniques as regression analysis and variance analysis. Yet this does not mean that the techniques themselves are of no value. Rather it seems that the results of these techniques have to be interpreted with regard to the data that are used and the circumstances prevailing during the period covered by the analysis.

These precautions apply as strongly to the present method as to many others, and Easterlin has brought out some examples of such cases. Many other examples could be cited too, but I shall forego doing so for lack of space. Here again, however, I think it only fair to refer the reader to the paper itself where the need for such precaution is stressed in several places. Particular stress is placed therein on the pitfalls and difficulty of ascribing effects due to population or any other factor based on statistical results alone and on the importance of relating results to the dimension of analysis.

I must admit being surprised by Easterlin's allegation that I failed to distinguish between direct and indirect effects and between gross and net effects. The latter distinction is defined on page 504, whereas the distinction between direct influences and interaction effects is spelled out explicitly in footnote 3. Easterlin may have been misled by an occasional slip of mine in substituting the word "indirect" for "interaction"; the two are clearly not the same.

Taking an over-all view, I should like to emphasize, as is stated in the paper, that this is an exploratory investigation using a technique which has received virtually no attention in the past. Because of this, it is all the more surprising that Mrs. Crockett happened to select, independently, virtually the same general technique in her paper, although she applied it in a different manner. Exploratory though her and my results may be, it seems to me that they indicate that this technique has considerable promise and merits more attention in the future.

COMMENT on Crockett and Ferber

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As a non-demographer, I have been impressed by the growing recognition of the fact that demographers and economists cannot work successfully alone, especially when it comes to any sort of prediction. Projections of population change cannot be made without knowledge of economic

factors. Similarly, economists are increasingly aware that projections of economic variables require knowledge of demographic changes and their interaction with the elements of the economic system.

Two papers presented at this meeting are concerned with the attempt to evaluate the effects of population change on consumption expenditures. Jean B. Crockett and Robert Ferber are concerned with measuring the influence of demographic variables (total population growth, age of head, race, certain distributional effects, and the like) over time upon specific categories of consumer expenditures—in the first case, food; in the second, services. They both use multiple correlation–variance techniques to estimate the effects of demographic variables upon food and service expenditures from cross-section data; Ferber also experiments with time series.

Mrs. Crockett predicts food expenditures from 1950–1970, making assumptions derived from Census data as to population growth and changes in distributional factors over the period. In using the period 1935–1956, Ferber has the advantage of actual figures for population growth for his experiments with both cross-section and time-series data. He compares the results of the two studies in analyzing the interaction of demographic and economic effects upon services expenditures during this period.

How significant are the results of these investigations? The authors would be the first to admit their inadequacy as predictions, the data difficulties and the heroic assumptions necessary. Mrs. Crockett finds that age and racial factors appear to have quantitatively small effects upon food expenditures over the projected period. Ferber's analysis of time series indicates that population growth seems to have had considerably less effect on service expenditures from 1935–1956 than price changes and consumption effects. The results of his cross-section study show that direct population growth had greater quantitative impact upon service expenditures than the other variables used; this also is true for Mrs. Crockett's study.

As Ferber himself states, the difficulties of comparing the results of his cross-section and time-series studies are truly formidable. With Easterlin, I find difficulty in accepting Ferber's use of three cross-section surveys[1] which are in many serious respects noncomparable, as the basis for estimating consumption and income changes from 1935–1956. I question as well Ferber's use of income distribution changes, derived from these

[1] The Consumer Purchases Study, 1935–1936; the BLS Survey of Consumer Expenditures, 1950; the Time-Life Consumer Survey, 1956.

three surveys, to represent population distribution changes, for which there was no available information. This distribution change was found to be an important interaction factor, but can this result be taken with any confidence as an indication of the effects of distributional changes in population? Easterlin questions this, too.

The essence of the critiques of the Crockett and Ferber papers by their discussants, Fox and Easterlin respectively, seems to be that the authors would have done better to engage in a more strictly defined economic analysis per se. Fox points out that aggregate food expenditures are a poor category to select for analysis and that significant results can hardly be expected unless food is broken down into its components. He suggests that relative price differences, the behavior of various subcategories of food expenditures, food eaten at home as compared with food eaten at restaurants, and so on, should all be considered. Easterlin emphasizes that the inclusion of more economic variables would have improved Ferber's analysis.

This is no doubt true, but for the purposes of this conference, explorations into the relations among economic and demographic variables are certainly pertinent. Regarded in this light, the Crockett and Ferber papers provide useful exploratory contributions to a new and difficult field of investigation, the interrelationships of economic and demographic variables. Obviously more work in the area is needed before significant quantitative results can be obtained. The authors concur heartily in this. Both Mrs. Crockett and Ferber note the prevalence of interaction among economic and demographic variables. In the case of food, Mrs. Crockett emphasizes the extent to which income as a variable subsumes the effects of demographic variables such as age and race, with the result that income effects taken alone are greatly distorted. Ferber points out at some length the importance of trying to measure the indirect repercussions of population changes on service expenditures.

The same problem, that of measuring the direct and indirect relationships among economic and demographic variables, is being tackled by Andre Daniere and myself in the consumption research at the Harvard Economic Research Project. Preliminary results, which will be presented at a Wharton School Conference in March, exhibit an extensive amount of interaction and nonlinearity. Using the 1950 BLS Survey data for individual families, we are engaged in a complicated stratification procedure, using some 27 economic and demographic variables, in which these families are grouped and regrouped according to the observed relationships with these variables in succession. So far, the experiments

relate only to the effect of five major variables (with subgroups)[2] and a few other economic variables, such as net assets, upon clothing expenditures. Interaction and nonlinearity appear to be widespread and differ within subgroups.

It is hoped that ranges of combinations of variables and subvariables can be found over which additivity and linearity can be reasonably assumed, which, with the use of dummy variables, will reduce substantially the number of variables to be used in an eventual multiple regression analysis. Daniere's preliminary theoretical model for the stratification procedure, while related to variance analysis, is expected to make possible the testing of a wider range of hypotheses than the traditional variance model. The basic hypotheses about the structure of consumption resulting from the detailed stratification procedure should make the interpretation of the final regression results more meaningful.

Our investigation is an extension of the type of analysis presented by Crockett and Ferber on cross-section data. At this stage, it is more disaggregated and includes many more variables. We are faced with the same problems, assuming we get significant measures of reaction among variables: how do we predict on the basis of cross-section results over time? For this we need from demographers estimates of distributional changes in population; from economists, estimates of changes in income distribution. We need also, economists and demographers alike, a more explicit examination of our basic hypotheses and those implied by the statistical and mathematical techniques used.

[2] Disposable income, age of head, family size, family type, tenure.