

DEMOGRAPHIC AND SOCIOECONOMIC CHANGES: IMPLICATIONS FOR U.S. AGRICULTURE

*Lester H. Myers**
Economic Research Service, USDA

Recent financial conditions within the agricultural sector have been closely linked to international trade and to agricultural and macroeconomic policies believed to have an effect on our competitive position in international markets. Given this environment, it is possible to lose sight of the tremendous dependence the agricultural sector has on the domestic market. Since 1982, total gross cash income to United States farmers has averaged about \$150 billion per year. Exports have declined from more than \$40 billion per year to a forecast of less than \$34 billion in 1985. Valued at the farm level, exports comprise approximately 18 percent of recent United States agricultural production.

Many agricultural subsectors are almost entirely dependent on the United States domestic market. For example, in 1983 domestic civilian meat use actually exceeded domestic production by 4 percent. Domestic civilian chicken consumption represented 95 percent of total production. The similar statistic for all dairy products was 96 percent. In fact, the only major United States agricultural subsector for which the domestic market does not absorb more than 90 percent of the domestic production is field crops.

Because of this dependence, future resource adjustments within many agricultural subsectors are likely to be closely linked to changes in the domestic consumer demand for specific foods. Economists tend to think of consumer demand within the context of the static classical model of individual consumer behavior. For a given consumer, relative prices and the budget constraint at a point in time become the explanatory variables determining consumption levels. Empirically, we are forced to use market aggregates of time-series data observations to obtain measures of the relevant demand parameters. Thus, either implicitly or explicitly, we usually assume (a) homogeneous preference functions across individuals and (b) independence between the pref-

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erence function and producer behavior. Also, empirical demand analysis is usually devoid of dynamic theoretical underpinnings.

The focus on behavioral differences among different demographic and social groups addresses directly the assumption of homogeneous preference functions. The assumption is that individuals belonging to the same demographic and/or social group are likely to have similar, if not completely homogeneous, preference functions. If the population characteristics, as measured by the number of people in different groups, change over time, aggregate consumption patterns can be altered. Measuring how different groups respond to economic stimuli in their purchase decisions is difficult and data intensive. Thus, we usually observe differences in average consumption levels for a point in time and then use the observations to statistically measure the magnitude of "demand level shifts" associated with particular groups.

Before presenting some of our analysis relating to demographic and socioeconomic factors in demand, it is appropriate to mention two limitations when such analysis is used for projection purposes. First, there is an implicit assumption that as an individual moves from one group to another his or her preference function immediately takes on the characteristics of the "new" group, regardless of the preference function's previous characteristics. Second, the analysis is based on cross-sectional data collected over a short period of time and it is usually assumed that prices are constant across groups. Thus, the observed purchase behavior is for a fixed set of food and non-food prices. No one can be sure that the same consumption patterns would exist under alternative relative price observations.

Given this background and the several caveats, the remainder of the paper will be devoted to presenting some results from a recent study of food consumption by demographic groups using data from the Bureau of Labor Statistic's Continuing Consumer Expenditure Survey for 1980 and 1981.¹ The presentation will be organized as follows: (1) identification of important socioeconomic and demographic groups; (2) expenditure patterns for the groups expected to experience the most dynamic changes; (3) implications for future food demand; and (4) implications for production agriculture.

Consumption Patterns by Demographic and Socioeconomic Group

With respect to implications for food consumption, the following demographic and socioeconomic changes appear to be the most critical:

1. The slowing of the overall population growth rate with the pro-

¹The full details of this study and the results will be released in the Fall of 1985 in an ERS Technical Bulletin entitled, *Demographics and Household Food Demand With Projections* by James R. Blaylock and David M. Smallwood. Summary statistics on food consumption expenditures for different groups based on the survey are available in printed form in ERS Statistical Bulletin #731, *Food Spending in American Households, 1980-1981*, by David M. Smallwood and James R. Blaylock. This bulletin can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.

jected growth over the next 30 years (24 percent) being half the growth between 1950 and 1980 (50 percent).

2. Changes in the age distribution toward an older population. For example the median age was 30.6 years in 1982 and is projected to be 36.3 years by the year 2000.
3. The dramatic increase in one-person households from 17 percent of the population in 1970 to 23 percent in 1980.
4. The trend toward single-female-parent families with children under 18 years of age. These families increased from 4.5 percent of all households in 1970 to 6.7 percent in 1980.
5. Changing geographic distributions suggesting that the Northeast and North Central regions will experience declines in their share of the total population while the South and West will gain population share over the next 20 years.
6. Changing racial mix with blacks becoming a larger share of the total. Blacks currently represent about 12 percent of the population and are expected to account for more than 14 percent 30 years from now.

Tables 1, 2, and 3 contain summarized results of tobit analysis of the 1980–81 Bureau of Labor Statistics (BLS) Continuing Consumer Expenditure Survey designed to determine the net effect on food expenditures due to changes in certain demographic variables. The results are reported in percentages relative to a “base” number as defined in a footnote to each table. In each case, all explanatory variables, except those of interest, are held constant at their mean values. Thus,

TABLE 1
SIMULATED IMPACT OF REGIONAL LOCATION ON PER PERSON
FOOD EXPENDITURES: SELECTED FOODS

Item	Northeast	North Central	South	West
	Percent of base ^a			
All Food	103.4	96.6	97.6	103.2
Food Away From Home	98.7	98.6	100.0	102.7
Food At Home	105.9	96.2	96.2	103.0
Beef	107.5	96.6	98.3	99.0
Pork	99.1	104.2	99.0	97.4
Poultry	119.2	82.8	103.0	100.5
Dairy Products	104.3	97.9	92.7	106.4
Fruits	106.9	91.0	93.2	111.6
Vegetables	102.9	91.6	100.7	106.0
Fats & Oils	105.0	96.6	94.6	105.2

^aPercent of overall sample means, holding all other variables constant at mean levels.

Source: [1]

TABLE 2
SIMULATED IMPACT OF AGE ON PER PERSON
FOOD EXPENDITURES: SELECTED FOODS

Item	20-29	Age Group	65-74
		30-44	
		Percent of base ^a	
All Food	90.9	96.2	100.2
Food Away From Home	148.0	142.3	92.5
Food At Home	69.3	77.7	102.2
Beef	69.1	71.7	97.9
Pork	56.9	68.8	105.0
Poultry	61.5	75.8	98.9
Dairy Products	78.5	86.3	97.0
Fruits	65.5	70.1	127.2
Vegetables	67.7	76.7	108.3
Fats & Oils	71.6	77.5	109.2

^aPercent of the average for 45- to 64-year-old age group average expenditures, holding all other variables constant at mean levels.

Source: [1]

TABLE 3
SIMULATED IMPACT OF RACE ON PER PERSON FOOD EXPENDITURES:
SELECTED FOODS

Item	Nonblack	Black
	Percent of base ^a	
Total Food	101.7	90.3
Food Away From Home	102.1	87.7
Food At Home	101.5	91.3
Beef	100.7	95.7
Pork	97.4	116.4
Poultry	95.1	131.8
Dairy Products	105.3	70.6
Fruits	100.8	95.5
Vegetables	101.2	93.0
Fats & Oils	103.2	82.2

^aPercent of the overall sample means, holding all other variables constant at mean levels.

Source: [1]

the analysis is an attempt to measure the marginal impact of certain factors, holding all other factors constant.

Regional impacts on food expenditures are presented in Table 1. When adjusted for other socioeconomic and demographic variables, regional differences in consumption expenditures for aggregate food groups tend to be small. The most variation appears in the poultry group with expenditures in the Northeast averaging 19 percent above the base average and North Central expenditures averaging 17 per-

cent below the base. Expenditures for fruits are nearly 12 percent above average in the West.

Some regional variation in food expenditures may represent regional differences in average prices over the 1980–81 data collection period. Regional differences might be more important in determining how the food is prepared and consumed than in determining the absolute consumption level.

Table 2 focuses on estimates of how average per capita food expenditures change as the consumer's age changes; other factors held constant. The results are expressed as percentages of average expenditures for the 45- to 64-year-old "base" group. Food-away-from-home expenditures are 40 percent to 50 percent higher for persons between 20 and 44 than they are for persons 45 and over. On the other hand, food-at-home expenditures are 20 percent to 30 percent lower for the 20- to 44-year-old age group as opposed to those 45 and over. Because of this, the at-home expenditures for all the major food groups are less for the 20- to 44-year-old age group than for those 45 and older.

Per person expenditures for the following food groups show steady increases with increases in age: pork, fruits, vegetables, and fats and oils. Per capita expenditures for beef, poultry, and dairy products tend to peak in the 45- to 64-year-old age group. Within the dairy group, the decline after age 64 is due entirely to fluid milk and cream. Cheese and other dairy product expenditures are higher in the 65- to 75-year-old age group, other factors constant.

Other factors equal, nonblack households spend more per person than their black counterparts for most food groups (Table 3). Black households' average total food expenditures are estimated to be more than 11 percentage points below the average for nonwhite families of similar characteristics. Across food groups, the results imply that blacks and nonblacks allocate their food dollar in substantially different ways.

Nonblacks' per capita expenditures for dairy products average nearly 35 percentage points above the per capita expenditures by blacks. However, blacks tend to spend more for pork and poultry. In fact, the results suggest that average per capita expenditures for poultry are nearly 37 percentage points higher for blacks than nonblacks. Census projections indicating that blacks will represent a larger proportion of the total population will reinforce the growth in poultry consumption versus beef consumption.

Projections

There is strong interest in the implications of changing demographic and socioeconomic characteristics on long-term food demand patterns. An analysis of demographic differences in food demand using the 1980-81 BLS Continuing Consumer Expenditure Survey was combined with projections of changes in age distribution, regional shifts, racial mix,

and total population growth to obtain estimates of the impact on future expenditure patterns. It is beyond the scope of this report to detail all of the assumptions underlying the projections for changes in the demographic characteristics over the next 20 years. Additional specific assumptions are detailed in [1].

Results summarized here are from projections based on the following assumptions:

- a. The United States population will grow from 239 million in 1985 to 276 million in 2005. This is the Bureau of Census Middle Series projection [2].
- b. Blacks will increase from 12.2 percent of the total population in 1985 to 13.7 percent in 2005.
- c. The regional population distribution, expressed as shares of the total United States population, will change as follows [1]:

Year	Northeast	North Central	South	West
----- Percent -----				
1985	20.5	25.1	34.2	20.2
2005	16.4	21.4	37.8	24.4

- d. The age distribution, expressed as a percent of the total population, will change as follows [2].

Age Group	1985	2005
----- Percent -----		
0-9	14.7	12.7
10-19	14.7	14.0
20-29	18.1	13.2
30-44	21.8	21.2
45-64	18.7	25.6
Over 65	12.0	13.1

The demographic determinants of demand considered in the projections are race (black-nonblack), age distribution, geographic distribution, and size of the population. Projections are also made under alternative assumptions of growth in consumer purchasing power. Although commodity prices and consumer tastes and preferences are known to be important factors influencing food consumption over time, economists generally have little knowledge about the future course of these factors. For purposes of this study, relative prices and consumer tastes and preferences within the defined categories are assumed to remain stable at levels existing during the 1980-81 period.

Table 4 contains the projected changes in per capita consumption between 1980 and 2005 due to projected changes in demographic characteristics and to assumed income growth. Columns 1 through 4 con-

TABLE 4
ESTIMATED PERCENTAGE CHANGE IN FOOD EXPENDITURES, 1980 TO 2005

Food Group	Effect Due to:				Total ^b
	Age Distribution	Regional Distribution	Race	Income ^a	
				Percent	
All Food	1.7	0	-0.2	21.1	22.7
Beef	3.0	-0.4	-0.1	13.4	16.1
Pork	5.7	-0.3	0.4	8.2	14.2
Poultry	5.5	0.1	0.6	4.4	10.8
Cereals & Bakery	3.1	-0.9	-0.2	8.4	10.4
Dairy Products	2.2	-0.1	-0.7	7.7	9.0
Fruits	4.1	0.4	-0.1	13.4	18.1
Vegetables	4.5	0.6	-0.2	13.5	18.7
Sugar & Sweeteners	2.1	-0.2	-0.4	8.2	9.8
Fats & Oils	4.2	-0.1	-0.4	9.8	13.6

^aAssumed 2 percent per year growth in real per capita income.

^bNet adjustment after accounting for projected changes in all variables.

Source: [1]

tain the estimated impacts of changes in individual factors, assuming all else is unchanged. The last column, labeled "Total," contains the net estimated change after accounting for the projected adjustments in all variables.

Of the three demographic characteristics (age, regional distribution, and race), changes in age distribution are likely to have the biggest impact on per person food demand. Age distribution changes are projected to increase per capita food expenditures by 1.7 percent over the 25-year period. Regional population distribution changes are expected to have no effect on total food expenditures and changing racial mix will have an expected slight negative impact.

The change in age distribution has the most impact on pork and poultry expenditures, up 5.7 and 5.1 percent, respectively, over the 25-year period. The least impact is expected for dairy products (+2.2 percent) and sugars and sweeteners (+2.1 percent). Age distribution changes are expected to be a positive force for per capita expenditures of all major food groups.

As indicated by the result for total food, per capita expenditures for the identified food groups are expected to be influenced little by changes in the regional population distribution. Beef, pork, cereals, and bakery products expenditures would experience a slight decline; other factors constant. Vegetables and fruits expenditures are projected to be slightly increased. Regional shifts should have a negligible impact on per capita expenditures for poultry, dairy products, sugars and sweeteners, and fats and oils.

While racial distribution changes will generally have a negative

impact on per capita expenditures, poultry and pork are expected to benefit from the increasing proportion of blacks in the population. Dairy products, sugars and sweeteners, and fats and oils are hurt the most by this trend.

Far overshadowing the implications of changes in demographic characteristics are the projected changes in per capita food expenditures due to income growth. If we assume an average 2 percent per year growth rate for per capita real income, total per person food expenditures are projected to increase 21 percent over the 25-year period. Much of the total income response occurs in food-away-from-home expenditures which are estimated to grow 36 percent.

Income growth benefits the beef, fruits, and vegetable food groups the most. For each of these, the impact of 2 percent annual growth in real income is an estimated 13.5 percent growth in per capita expenditures between 1980 and 2005. Poultry appears to benefit the least from income growth; other factors constant.

The scope of this presentation prohibits going into much detail concerning the projections. However, it is appropriate to note that these projections are for per capita expenditures, assuming fixed relative prices. As supply and demand conditions change over time, relative prices have to change and the expenditure growth patterns suggested here could be altered dramatically. Also, these results implicitly reflect changes in the quality and product mix of purchases. For example, the strong income-generated growth in dairy product expenditures reflects high growth in cheese (17.7 percent) and other processed dairy products (11.9 percent) categories and very little impact on milk and cream (1.2 percent).

The net effect of projected changes in demographics and an assumed 2 percent real income growth is given in column 5 of Table 4. Overall, per capita food expenditures are expected to grow 22.7 percent. The largest increases are anticipated for beef (16 percent), fruits (18 percent), and vegetables (18.7 percent). The only two categories for which the net estimated growth is less than 10 percent are dairy products and sugars and sweeteners.

So far we have discussed the implications of demographic change and economic growth on per capita food expenditures. Another very important factor driving growth in food demand is the expansion of the total population.

As indicated earlier, the Bureau of Census middle series projections suggest that nearly 40 million additional people will have to be fed in the year 2005 compared to 1985. Table 5 contains estimates of the percentage changes in total national food demand between 1980 and 2005 after accounting for projected per capita expenditure changes and changes in total population.

Total food expenditures are projected to increase 49 percent. Food-

TABLE 5
ESTIMATED PERCENTAGE CHANGE
IN NATIONAL TOTAL FOOD EXPENDITURES, 1980 to 2005.

Food Group	Percent Growth ^a
All Food	49.3
Away From Home	62.7
At Home	39.8
Beef	41.3
Pork	39.0
Poultry	34.9
Cereals and Bakery Products	34.4
Dairy Products	32.7
Fruits	43.7
Vegetables	44.4
Sugars and Sweeteners	33.6
Fats & Oils	38.3

^aAssumes 2 percent annual income growth and Bureau of Census Middle Series population growth projections.
Source: [1]

away-from-home expenditures jump 62.7 percent compared to 39.8 percent expansion for at-home expenditures. Recall that these projections are made under the assumption of constant real prices; thus the estimates for individual food categories represent a “rough” estimate of volume changes. Note also that the individual food groups represent at-home consumption only. To the extent that the away-from-home market grows for particular foods, these projections tend to understate total expenditure growth for individual food groups.

Population growth is a dominant factor affecting food expenditures expansion. Therefore, the variation of growth levels between food groups as indicated in Table 5 is less than that exhibited by the per capita projections. The largest projected increase is for vegetables (44.4 percent) and the smallest is for dairy products (32.7 percent).

Implications For Agriculture

While it is beyond the scope of this paper to detail all the implications for agriculture, some general observations relative to implications for resource use are appropriate. If total beef requirements for domestic consumption were to increase the 41 percent projected for at-home use between 1980 and 2005, the number of cattle marketed would increase from about 45.6 million head to 64.4 million head. This assumes constant average weights and beef yields. The 64.4 million head is only 14 percent more than the 56.4 million head marketed in 1977. The projected increase in pork consumption implies that the domestic market will use about 39 million head of hogs more than the record 100 million head marketed in 1980; again assuming constant average weights.

Between 1955–59 and 1979–83, a period of 25 years, yields for major crops increased as follows: corn (110 percent), wheat (58 percent), sorghum (94.5 percent), and soybeans (29.5 percent). If we assume trend growth rates in average crop yields, it is obvious that the projected increases in meat and dairy products demand will not require net additional acres of land for feed production purposes. This is consistent with historical patterns. In 1950, roughly 295 million acres were required to produce the feed and food needed for domestic use. Thirty years later, domestic uses required only the output of 115 million acres. The trend for average yield increases to be larger than domestic demand growth rates is not expected to be reversed.

Dairy is an example of acute discrepancy between the growth in domestic commercial demand and in milk yields per cow. During the 1955–59 period, average milk production per cow was 6,307 pounds per year. By 1979–83, that average had nearly doubled to 12,094 pounds. If we assume that milk yields increase over the next 25 years in the same proportion as the increase from 1955–59 to 1979–83, the projected demand expansion suggests that only 7.5 million head of milk cows, including heifers that have calved, will be required in the year 2005. This compares to 10.8 million head on farms in 1980.

Admittedly, the above stated implications are oversimplified, but they do illustrate the basic general conclusion that demographic and socioeconomic factors are not likely to generate sufficient domestic demand growth over the next 20 to 25 years to offset likely increases in productivity. This implies, of course, that resources may have to be shifted out of agriculture or that we will have to experience substantial growth in foreign demand to maintain constant real prices.

REFERENCES

- [1] Blaylock James R. and David M. Smallwood. *Demographics and Household Food Demand with Projections*. Washington DC: USDA ERS Technical Bulletin, forthcoming.
- [2] Bureau of the Census. *Projections of the Population of the United States*. Washington DC: Series P-25, No. 952, May 1984.