

Empirical Results

The equation we estimate for each of the 16 food groups based upon theoretical equation 37 is:

$$w_{iht} = A_{it} + A_{inc}D_{nc} + A_{is}D_s + A_{iw}D_w + Z_{iz} \ln Z_h + R_1D_r + (Y_{it} + Y_{inc}D_{nc} + Y_{is}D_s + Y_{iw}D_w + Y_{ir}D_r) (\ln X_{ht} - \alpha_0), \quad (38)$$

where $t = 1990 \dots 1995$ and the D subscripted variables are dummy variable shifters for both the intercepts A_{it} and Y_{it} for the demographic groups in the North Central States, the South, and the West as well as for race (race is dropped from the low-income equations). In addition, we have the intercept shift variable for household size, Z_{iz} . For the variable Z_h , we used the log of the family-size equivalence scales implicit in the official poverty thresholds published by the Bureau of the Census, U.S. Department of Commerce, for households of one to seven persons. X_{ht} is household expenditure on food at home. Thus, we have made the assumption that at-home food expenditures are separable from expenditures on all other goods including food away from home. We also made the usual assumptions of intertemporal separability and separability of market goods from leisure and public goods. Finally, α_0 is the minimum household expenditure on food at home and is known as the reference household. We used eight demographic reference households for the total population in this study: black and nonblack single-person households in the Northeast, the North Central States, the South, and the West. For the low-income population, we used four demographic reference households: single-person households in the Northeast, the North Central States, the South, and the West.

Tables 4 and 5 present the estimates for the 16 Engel curves for the total population and the food stamp eligible population. For each equation, A_{90} through A_{95} represent the intercept for the Northeast for each year of data (nonblack households for the total population). A_{nc} through A_w represent regional demographic dummy variables for the North Central States, the South, and the West. The variable Z represents the estimated coefficient for household size, while R_1 is the demographic dummy variable for race.

Slope expenditure parameters are represented by Y through Y_w , where Y represents the estimated expenditure coefficient for nonblacks (both nonblacks and blacks in the eligible for food stamp equations) in the Northeast and Y_{nc} , Y_s , and Y_w are the estimated dummy slope shifters for non-blacks' expenditures in the North Central States, the South, and the West, respectively. Y_r is the dummy expenditure slope shifter for the black race (only in the total population equations). R^2 is a statistic for the goodness of fit of each equation. F is a significance test of estimating an intercept for each year, compared with estimating one common intercept for all years.

Many of the estimated coefficients are highly significant. All of the estimated intercepts for the Northeast are significant at the 5-percent level or greater except for pork in the low-income population. The regional dummy intercepts, which are in effect a test of their significance relative to non-black households of the Northeast, are mixed. For the total population, many of these dummy shifts are insignificant. All three regional dummy shifters are significant at the 5-percent level or better in the poultry, eggs, processed fruit, and miscellaneous prepared food equations. Two of the three regional dummy shifters are significant at the 5-percent level or better in the bakery products, fresh vegetables, sugar and sweeteners, and nonalcoholic beverages equations. In the remaining equations, at least one regional dummy shifter is significant at the 5-percent level or better except for the cereals and pork equations.

The regional dummy intercept shifters are even less significant in the low-income equations. All three regional shifters are statistically significant at the 5-percent level or better only in the egg equation. Equations in which two of the three dummy shifters are significant at the 5-percent level include bakery products, pork, poultry, dairy, and processed fruit. One regional shifter is significant

in the cereals, fresh fruit, processed vegetables, sugar and sweeteners, and the miscellaneous prepared foods equations. Remember, in this population, the regional shifters are strictly tests for a difference between regional expenditures, regardless of race.

All coefficients for the household size variable are significant at the 5-percent level in the total population except those for the equations for bakery products, pork, poultry, and nonalcoholic beverages. For low-income households, the household size variable was significant at the 5-percent level or better except for pork, poultry, and miscellaneous prepared foods.

Finally, the intercept shifter for black households in the total population is statistically significant at the 5-percent level for all equations except for cereals (significant at the 6-percent level), bakery products, other meats and fish (significant at the 8-percent level), fresh vegetables, processed vegetables, sugar and sweeteners (significant at the 6-percent level), and fats and oils.

Turning to the slope estimates for the expenditure variables of the total population, all estimates for nonblack households in the Northeast are statistically significant at the 5-percent level except for poultry and fresh vegetables. The remaining dummy variables for the slope coefficients, which, like the intercept shifters, are a test for significant difference between nonblack households in the Northeast and the relevant region, offer very mixed results. For the North Central States, three slope shifters were statistically significant at the 5-percent level: other meats and fish, eggs, and nonalcoholic beverages. In addition, both the fresh fruit and fresh vegetable shifters were significant at the 10-percent level. For the South, four slope shifters were statistically significant at the 5-percent level: other meats and fish, poultry, eggs, and nonalcoholic beverages. In addition, pork was significant at the 6-percent level, and fresh vegetables was significant at the 9-percent level. Three slope shifters were significant at the 5-percent level or better for the West: eggs, processed fruit, and fats and oils. Furthermore, the slope shifter for cereals was significant at the 7-percent level, and the shifter for miscellaneous prepared food was significant at the 10-percent level.

For low-income households in the Northeast, the slope expenditure coefficients were significant at the 5-percent level except those for cereals, poultry, fresh fruit, and fresh vegetables. In addition, the slope expenditure coefficient for miscellaneous prepared food was significant at the 7-percent level, and the estimate for sugar and sweeteners was significant at the 10-percent level. Evidently, these households tend to concentrate their marginal food dollars on the remaining 10 food categories: bakery products, beef, pork, other meats and fish, eggs, dairy, processed fruit, processed vegetables, fats and oils, nonalcoholic beverages, and perhaps sugar and sweeteners, as well as miscellaneous prepared foods.

Among the regional slope shifters for the low-income households, bakery products and eggs were statistically significant at the 5-percent level for the North Central States and the South. For the West, eggs, dairy, and fresh fruit were statistically significant at the 5-percent level, while cereals and pork were significant at the 7-percent level, and processed fruit was significant at the 8-percent level.

The last variable of the model for the total population is an estimate for a significant difference between black and nonblack households on marginal expenditures for the 16 food categories. Eight categories were found to be statistically insignificant: cereals, beef, dairy, fresh vegetables, processed fruit, processed vegetables, sugar and sweeteners, and miscellaneous prepared food. Other meats and fish and poultry were significant at the 6-percent level, and fats and oils were significant at the 9-percent level. Note that these are for differences in marginal expenditures above that of the appropriate reference household. Hence, for an item like dairy, blacks have a substantially lower budget share and a statistically significant negative dummy intercept shifter, relative to nonblacks, even though marginal expenditure levels may not be different.

F-tests indicate that most equations for the total population are better represented by letting the intercept shift from one time period to another rather than using a single estimated parameter,

Table 4—Parameter estimates of Engel curves, total population

Food category	A ₉₀	A ₉₁	A ₉₂	A ₉₃	A ₉₄	A ₉₅	A _{nc}	A _s	A _w
Bakery products	0.1226 (.003)	0.1236 (.003)	0.1263 (.003)	0.1256 (.003)	0.1271 (.003)	0.1260 (.003)	-0.0036 (.004)	-0.0121 (.004)	-0.0152 (.004)
Beef	.0585 (.004)	.0574 (.004)	.0543 (.004)	.0558 (.004)	.0537 (.004)	.0527 (.004)	-.0046 (.005)	-.0008 (.005)	-.0040 (.005)
Cereals	.0491 (.003)	.0533 (.003)	.0520 (.003)	.0582 (.003)	.0589 (.003)	.0598 (.003)	.0000 (.003)	.0028 (.003)	-.0053 (.003)
Dairy	.1609 (.003)	.1560 (.003)	.1583 (.003)	.1528 (.003)	.1516 (.004)	.1506 (.004)	.0084 (.005)	.0045 (.005)	-.0060 (.004)
Eggs	.0203 (.0009)	.0205 (.0009)	.0195 (.0009)	.0204 (.0009)	.0198 (.0009)	.0200 (.0009)	-.0060 (.001)	-.0045 (.001)	-.0025 (.001)
Fresh fruit	.0650 (.003)	.0630 (.003)	.0639 (.003)	.0651 (.003)	.0656 (.003)	.0678 (.003)	.0049 (.004)	-.0058 (.004)	.0101 (.004)
Fats and oils	.0233 (.002)	.0238 (.002)	.0233 (.002)	.0241 (.002)	.0235 (.002)	.0242 (.002)	-.0029 (.002)	.0023 (.002)	.0047 (.002)
Fresh vegetables	.0606 (.002)	.0614 (.002)	.0611 (.002)	.0620 (.002)	.0642 (.002)	.0642 (.002)	-.0152 (.003)	-.0086 (.003)	.0013 (.003)
Miscellaneous prepared food	.0992 (.005)	.1070 (.005)	.1093 (.005)	.1030 (.005)	.1032 (.005)	.1012 (.005)	.0223 (.007)	.0251 (.007)	.0497 (.007)
Nonalcoholic beverages	.0975 (.004)	.0949 (.004)	.0891 (.004)	.0936 (.004)	.0958 (.004)	.0977 (.004)	.0276 (.005)	.0292 (.005)	.0052 (.005)
Other meats and fish	.0599 (.003)	.0555 (.003)	.0513 (.003)	.0512 (.003)	.0513 (.003)	.0534 (.003)	-.0067 (.004)	-.0035 (.004)	-.0111 (.004)
Pork	.0262 (.003)	.0273 (.003)	.0306 (.003)	.0276 (.003)	.0289 (.003)	.0263 (.003)	-.0008 (.004)	-.0025 (.004)	-.0051 (.004)
Processed fruit	.0533 (.002)	.0508 (.002)	.0540 (.002)	.0524 (.002)	.0495 (.002)	.0491 (.002)	-.0074 (.003)	-.0111 (.003)	-.0113 (.003)
Poultry	.0511 (.003)	.0538 (.003)	.0539 (.003)	.0544 (.003)	.0546 (.003)	.0535 (.003)	-.0243 (.004)	-.0223 (.004)	-.0204 (.004)
Processed vegetables	.0205 (.002)	.0197 (.002)	.0200 (.002)	.0205 (.002)	.0208 (.002)	.0191 (.002)	.0011 (.002)	.0053 (.002)	.0008 (.002)
Sugar and sweeteners	.0318 (.002)	.0320 (.002)	.0332 (.002)	.0334 (.003)	.0316 (.003)	.0346 (.003)	.0071 (.003)	.0021 (.003)	.0091 (.003)

See notes at the end of the table.

--Continued

Table 4—Parameter estimates of Engel curves, total population--Continued

Food category	Z	R ₁	Y	Y _{nc}	Y _s	Y _w	Y _r	R ²	F
Bakery products	-0.0017 (.002)	-0.0055 (.005)	-0.0069 (.002)	0.0006 (.002)	0.0003 (.002)	0.0013 (.002)	-0.0065 (.003)	0.68	10.87 ***
Beef	.0083 (-.002)	.0152 (.006)	.0108 (-.002)	-.0006 (.003)	.0032 (.003)	-.0012 (.003)	-.0003 (.003)	.45	2.52 **
Cereals	.0168 (.001)	.0072 (.004)	-.0029 (.001)	.0009 (.002)	-.0014 (.002)	.0034 (.002)	-.0200 (.002)	.52	23.27 ***
Dairy	.0454 (.002)	-.0392 (.005)	-.0307 (.002)	-.0006 (.003)	-.0016 (.003)	.0040 (.003)	.0042 (.003)	.71	10.69 ***
Eggs	.0052 (.001)	.0095 (.001)	-.0058 (.000)	.0026 (.001)	.0027 (.001)	.0021 (.001)	-.0027 (.001)	.31	1.92 *
Fresh fruit	-.0138 (.002)	-.0127 (.004)	-.0032 (.002)	-.0034 (.002)	.0012 (.002)	-.0034 (.002)	.0047 (.002)	.45	2.58 **
Fats and oils	-.0061 (.001)	-.0032 (.002)	.0053 (.001)	.0010 (.001)	-.0013 (.001)	-.0025 (.001)	.0021 (.001)	.47	.52
Fresh vegetables	-.0150 (.001)	-.0015 (.004)	-.0003 (.001)	.0028 (.002)	.0029 (.002)	.0002 (.002)	-.0010 (.002)	.51	3.24 ***
Miscellaneous prepared food	-.0133 (.003)	-.0325 (.008)	.0122 (.003)	.0036 (.004)	-.0020 (.004)	-.0067 (.004)	-.0010 (.004)	.62	4.46 ***
Nonalcoholic beverages	.0033 (.002)	-.0275 (.006)	-.0084 (.002)	-.0068 (.003)	-.0100 (.003)	.0003 (.003)	.0081 (.003)	.54	5.82 ***
Other meats and fish	-.0094 (.002)	.0089 (.005)	.0133 (.002)	-.0052 (.002)	-.0048 (.002)	-.0008 (.002)	.0052 (.003)	.46	9.10 ***
Pork	-.0009 (.002)	.0450 (.005)	.0111 (.002)	.0002 (.002)	.0041 (.002)	-.0003 (.002)	-.0064 (.003)	.38	2.51 **
Processed fruit	-.0084 (.001)	.0080 (.003)	-.0041 (.001)	.0019 (.002)	.0031 (.001)	.0044 (.002)	-.0026 (.002)	.43	7.55 ***
Poultry	-.0009 (.002)	.0337 (-.004)	.0020 (.002)	.0027 (.002)	.0047 (.002)	.0025 (.002)	-.0044 (.002)	.38	1.66
Processed vegetables	-.0055 (.001)	.0017 (.002)	.0050 (.001)	-.0007 (.001)	-.0013 (.001)	-.0007 (.001)	.0002 (.001)	.42	1.14
Sugar and sweeteners	-.0035 (.001)	-.0071 (.004)	.0027 (.001)	-.0008 (.002)	.0000 (.002)	-.0025 (.002)	.0023 (.002)	.34	1.60

*, **, *** = Significant at the 10-, 5-, and 1-percent levels. Numbers in parentheses are standard errors.

Source: USDA, ERS.

Table 5—Parameter estimates of Engel curves, low-income households

Food category	A ₉₀	A ₉₁	A ₉₂	A ₉₃	A ₉₄	A ₉₅	A _{nc}	A _s	A _w
Bakery products	0.1514 (.010)	0.1564 (.010)	0.1581 (.010)	0.1563 (.010)	0.1588 (.010)	0.1533 (.010)	-0.0241 (-.014)	-0.0490 (.011)	-0.0452 (.011)
Beef	.0364 (.013)	.0346 (.013)	.0331 (.013)	.0336 (.013)	.0343 (.013)	.0388 (.013)	-.0178 (.018)	.0148 (.015)	.0206 (-.014)
Cereals	.0625 (.009)	.0593 (.009)	.0614 (.009)	.0662 (.009)	.0643 (.009)	.0672 (.009)	.0038 (.012)	.0000 (.010)	-.0203 (.010)
Dairy	.2060 (.013)	.1974 (.012)	.1947 (.012)	.1937 (.013)	.1889 (.013)	.1902 (.013)	-.0043 (.018)	-.0310 (.015)	-.0627 (.014)
Eggs	.0317 (.003)	.0324 (.003)	.0316 (.003)	.0327 (.003)	.0326 (.003)	.0341 (.003)	-.0123 (.004)	-.0116 (.004)	-.0108 (.004)
Fresh fruit	.0518 (.009)	.0498 (.009)	.0530 (.009)	.0518 (.009)	.0532 (.009)	.0568 (.009)	.0120 (.013)	.0025 (.010)	.0342 (.010)
Fats and oils	.0162 (.005)	.0190 (.005)	.0174 (.005)	.0213 (.005)	.0160 (.005)	.0193 (.005)	.0009 (.007)	.0008 (.006)	.0099 (.006)
Fresh vegetables	.0445 (.008)	.0487 (.008)	.0523 (.008)	.0497 (.008)	.0489 (.008)	.0490 (.008)	-.0035 (.011)	.0049 (.009)	.0114 (.009)
Miscellaneous prepared food	.0797 (.016)	.0810 (.016)	.0752 (.016)	.0783 (.016)	.0730 (.017)	.0767 (.017)	.0350 (.023)	.0321 (.019)	.0719 (.019)
Nonalcoholic beverages	.1065 (.012)	.1048 (.012)	.0974 (.012)	.1064 (.012)	.1077 (.013)	.1031 (.013)	.0302 (.017)	.0008 (.014)	-.0027 (.014)
Other meats and fish	.0449 (.010)	.0426 (.010)	.0358 (.010)	.0314 (.010)	.0331 (.010)	.0401 (.010)	.0006 (.014)	.0040 (.012)	.0025 (.012)
Pork	.0006 (.011)	.0065 (.011)	.0161 (.011)	.0071 (.011)	.0155 (.011)	.0086 (.011)	.0182 (.015)	.0318 (.012)	.0281 (.012)
Processed fruit	.0625 (.007)	.0555 (.007)	.0608 (.007)	.0590 (.007)	.0587 (.007)	.0597 (.007)	-.0138 (.009)	-.0134 (.008)	-.0194 (.008)
Poultry	.0626 (.010)	.0661 (.010)	.0689 (.010)	.0695 (.010)	.0698 (.010)	.0638 (.010)	-.0300 (.014)	-.0117 (.012)	-.0318 (.011)
Processed vegetables	.0218 (.006)	.0207 (.005)	.0222 (.006)	.0202 (.006)	.0226 (.006)	.0186 (.006)	-.0028 (.008)	.0123 (.006)	.0007 (.006)
Sugar and sweeteners	.0221 (.007)	.0252 (.007)	.0219 (.007)	.0225 (.007)	.0225 (.007)	.0207 (.007)	.0080 (.010)	.0058 (.008)	.0136 (.008)

See notes at the end of the table.

--Continued

Table 5—Parameter estimates of Engel curves, low-income households--Continued

Food category	Z	Y	Y _{nc}	Y _s	Y _w	R ²	F
Bakery products	-0.0116 (.004)	-0.0208 (.004)	0.0113 (.006)	0.0130 (.006)	0.0086 (.006)	0.66	1.02
Beef	.0105 (.005)	.0169 (.006)	.0033 (.008)	.0048 (.007)	-.0052 (.007)	.45	.32
Cereals	.0138 (.003)	-.0017 (.004)	-.0027 (.005)	-.0028 (.005)	.0093 (.005)	.49	1.48
Dairy	.0403 (.005)	-.0373 (.006)	.0052 (.007)	.0000 (.007)	.0172 (.007)	.66	2.94 **
Eggs	.0088 (.001)	-.0088 (.001)	.0052 (.002)	.0046 (.002)	.0039 (.002)	.37	.94
Fresh fruit	-.0170 (.003)	.0036 (.004)	-.0069 (.005)	-.0047 (.005)	-.0176 (.005)	.42	.77
Fats and oils	-.0056 (.002)	.0067 (.002)	-.0010 (.003)	-.0013 (.003)	-.0019 (.003)	.43	1.98 *
Fresh vegetables	-.0169 (.003)	.0032 (.003)	-.0009 (.005)	-.0007 (.004)	-.0006 (.005)	.48	1.34
Miscellaneous prepared food	-.0065 (.006)	.0133 (.007)	-.0041 (.010)	-.0034 (.009)	-.0125 (.010)	.56	.42
Nonalcoholic beverages	.0091 (.005)	-.0116 (.006)	-.0061 (.007)	-.0004 (.007)	-.0039 (.007)	.50	1.14
Other meats and fish	-.0078 (.004)	.0144 (.005)	-.0051 (.006)	.0003 (.006)	.0035 (.006)	.44	3.69 ***
Pork	-.0001 (.004)	.0200 (.005)	-.0061 (.006)	-.0007 (.006)	-.0115 (.006)	.37	4.27 ***
Processed fruit	-.0103 (.002)	-.0062 (.003)	.0047 (.004)	.0013 (.004)	.0067 (.004)	.40	1.65
Poultry	.0047 (.004)	-.0022 (.005)	.0050 (.006)	-.0002 (.006)	.0051 (.006)	.34	1.18
Processed vegetables	-.0055 (.002)	.0053 (.002)	-.0010 (.003)	-.0046 (.003)	.0005 (.003)	.37	.82
Sugar and sweeteners	-.0059 (.003)	.0052 (.003)	-.0009 (.004)	.0012 (.004)	-.0017 (.004)	.36	.58

*, **, *** = Significant at the 10-, 5-, and 1-percent levels. Numbers in parentheses are standard errors.

Source: USDA, ERS.

except for poultry, processed vegetables, sugar and sweeteners, and fats and oils. We hypothesize that very little substitution occurs between these four categories and the other food categories. Just the opposite happens with the low-income population. In this group, just four equations are better represented by letting the intercept shift from one time period to another. They are pork, other meats and fish, dairy, and fats and oils.

There may be a very good reason why the low-income population has rather fixed budget shares. About 70 percent of this group receive food stamps, and they have the lowest food expenditures of the total population. This group is likely to consume the least costly foods, and have less possibility for substitution when relative prices change. Given this, we could calculate the Tornqvist index for the population eligible for food stamps. However, we choose to calculate the true-cost index developed by Fry and Pashardes that is based on the estimated Engel curves, since we gain both the demographic and the marginal expenditure differences. Hence, while substitution effects are quite muted for this group, some substitution does take place.

A true-cost index for a reference household, as noted above, can be calculated from the estimated intercepts of the Engel curves. In turn, marginal indexes can be used with the reference household index to construct indexes that take into account the effects of race, region, and household size. Marginal expenditure indexes for households with budgets above the reference household can also be constructed, again taking into account race and region (just region for the population eligible for food stamps).

Tables 6 and 7 show the demographic marginal indexes for race, region, and household size for the total population and low-income households. All values are shown in logs so that the antilog converts the value into a standard index in which 1990 = 100. The reference index for the Northeast is shown in column one. This index is for the nonblack household with the least expenditures in 1990. In log terms, food costs rose by 0.1212 over the 6-year period. The race variable is for black reference households, because the dummy variable for nonblack households was eliminated from the model to avoid perfect multicollinearity. For the study period, food-at-home costs of black households increased less than those of nonblack households. These values ranged from -0.002 in 1991 to -0.009 in 1995. The three regional dummy variables are all positive, indicating that the reference household in the

Table 6—Demographic marginal indexes and marginal expenditure indexes, total population, 1991-95

Year	Demographic marginal indexes								
	Northeast reference	Black household	Region			Household size			
			North Central	South	West	2	3	4	5
1991	0.0229	-0.0017	0.0016	0.0007	0.0034	-0.0019	-0.0030	-0.0038	-0.0044
1992	.0345	-.0058	.0022	.0013	.0032	-.0013	-.0021	-.0026	-.0030
1993	.0561	-.0035	.0005	.0001	.0029	-.0015	-.0023	-.0030	-.0034
1994	.0869	-.0060	.0022	.0015	.0035	-.0021	-.0034	-.0043	-.0049
1995	.1212	-.0088	.0022	.0014	.0046	-.0043	-.0068	-.0086	-.0099
Marginal expenditure indexes									
	Northeast reference	Black household	Region						
			North Central	South	West				
1991	0.0016	0.0005	-0.0004	-0.0001	-0.0011				
1992	.0009	.0006	-.0005	-.0007	-.0008				
1993	.0015	.0000	-.0001	-.0002	-.0009				
1994	.0012	.0007	-.0007	-.0010	-.0011				
1995	.0003	.0012	-.0009	-.0012	-.0012				

Source: USDA, ERS.

Northeast experienced the lowest rate of food-at-home price increases. In general, and relative to the Northeast, the South appears to have had the smallest increases and the West the largest.

Table 6 also includes the demographic marginal indexes for household size. Each value for household size 2 through 5 is negative, and increases in size as household size increases. In addition, the value for any household size tends to be larger in the later years, especially 1994-95. This pattern indicates that, relative to a single-member household, the true cost of food at home rises proportionally less as household size increases. This may seem contradictory, but one needs to remember that costs can increase at a decreasing rate as household size increases.

Table 6 also shows the marginal expenditure indexes. These marginal indexes are used to construct true-cost-of-food indexes for households having higher expenditures than the reference household. They indicate how much the reference index changes for every 1-percent increase in food-at-home expenditures. The race variable for black households is positive, although very small, indicating that the true-cost-of-food index increases as expenditures surpass the expenditure of the reference household relative to nonblacks. Note, this does not mean that the indexes for blacks will be higher than the indexes for nonblacks. Simply, that black households have a higher marginal propensity to consume food at home than nonblacks. Contrasted to this, the three regional dummy slope shifters are all negative, indicating that consumers in the Northeast have a larger marginal propensity to consume than consumers in the other three regions. The marginal indexes for the regions are all very small.

Table 7 contains the marginal indexes for the low-income population. Table 7 is identical to table 6, except there is no race index. Column one again contains the reference index for the Northeast.

Over the 6-year period, costs rose in log terms by 0.1168. This is less than the amount for the total population, and indicates that the reference household contained costs by substitution, relative to the total population. Like the total population, the marginal indexes for regions are positive and larger than those of the total population.

The marginal indexes for household size are also negative, but bigger than those of the total population. This is not too surprising. It is logical that poor households will try to conserve expenditures relative to households that are better off. Finally, the marginal expenditure indexes are shown in table 7. Again the first column indicates the marginal expenditure index for the reference household

Table 7—Demographic marginal indexes and marginal expenditure indexes, low-income households, 1991-95

Households, 1991-95								
Demographic marginal indexes								
Year	Northeast reference	Region			Household size			
		North Central	South	West	2	3	4	5
1991	0.0183	0.0039	0.0033	0.0094	-0.0023	-0.0036	-0.0046	-0.0053
1992	.0320	.0033	.0006	.0046	-.0024	-.0037	-.0047	-.0055
1993	.0528	.0018	.0008	.0057	-.0023	-.0037	-.0047	-.0054
1994	.0836	.0044	.0007	.0060	-.0031	-.0049	-.0061	-.0071
1995	.1168	.0060	-.0001	.0084	-.0053	-.0084	-.0106	-.0123
Marginal expenditure indexes								
	Northeast reference	Region						
		North Central	South	West				
1991	0.0030	-0.0015	-0.0007	0.0032				
1992	.0013	-.0010	-.0002	.0010				
1993	.0020	-.0007	-.0001	.0013				
1994	.0015	-.0016	-.0004	.0020				
1995	.0008	-.0022	-.0005	.0031				

Source: USDA, ERS.

in the Northeast. This is larger than the marginal expenditure index for the total population, indicating that costs rise faster on the margin for these households than for the reference household of the total populations (that is, the marginal propensity to consume food at home is higher). It does not say that costs will be higher for the low-income population than for the total population. Rather, as we showed in the descriptive statistics, these households are starting at a lower base of food spending, and their costs rise faster as more marginal dollars become available for food-at-home spending. Like the total population, the three regional dummy slope shifters are all negative, indicating that consumers in the Northeast have a larger marginal propensity to consume than consumers in the other three regions. Once again these marginal regional indexes are all small.

With this background, we can now look at various cost-of-food-at-home indexes constructed from the estimated Engel curves. In table 8, we constructed indexes for the reference household for each race (black and nonblack) and all four regions. We have included the CPI for food at home to compare with our estimated indexes.

In looking at the constructed indexes, two trends become apparent. First, the indexes for nonblacks tend to be close to the CPI, at least for 1990-93, and just slightly above the CPI for 1994-95. And second, the true indexes for blacks tend to lie below the CPI for all years. Reasons for this may be cultural in the sense that blacks may consume a diet markedly different from that consumed by the majority of the population (the backbone of the CPI), or it could be that black households face higher relative prices than other households. Overall, the CPI for food at home increased by a modest 12.5 percent over the time in question. However, nonblack households in the West saw their food-at-home costs increase by 13.4 percent. This was followed by nonblack reference households in the Northeast at 12.9 percent, the North Central States at 13.1 percent, and the South at 13.0 percent. Contrasted with this, black reference household of the Northeast saw their food-at-home costs increase by 11.9 percent over the 6-year period. Blacks in both the North Central States and the South saw their costs rise by 12.1 percent, and those in the West by 12.4 percent. This is a modest underperformance relative to the CPI, but still indicates that the food price inflation of the early to mid-1990's did not adversely affect these reference households.

Given the low level of inflation over the past few years, it is not surprising that the true-cost indexes are just below or only slightly above the CPI. Given substitution away from more expensive goods as relative prices increase, we would expect the true-cost index to be below the fixed-weight CPI. However, it is possible that nonblack households had a larger budget share of miscellaneous prepared foods in 1994-95 so that their indexes were above the CPI. Over the past 20 years, consumers have increased their budget shares of prepared foods and food away from home.

Table 9 contains the same reference households, except the nonblack and black indexes have been aggregated together. This facilitates comparisons with the indexes constructed for the low-income households. Since nonblack households make up the majority of the population, these indexes are the same as or fairly close to the nonblack indexes of the total population. Briefly, the reference

Table 8—Single-person reference households from the total population, 1991-95

Year	CPI	Northeast nonblack	Northeast black	North Central nonblack	North Central black	South nonblack	South black	West nonblack	West black
<i>1990 = 100</i>									
1991	102.6	102.3	102.1	102.5	102.3	102.4	102.2	102.7	102.4
1992	103.4	103.5	102.9	103.7	103.1	103.6	103.0	103.8	103.2
1993	105.9	105.8	105.4	105.8	105.5	105.8	105.4	106.1	105.7
1994	108.9	109.1	108.4	109.3	108.7	109.2	108.6	109.5	108.8
1995	112.5	112.9	111.9	113.1	112.1	113.0	112.1	113.4	112.4

Source: USDA, ERS.

Table 9—Single-person reference households, total population, 1991-95

Year	CPI	Northeast	North Central	South	West	National
<i>1990 = 100</i>						
1991	102.6	102.3	102.5	102.4	102.7	102.5
1992	103.4	103.5	103.6	103.5	103.8	103.6
1993	105.9	105.8	105.8	105.7	106.1	105.9
1994	108.9	109.0	109.2	109.1	109.5	109.2
1995	112.5	112.8	113.0	112.9	113.4	113.0

Source: USDA, ERS.

Table 10—Single-person reference households, low-income households, 1991-95

Year	CPI	Northeast	North Central	South	West	National
<i>1990 = 100</i>						
1991	102.6	101.9	102.2	102.2	102.8	102.3
1992	103.4	103.2	103.6	103.3	103.7	103.4
1993	105.9	105.4	105.6	105.5	106.0	105.6
1994	108.9	108.7	109.2	108.8	109.4	109.0
1995	112.5	112.4	113.1	112.4	113.3	112.8

Source: USDA, ERS.

household of the West had the largest increase in food cost at 13.4-percent, while the reference household of the Northeast had the smallest at 12.8. Overall, the true food-at-home cost for the Nation increased by 13 percent over the 6-year period, compared with 12.5 percent for the CPI.

Table 10 contains the constructed true-cost indexes for the reference single-person, low-income households. The constructed true-cost indexes tend to lie below or to be the same as the true-cost indexes of the total population, with the exception of the North Central States. Comparisons with the CPI, however, are more mixed. The true indexes for both the Northeast and the South lie below the CPI, whereas the true indexes for the West and the North Central States tend to lie above the CPI. Overall, food-at-home costs rose most in the North Central States and the West, 13.1 and 13.3 percent, and least in the Northeast and South at 12.4 percent. When aggregated together to form a national true-cost-of-food-at-home index, the individual years tend to lie at or below the CPI for 1991-93, and above in 1994-95. This pattern is similar to table 9 for the total population, although the indexes for the low-income population are all below those of the total population except for the North Central States in 1995.

We now turn to taking into account households that spend more on food at home than the reference household. To do this, we decided to construct indexes for two- and four-person households with average expenditures for their group. That is, for the total population (and later the low-income population), we took the expenditure means for two- and four-person households, and then constructed the true-cost-of-food-at-home index for that group.

Table 11 contains the true indexes for two- and four-person households, with average expenditures. Some interesting patterns emerge. For the two-person households, the indexes are the same as or slightly above the reference household index, except for 1995, when they are below. The same holds true for the four-person household, except in the West, where both black and nonblack households have indexes equal to or below the reference household. For nonblack households, the calculated true-cost indexes are the same as or slightly above the CPI. In no instance is the true index ever more than 0.2 percentage point from the CPI. For black households, all the calculated indexes are below those of the CPI. Note that in 1995, the indexes for two-person nonblack households are equal to the CPI, except in the South, which is just below it. For two-person, nonblack households, food costs

Table 11—Indexes for two- and four-person households from the total population, 1991-95

Year	CPI	Northeast nonblack	Northeast black	North Central nonblack	North Central black	South nonblack	South black	West nonblack	West black
<i>1990 = 100</i>									
Two-person household:									
1991	102.6	102.4	102.3	102.5	102.4	102.5	102.4	102.6	102.4
1992	103.4	103.6	103.1	103.7	103.2	103.6	103.1	103.7	103.2
1993	105.9	105.9	105.5	106.0	105.6	105.9	105.5	105.7	105.6
1994	108.9	109.1	108.5	109.2	108.7	109.0	108.5	109.3	108.7
1995	112.5	112.5	111.7	112.5	111.8	112.4	111.6	112.7	112.0
Four-person household:									
1991	102.6	102.3	102.2	102.4	102.3	102.3	102.2	102.4	102.3
1992	103.4	103.4	103.0	103.6	103.1	103.4	102.9	103.6	103.1
1993	105.9	105.8	105.4	105.8	105.5	105.8	105.4	105.9	105.5
1994	108.9	108.9	108.4	109.0	108.5	108.8	108.3	109.0	108.5
1995	112.5	112.0	111.3	112.0	111.3	111.9	111.2	112.2	111.5

Source: USDA, ERS.

Table 12—Aggregated indexes for two- and four-person households, total population, 1991-95

Year	CPI	Northeast	North Central	South	West	National
<i>1990 = 100</i>						
Two-person households:						
1991	102.6	102.4	102.5	102.5	102.6	102.5
1992	103.4	103.6	103.7	103.5	103.7	103.6
1993	105.9	105.9	106.0	105.8	105.7	105.9
1994	108.9	109.1	109.2	108.9	109.3	109.1
1995	112.5	112.4	112.4	112.3	112.7	112.5
Four-person households:						
1991	102.6	102.3	102.4	102.3	102.4	102.4
1992	103.4	103.4	103.6	103.3	103.6	103.5
1993	105.9	105.8	105.8	105.7	105.9	105.8
1994	108.9	108.9	109.0	108.7	109.0	108.9
1995	112.5	111.9	111.9	111.8	112.2	112.0

Source: USDA, ERS.

rose 12.4 percent in the South, 12.5 percent in the Northeast and North Central States, and 12.7 percent in the West. Among black households, those in the West had the largest increase at 12.0 percent, while those in the South had the smallest at 11.6 percent.

The indexes of the four-person households are all less than those of the two-person households. In this case, the negative effect from the increase in household size has offset the positive effect of an increase in average food expenditures. Finally, note again that all calculated indexes for 1995 lie well below the CPI, and are considerably less than the corresponding numbers for two-person households. Hence, among nonblack households, the West had the largest increase at 12.2 percent, and the South the lowest at 11.9 percent.

In table 12, the indexes for black and nonblack households have been aggregated together to facilitate comparison with the indexes for the low-income households. Once again, these aggregated indexes are equal to or close to the indexes for nonblack households in table 11. In turn, the regional indexes have been aggregated into a national index. The patterns noted above emerge, in that the true indexes are at or below the CPI, with the indexes for four-person households below those for two-person households. Hence, over the 6-year study period, food-at-home costs rose 12.5 percent for a two-person household with average food expenditures, and 12.0 percent for a four-person household.

Finally, table 13 contains the calculated indexes for two- and four-person low-income households. In general, the Northeast and South have lower indexes than the North Central States and the West, with the West having the highest indexes. The calculated indexes tend to lie below the CPI and the true-cost indexes for the total population. For two-person households, food costs rose most in the West, 12.3 percent, and least in the South, 11.8 percent, over the 6-year period; they rose by 12.0 percent in both the Northeast and the North Central States. For four-person households, costs rose 11.7 percent in the West, and 11.3 percent in the South, with the Northeast and the North Central States experiencing a cost increase of 11.4 percent.

In general, the results of this study indicate that the CPI for food at home has been a fairly good indicator of the costs incurred by American households over the study period. True-cost indexes calculated for the general population tend to be the same as or lower than the CPI except for 1994 and 1995. The true-cost indexes also indicate that there are economies to household size, and that black households incur lower costs than nonblack households. Also, households in the West tend to have the highest costs, while those in the Northeast tend to have the lowest. In addition, the true-cost indexes for low-income households tend to be about the same as the CPI for one-person households, and lower than the CPI for two- and four-person households. This is a significant finding in that components of the CPI for food at home are indirectly used to adjust benefit levels for food stamp recipients. The results of this study indicate that the CPI has not systematically overestimated or underestimated the food costs incurred by one-person households or, for that matter, the food costs of the general population.

Table 13—Aggregated indexes for two- and four-person, low-income households, 1991-95

Year	CPI	Northeast	North Central	South	West	National
<i>1990 = 100</i>						
Two-person households:						
1991	102.6	102.3	102.4	102.4	102.6	102.4
1992	103.4	103.3	103.4	103.3	103.5	103.4
1993	105.9	105.6	105.7	105.6	105.9	105.7
1994	108.9	108.6	108.8	108.7	108.9	108.8
1995	112.5	112.0	112.0	111.8	112.3	112.0
Four-person households:						
1991	102.6	102.1	102.2	102.2	102.3	102.2
1992	103.4	103.1	103.2	103.1	103.3	103.2
1993	105.9	105.5	105.5	105.4	105.7	105.5
1994	108.9	108.5	108.5	108.4	108.6	108.5
1995	112.5	111.4	111.4	111.3	111.7	111.5

Source: USDA, ERS.