Decomposition and Sensitivity Analyses

As shown in the econometric results, commodity consumption is affected by a host of economic, social, and demographic factors. The change in commodity consumption between 2000 and 2020 was decomposed into individual effects. Some of the factors affect commodity consumption directly and indirectly. For example, household income affects commodity consumption directly through the consumption equation, and also affects eating out and diet-health knowledge, which in turn affect commodity consumption. The income effect can be decomposed into direct and indirect effects.

In addition to being affected by changes in income, social, and demographic factors, the consumption projections are also affected by the underlying assumptions (see "Assumptions Underlying the Forecasts," p. 13). A sensitivity analysis was conducted to examine the changes under an alternative assumption about eating-out behavior.

Effects of Economic, Social, and Demographic Factors

We conducted a decomposition analysis on the expected changes in commodity consumption between 2000 to 2020. The decomposition was also conducted for food consumption; while those results are not reported here, they are available from the authors. Because the Tobit model is nonlinear, the individual effects have to be adjusted so that they sum to the total change. The individual and total effects are expressed in terms of percent change from the 2000 projected consumption, at home, away from home, and total.

The total change and individual effects are reported in table 13 for commodity consumption at home, in table 14 for away-from-home consumption, and in table 15 for total consumption. The first column in the three tables, total effect, shows the percent change between 2000 and 2020 for the total U.S. market, incorporating projected population growth. Numbers in other columns measure the percent change from 2000 to 2020 on a per capita basis, with the column "net" showing net change in per capita consumption, followed by changes attributable to individual variables.

For the at-home market, per capita consumption is predicted to increase between 2000 and 2020 for poultry, fish, yogurt, all fruits, nuts and seeds, tomatoes, lettuce, other vegetables, and grains. Per capita consumption of beef, pork, other meat, eggs, milk, cheese, fried potatoes, other potatoes, and sugar is predicted to fall. As expected, income plays an important role in commodity consumption. For example, growth in income dampens at-home beef, pork, and egg consumption directly and indirectly. As income rises, Americans eat less at home and accumulate more diet-health knowledge, both of which have negative effects on at-home consumption of beef, pork, and eggs (see the Tobit results in the appendix tables, p. 34-58). The aging of the U.S. population will increase per capita consumption of fish, eggs, fruits, other potatoes, lettuce, and other vegetables at home. The changing racial composition of the U.S. population affects eating out and diet-health knowledge, and hence directly and indirectly affects consumption of several commodities at home—positive effects for poultry, fish, eggs, and fruits; negative effects for dairy and potato products. As household heads become more educated and their diet-health knowledge improves, per capita at-home consumption of fruits is expected to rise but consumption of beef, pork, and eggs is expected to decline.

With respect to effects on away-from-home consumption, income and the aging of the population dominate other factors (table 14). Per capita consumption of the 22 commodities away from home is expected to rise with income as rising income drives an increase in eating out. On the other hand, the aging of the population negatively affects eating out and, hence, the away-from-home consumption of all commodities, except fish and other potatoes.

Changes in the aggregated at-home and away-from-home commodity consumption are shown in table 15. The total U.S. consumption of fruits and fish will lead the commodity market in growth over the next two decades, while potatoes, beef, pork, other meat, milk, cheese, and sugar will show the smallest growth. The growth in fruit consumption comes mainly from the at-home segment and is greatly influenced by rising income, the changing racial composition, and diet-health knowledge from higher educational achievement. Income and educational achievement are also the main drivers for rising per capita yogurt consumption. Income also affects per capita fish consumption, but to a lesser degree than the aging of the population and the changing racial composition.

Table 13—Changes in at-home commodity consumption under the base scenario, 2000 to 2020

Commodity group	Total	Per capita effects							
		Net	Income	Age	Region	Urbanization	Race	Household type	Education
		Percent change from 2000 projected consumption							
Meats									
Beef	12.52	-4.61	-2.49	-0.08	-0.22	-0.33	0.52	-1.27	-0.73
Pork	12.55	-4.58	-2.39	0.73	-0.69	-0.48	-0.20	-0.70	-0.86
Poultry	18.69	0.63	-0.85	0.33	-0.33	0.02	1.95	-0.54	0.04
Fish	23.25	4.49	-0.79	2.17	0.12	0.35	2.32	0.51	-0.19
Other meat	12.51	-4.61	-1.99	-0.16	-0.35	-0.09	-0.80	-0.65	-0.58
Eggs	17.05	-0.77	-3.31	2.08	0.02	-0.34	2.57	-0.82	-0.97
Dairy									
Milk	16.67	-1.09	-0.39	-0.17	0.02	0.37	-1.22	-0.27	0.57
Cheese	15.88	-1.76	0.36	-0.50	-0.13	0.09	-1.88	-0.55	0.85
Yogurt	20.55	2.20	1.38	0.57	-0.16	0.50	-1.57	0.41	1.06
Vegetable oils	17.51	-0.38	-0.71	0.65	-0.12	-0.07	-0.09	-0.19	0.16
Fruit									
Citrus	27.51	8.10	1.72	1.24	-0.66	0.45	2.64	0.32	2.40
Apples	27.86	8.40	1.84	1.56	-0.57	0.48	2.51	0.23	2.35
Grapes	24.43	5.49	1.07	1.14	-0.48	0.41	1.42	0.09	1.85
Other fruit	26.72	7.43	1.31	2.61	0.05	0.53	1.42	-0.19	1.70
Nuts and seeds	20.72	2.34	-0.61	1.06	0.29	-0.22	1.85	-0.30	0.27
Vegetables									
Fried potatoes	5.38	-10.66	-1.26	-3.40	-0.03	-0.78	-2.11	-1.59	-1.49
Other potatoes	13.18	-4.04	-3.09	3.18	-0.77	-0.55	-1.94	-1.16	0.29
Tomatoes	19.12	0.99	-0.22	0.69	0.03	-0.03	1.00	-0.47	-0.01
Lettuce	22.18	3.58	-0.38	2.59	-0.22	0.12	0.48	0.35	0.65
Other vegetables	21.35	2.88	-0.48	2.19	-0.18	0.07	0.61	0.15	0.51
Grains	19.09	0.97	-0.40	0.27	-0.14	0.04	0.93	-0.07	0.34
Sugar	15.61	-1.99	-0.58	-0.56	-0.14	0.08	-0.88	-0.09	0.19

See footnotes in table 10.

Effects of Eating Out and Diet-Health Knowledge on Commodity Consumption

Tables 13-15 show the effects of exogenous variables on future commodity consumption. The effects include those channeled through eating out and diet-health knowledge. It is also useful to assess the effects of increases in eating out and diet-health knowledge between 2000 and 2020 on commodity consumption.

As eating out rises over the next two decades, the away-from-home consumption of all 22 commodities will also rise, whereas the at-home consumption of all commodities, except fried and other potatoes, will fall (table 16). As eating out increases, the rise in away-

from-home beef consumption will outpace the fall in at-home beef consumption, resulting in an increase in per capita beef consumption of 0.2 percent. Similarly, potatoes, cheese, vegetable oils, lettuce, and sugar are predicted to have positive growth due to an increase in eating out. It should be noted that the total effects are the sum of effects at home and away from home, weighted by their market shares.

As consumers accumulate better diet-health knowledge, they are predicted to consume, both at home and away from home, less beef, pork, other meats, and fried potatoes, but consume more grains, tomatoes, and nuts and seeds (table 16). With increased knowledge, consumers are predicted to consume less poultry but more fish

Table 14—Changes in away-from-home commodity consumption under the base scenario, 2000 to 2020

Commodity group	Total	Net	Income	Age	Region	Urbanization	Race	Household type	Education
					Per capita effects				
				Percent change from 2000 projected consumption					
Meats									
Beef	18.90	0.80	2.94	-3.91	0.25	0.01	0.70	0.80	0.02
Pork	20.92	2.52	3.35	-2.28	0.19	0.34	0.33	0.58	0.01
Poultry	17.79	-0.14	3.42	-4.72	0.04	0.71	-0.13	0.51	0.03
Fish	30.44	10.59	4.76	0.98	0.64	0.24	1.88	0.95	1.14
Other meat	16.80	-0.98	3.14	-3.82	-0.17	0.52	-0.85	0.59	-0.40
Eggs	23.02	4.29	3.24	-0.69	0.46	0.40	-1.19	1.67	0.41
Dairy									
Milk	15.69	-1.92	1.49	-4.57	-0.52	0.07	-0.97	2.27	0.31
Cheese	16.90	-0.89	3.91	-6.57	0.25	0.51	-0.53	0.73	0.81
Yogurt	15.84	-1.80	1.71	-5.18	-0.68	0.14	-1.19	3.23	0.19
Vegetable oils	20.34	2.03	3.90	-3.79	0.26	0.42	-0.38	1.07	0.55
Fruit									
Citrus	19.83	1.59	3.12	-5.77	-0.33	0.43	1.19	3.01	-0.06
Apples	20.23	1.93	2.90	-5.50	-0.24	0.37	1.43	3.11	-0.13
Grapes	19.64	1.43	2.81	-4.93	-0.11	0.37	0.73	2.48	0.08
Other fruit	21.72	3.20	3.07	-3.74	0.12	0.25	0.52	2.23	0.76
Nuts and seeds	24.29	5.37	4.61	-3.41	0.94	0.10	0.89	0.95	1.30
Vegetables									
Fried potatoes	10.11	-6.65	1.56	-8.01	0.14	0.10	-1.35	1.09	-0.19
Other potatoes	20.41	2.08	3.91	3.17	-0.75	-0.26	-3.37	0.08	-0.69
Tomatoes	20.42	2.09	4.30	-5.31	0.35	0.43	0.50	1.07	0.75
Lettuce	26.31	7.08	5.42	-1.83	0.53	0.46	0.21	1.50	0.79
Other vegetables	25.75	6.61	5.29	-2.14	0.51	0.45	0.24	1.44	0.81
Grains	21.80	3.26	4.12	-4.16	0.30	0.56	0.69	0.95	0.80
Sugar	17.18	-0.66	3.41	-4.98	0.22	0.39	-0.58	0.48	0.40

See footnotes in table 10.

away from home and consume fewer eggs but more fruits and dairy products, mainly at home.

Direct and Indirect Effects of Income

Household income affects eating out and diet-health knowledge, and hence indirectly affects commodity consumption. The total effects of rising household income over the next two decades are decomposed into three components: direct effect, indirect effect through eating out, and indirect effect through diet-health knowledge (fig. 11 and table 17, p. 28).

All three income-induced effects will contribute to a lower per capita consumption of pork and other meat, but contribute to a higher consumption of cheese and lettuce. Eating out favors beef consumption, but the other two effects outweigh eating out and result in lower per capita beef consumption. On the other hand, income has a positive direct effect, as well as a positive indirect effect through diet-health knowledge, but a negative indirect effect through eating out on the consumption of fish, milk, yogurt, all fruits, nuts and seeds, tomatoes, other vegetables, and grains.

Table 15—Changes in total commodity consumption under the base scenario, 2000 to 2020

Commodity group	Total	Net	Income	Age	Region	Urbanization	Race	Household type	Education
					Per capita effects				
		Percent change from 2000 projected consumption							
Meats									
Beef	14.65	-2.80	-0.67	-1.36	-0.06	-0.22	0.58	-0.58	-0.48
Pork	14.33	-3.07	-1.17	0.09	-0.50	-0.30	-0.09	-0.42	-0.67
Poultry	18.41	0.38	0.50	-1.26	-0.21	0.24	1.29	-0.21	0.03
Fish	25.71	6.58	1.11	1.76	0.30	0.31	2.17	0.66	0.26
Other meat	13.52	-3.76	-0.79	-1.01	-0.30	0.05	-0.81	-0.36	-0.54
Eggs	18.35	0.33	-1.89	1.48	0.12	-0.18	1.75	-0.28	-0.67
Dairy									
Milk	16.54	-1.19	-0.15	-0.73	-0.05	0.34	-1.19	0.05	0.54
Cheese	16.26	-1.44	1.67	-2.73	0.01	0.24	-1.38	-0.08	0.83
Yogurt	20.41	2.08	1.39	0.40	-0.18	0.49	-1.56	0.50	1.04
Vegetable oils	18.42	0.40	0.77	-0.78	0.00	0.09	-0.19	0.21	0.29
Fruit									
Citrus	26.68	7.40	1.87	0.48	-0.62	0.45	2.48	0.61	2.13
Apples	27.20	7.84	1.93	0.95	-0.55	0.47	2.42	0.47	2.14
Grapes	24.00	5.13	1.23	0.59	-0.45	0.40	1.35	0.31	1.69
Other fruit	26.21	7.00	1.48	1.96	0.06	0.50	1.33	0.06	1.61
Nuts and seeds	21.43	2.94	0.42	0.18	0.42	-0.16	1.67	-0.05	0.47
Vegetables									
Fried potatoes	7.81	-8.60	0.19	-5.76	0.06	-0.33	-1.72	-0.21	-0.82
Other potatoes	14.45	-2.97	-1.86	3.18	-0.76	-0.50	-2.19	-0.94	0.12
Tomatoes	19.43	1.25	0.86	-0.75	0.11	0.08	0.88	-0.10	0.18
Lettuce	23.96	5.09	2.12	0.68	0.10	0.26	0.37	0.84	0.71
Other vegetables	22.21	3.61	0.65	1.34	-0.04	0.14	0.54	0.41	0.57
Grains	19.72	1.49	0.63	-0.74	-0.04	0.16	0.88	0.16	0.45
Sugar	15.98	-1.68	0.34	-1.58	-0.06	0.15	-0.81	0.04	0.24

See footnotes in table 10.

Sensitivity Analysis of Eating Out and Age

Eating out increases with age among children, peaks among those age 14-19, then declines with age among adults (table 2). The parameter estimates suggest that consumers age 45-54 eat out less than those age 30-44 by 4.6 percentage points (subtracting 9.8 from 14.4), in terms of the percent of food eaten out (fig. 12). This eating out-age relationship is maintained in the fore-casting analyses discussed so far, and this is termed the base scenario.

In the sensitivity analysis, we assumed that those age 45 and over in 2020 will eat out as much as those age 30-44 (fig. 13). Under this alternative scenario, eating out is predicted to rise much higher than the base scenario. Under the base scenario, eating out is predicted to represent 23.3 percent of total food consumption in 2020, compared with 38 percent under the alternative scenario. Clearly, the extent to which young adults will retain their eating-out habits as they grow older will greatly influence the growth of eating out, which in turn affects the type and amount of foods and commodities consumed by Americans.

In the interest of brevity, we report only the change in total and per capita consumption, combining at-home and away-from-home consumption. Under the alterna-tive scenario, the consumption of some commodities

Table 16—Changes in per capita commodity consumption due to increases in eating out and diet-health knowledge, 2000 to 2020

|	Effects of eating out			Effects of diet-health knowledge		
Commodity group	Total	Food at home	Food away from home	Total	Food at home	Food away from home
	Percent change from 2000 projected consumption					
Meats						
Beef	0.20	-0.47	1.52	-0.34	-0.41	-0.22
Pork	-0.03	-0.43	1.44	-0.45	-0.50	-0.27
Poultry	-0.02	-0.53	1.09	-0.04	0.06	-0.25
Fish	-0.21	-0.81	0.93	0.06	-0.14	0.46
Other meat	-0.17	-0.47	0.80	-0.38	-0.34	-0.54
Eggs	-0.22	-0.73	1.61	-0.33	-0.45	0.12
Dairy						
Milk	-0.46	-0.74	1.43	0.35	0.39	0.09
Cheese	0.02	-0.69	1.23	0.46	0.56	0.28
Yogurt	-0.49	-0.53	1.10	0.67	0.69	-0.02
Vegetable oils	0.10	-0.48	1.33	0.15	0.16	0.13
Fruit						
Citrus	-0.97	-1.26	1.39	1.34	1.52	-0.13
Apples	-0.99	-1.22	1.41	1.34	1.48	-0.17
Grapes	-0.77	-1.00	1.58	1.07	1.19	-0.07
Other fruit	-0.67	-0.90	1.32	1.00	1.07	0.38
Nuts and seeds	-0.35	-0.85	1.70	0.34	0.27	0.60
Vegetables						
Fried potatoes	0.73	0.04	1.38	-0.61	-1.00	-0.24
Other potatoes	0.28	0.05	1.35	0.15	0.32	-0.66
Tomatoes	-0.01	-0.43	1.34	0.08	0.02	0.27
Lettuce	0.10	-0.66	1.10	0.38	0.48	0.24
Other vegetables	-0.26	-0.60	1.14	0.36	0.39	0.25
Grains	-0.15	-0.58	1.27	0.28	0.28	0.27
Sugar	0.17	-0.38	1.98	0.13	0.16	0.02

See footnotes in table 10.

rises while the consumption of other commodities declines, compared with the base scenario (table 18).

As expected, the most affected commodity is fried potatoes (fig. 14 and table 19), the only commodity for which the away-from-home market exceeds the at-home market. Over the next two decades, total consumption of fried potatoes is predicted to grow by 7.81 percent under the base scenario and by 10.38 percent under the alternative scenario. Total consumption of other potatoes is also noticeably affected by the eating-out habits of the older age groups over time.

The differences between the base and alternative scenarios are affected by the relative size of the at-home and away-from-home market components. The market for fried potatoes is a case in point. However, other factors appear to affect the differences between the base and alternative scenarios. This is evident from the changes in beef and pork consumption. In 2000, at-home consumption was predicted to represent 67 percent of total beef consumption, while 79 percent of pork was predicted to be consumed at home. The rates of change between the two scenarios (the level under the alternative scenario over the level under the base scenario) are quite similar for beef and pork.

Figure 11
Income effects—direct and indirect
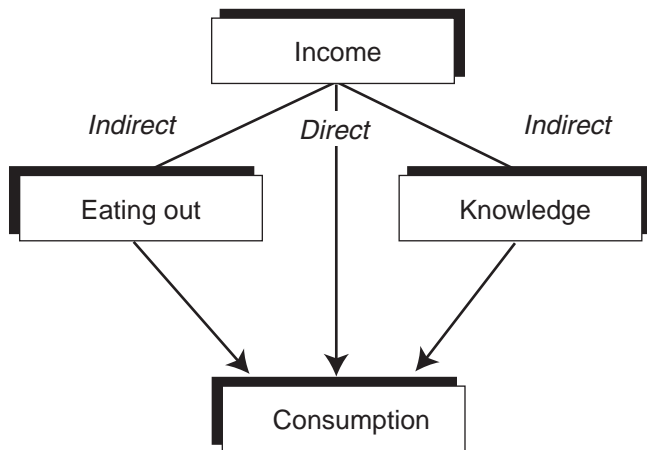
Source: Economic Research Service, USDA.

Compared with younger adults, older adults tend to eat more beef and pork when eating out, and they favor pork over beef (app. tables 1 and 2).

Compared with the base projections, the total consumption of several commodities is predicted to fall under the alternative scenario. Fruit is the major commodity that is predicted to fall in total consumption if older age groups eat out as much in 2020 as they did in 2000. This alternative assumption about eating out also dampens the consumption of milk and yogurt, but not cheese. Among the three dairy commodities, cheese has the highest portion of consumption away from home-37 percent in 2000, compared with 13 percent for milk and 3 percent for yogurt.

Table 17—Total, direct, and indirect effects of rising income on per capita commodity consumption, 2000-2020

Commodity group	Total income effect	Direct income effect	Indirect income effect	
			Eating out	Knowledge
	Percent change from 2000 projected consumption			
Meats				
Beef	-0.67	-0.59	0.32	-0.41
Pork	-1.17	-0.57	-0.04	-0.55
Poultry	0.50	0.59	-0.02	-0.05
Fish	1.11	1.42	-0.41	0.09
Other meat	-0.79	-0.07	-0.27	-0.46
Eggs	-1.89	-1.07	-0.40	-0.44
Dairy				
Milk	-0.15	0.12	-0.60	0.33
Cheese	1.67	1.00	0.03	0.62
Yogurt	1.39	1.38	-0.84	0.85
Vegetable oils	0.77	0.37	0.19	0.20
Fruit				
Citrus	1.87	1.85	-1.77	1.83
Apples	1.93	1.95	-1.81	1.81
Grapes	1.23	1.21	-1.42	1.48
Other fruit	1.48	1.36	-1.22	1.36
Nuts and seeds	0.42	0.58	-0.55	0.40
Vegetables				
Fried potatoes	0.19	-0.47	1.75	-1.08
Other potatoes	-1.86	-2.53	0.49	0.19
Tomatoes	0.86	0.76	-0.01	0.11
Lettuce	2.12	1.42	0.18	0.50
Other vegetables	0.65	0.63	-0.46	0.47
Grains	0.63	0.53	-0.27	0.36
Sugar	0.34	-0.18	0.34	0.19

See footnotes in table 10.

Figure 12
The estimated coefficients for age groups in the eating-out equation—the base scenario
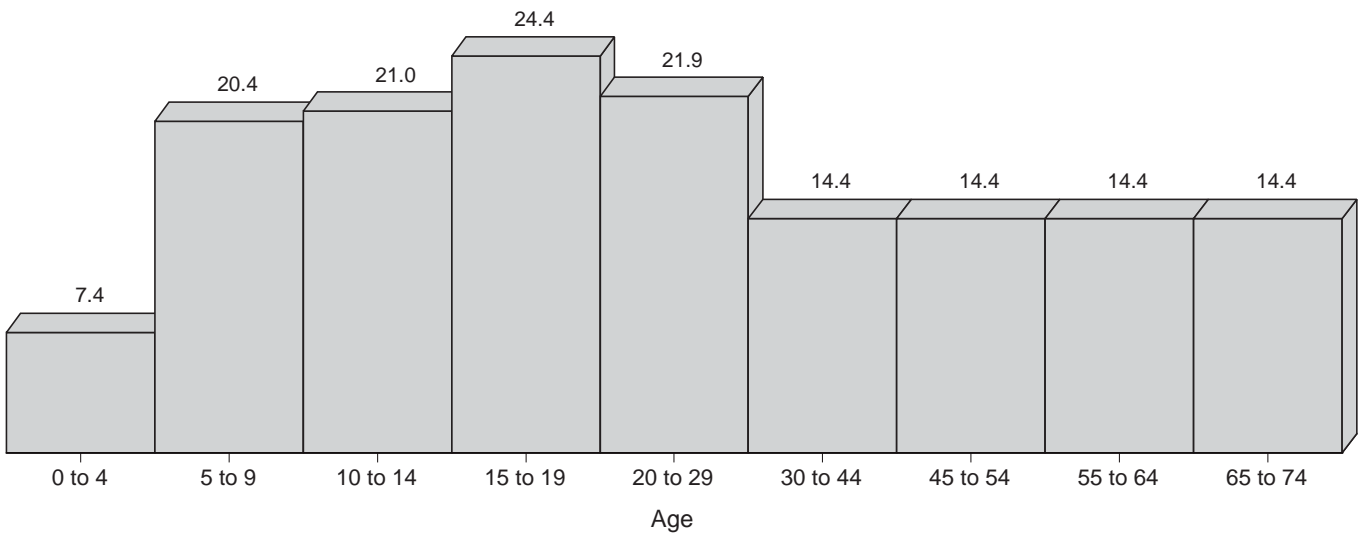
Percent of food eaten out
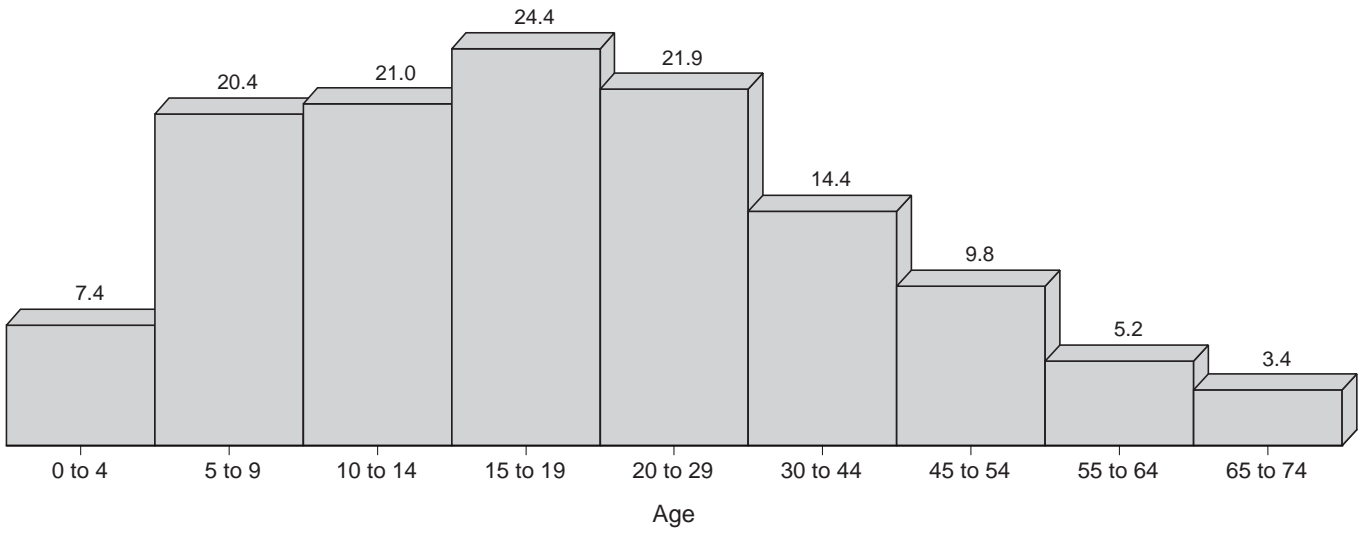
Source: Economic Research Service, USDA.

Figure 13
The assumed coefficients for age groups in the eating-out equation—the alternative scenario

Percent of food eaten out

Source: Economic Research Service, USDA.

Table 18—Changes in total commodity consumption under alternative scenario, 2000-2020
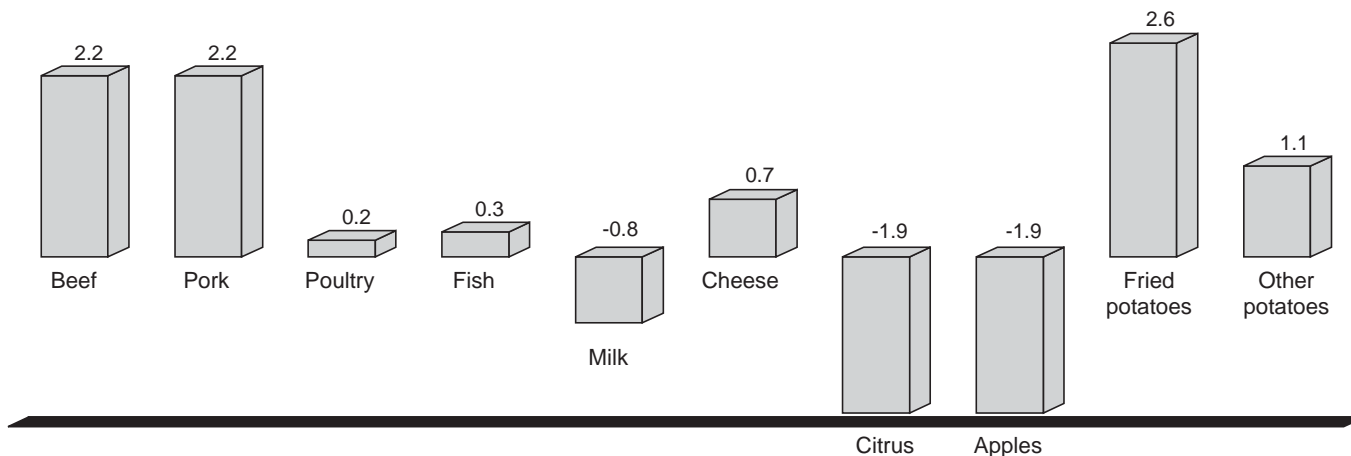
Commodity group	Total	Net	Income	Age	Region	Urbanization	Race	Household type	Education
				Per capita effects					
			Percent change from 2000 projected consumption						
Meats									
Beef	16.82	-0.96	0.22	-1.10	0.02	-0.18	0.67	-0.23	-0.36
Pork	16.48	-1.25	-0.44	0.40	-0.36	-0.23	0.18	-0.28	-0.52
Poultry	18.63	0.58	0.96	-1.55	-0.15	0.31	1.08	-0.10	0.04
Fish	26.04	6.86	1.73	1.49	0.36	0.27	2.03	0.60	0.38
Other meat	13.89	-3.45	-0.44	-1.32	-0.26	0.10	-0.71	-0.30	-0.51
Eggs	19.34	1.17	-1.00	1.28	0.18	-0.07	1.18	0.08	-0.47
Dairy									
Milk	15.77	-1.85	-0.12	-1.47	-0.11	0.32	-1.23	0.21	0.54
Cheese	16.91	-0.88	2.09	-3.13	0.07	0.30	-1.14	0.10	0.82
Yogurt	19.45	1.27	1.30	-0.26	-0.21	0.49	-1.62	0.52	1.06
Vegetable oils	19.17	1.03	1.30	-0.89	0.05	0.14	-0.24	0.35	0.32
Fruit									
Citrus	24.76	5.77	1.83	-1.21	-0.65	0.45	2.50	0.86	1.99
Apples	25.35	6.27	1.84	-0.63	-0.57	0.47	2.48	0.66	2.03
Grapes	22.06	3.48	1.08	-0.63	-0.43	0.39	1.15	0.41	1.52
Other fruit	24.79	5.79	1.40	0.90	0.07	0.48	1.22	0.17	1.54
Nuts and seeds	22.02	3.45	1.12	-0.34	0.54	-0.13	1.51	0.10	0.66
Vegetables									
Fried potatoes	10.38	-6.42	0.64	-4.82	0.09	-0.21	-1.55	0.07	-0.64
Other potatoes	15.59	-2.00	-1.33	3.56	-0.74	-0.47	-2.26	-0.83	0.07
Tomatoes	19.77	1.54	1.27	-1.11	0.14	0.12	0.84	0.03	0.24
Lettuce	24.80	5.80	2.74	0.53	0.19	0.31	0.34	0.97	0.73
Other vegetables	22.34	3.72	1.04	0.87	0.01	0.17	0.54	0.49	0.60
Grains	19.96	1.70	0.97	-1.13	0.00	0.20	0.96	0.23	0.48
Sugar	17.10	-0.72	0.92	-1.39	0.01	0.19	-0.78	0.09	0.24

See footnotes in table 10.

Figure 14

Change in per capita commodity consumption between the base and alternative scenarios

Percent change

Beef	Pork	Poultry	Fish	Milk	Cheese	Citrus	Apples	Fried potatoes	Other potatoes
2.2	2.2	0.2	0.3	-0.8	0.7	-1.9	-1.9	2.6	1.1

Source: Economic Research Service, USDA.

Table 19—Comparison of growth in commodity markets under the base and alternative scenarios, 2000-2020

Commodity group	Base scenario (A)	Alternative scenario (B)	(B)-(A)
	Percent change from 2000 projected consumption		
Meats			
Beef	14.65	16.82	2.17
Pork	14.33	16.48	2.15
Poultry	18.41	18.63	0.22
Fish	25.71	26.04	0.33
Other meat	13.52	13.89	0.37
Eggs	18.35	19.34	0.99
Dairy			
Milk	16.54	15.77	-0.77
Cheese	16.26	16.91	0.65
Yogurt	20.41	19.45	-0.96
Vegetable oils	18.42	19.17	0.75
Fruit			
Citrus	26.68	24.76	-1.92
Apples	27.20	25.35	-1.85
Grapes	24.00	22.06	-1.94
Other fruit	26.21	24.79	-1.42
Nuts and seeds	21.43	22.02	0.59
Vegetables			
Fried potatoes	7.81	10.38	2.57
Other potatoes	14.45	15.59	1.14
Tomatoes	19.43	19.77	0.34
Lettuce	23.96	24.80	0.84
Other vegetables	22.21	22.34	0.13
Grains	19.72	19.96	0.24
Sugar	15.98	17.10	1.12

Base scenario = eating out declines with age according to table 2. Alternative scenario = increased eating out for adults age 45 and over.
See footnotes in table 10.