# Supplementary material

## Age-year-cohort decomposition

Following McKenzie([1](#_ENREF_1)), individuals are observed over an age range comprising *j* age groups, over *k* periods. A cohort is defined as the same group of individuals observed on successive occasions, where individuals are observed based on their age in a specific period. Cohorts are thus indexed with the subscript (*j-k +1)*. The individual’s *i* age, cohort and year effects on the dependent variable of interest are then written as

FVi,c(j-k+1),aj,tk= b+ αc(j-k+1)+βaj+ρtk+μ (1)

where FV stands for fruits and vegetables, aj refers to age group j, tk to time period k and c(j-k+1) to cohort (j-k+1), b is a constant and μ is an error term. Theoretical and empirical results can serve to guide the functional form imposed on the age, time and cohort effects([2](#_ENREF_2)). However, it is possible to avoid any *a priori* functional forms for the three effects when sample size is sufficiently large through the use of dummy variables([3](#_ENREF_3)). It is further assumed that there are no interaction effects between age, cohort and time variables([3](#_ENREF_3)). Thus Equation (1) is estimated through matrices of age, year and cohort dummies. The cohort dummies are defined as cohort-year pairs: for each survey year there are *j* cohorts observed. All the matrices therefore have *j* times the number of surveys as lines, and, respectively, the number of age groups, the number of years and the number of cohorts as columns.

One column is dropped out of each matrix to avoid perfect collinearity given the constant term in (1). As it stands, however, the model is unable to attribute any estimates specifically to age, year or cohort effects as there exists a linear relationship among these variables due to the fact that cohort membership is determined through age and survey year. An approach used previously to address this problem is to make the year effects orthogonal to a time trend, i.e. lacking in trend or predictable pattern, and averaging to zero over the long run([4](#_ENREF_4); [5](#_ENREF_5)). Following Deaton([3](#_ENREF_3)), the normalization that achieves both conditions is given by:

 dt\* = dt – [(t-1)d2 – (t-2)d1] (2)

where d is the dummy variable for survey year, and where t = 1, …, 4. The choice of the normalization of the year effect assumes that age and cohort effects explain the trends on the data([5](#_ENREF_5)).

## Number of individuals in each cohort in each survey year used to calculate the median fruit and vegetable consumption behaviour of the individuals that belong to each cohort. Weighted counts.

|  |  |
| --- | --- |
|  | **Survey wave** |
| **Cohort number** | **1** | **2** | **3** | **4** |
| 1 |  |  |  | 11 |
| 2 |  |  | 12 | 11 |
| 3 |  | 14 | 15 | 11 |
| 4 | 18 | 14 | 8 | 16 |
| 5 | 14 | 10 | 12 | 8 |
| 6 | 13 | 11 | 15 | 9 |
| 7 | 16 | 14 | 12 | 13 |
| 8 | 11 | 9 | 9 | 11 |
| 9 | 17 | 9 | 12 | 10 |
| 10 | 13 | 10 | 13 | 14 |
| 11 | 18 | 11 | 11 | 9 |
| 12 | 11 | 14 | 13 | 14 |
| 13 | 11 | 10 | 13 | 14 |
| 14 | 10 | 18 | 12 | 10 |
| 15 | 13 | 12 | 13 | 15 |
| 16 | 15 | 11 | 13 | 14 |
| 17 | 12 | 15 | 12 | 6 |
| 18 | 16 | 18 | 16 | 8 |
| 19 | 15 | 11 | 6 | 12 |
| 20 | 12 | 14 | 17 | 18 |
| 21 | 26 | 9 | 17 | 16 |
| 22 | 10 | 10 | 13 | 8 |
| 23 | 24 | 16 | 12 |  |
| 24 | 9 | 23 |  |  |
| 25 | 14 |  |  |  |

The age range under study is 2 to 23 years. The youngest cohort was aged 2 in the 4th wave of the survey (2011/12), the last survey included; the oldest cohort was aged 23 in the first survey wave included (2008/09). Cohort 9 was 7 years in the first survey year, cohort 10 was 8 years in that same survey wave, and so on until the last cohort.

## Estimates of age effects on consumption of fruit and vegetable portions for males and females

|  |
| --- |
| Including composite dishes |
|  | Total Fruit and vegetable portions | Vegetable portions | Fruit portionsa | Fruit portionsb |
|  | Male | Female | Male | Female | Male | Female | Male | Female |
|  | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE |
| 2 years | (base) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 years | -0.12 | (0.25) | 0.02 | (0.25) | -0.23 | (0.20) | 0.11 | (0.15) | 0.34 | (0.34) | 0.40\* | (0.20) | 0.25 | (0.22) | 0.23 | (0.24) |
| 4 years | 0.37 | (0.40) | 0.18 | (0.56) | -0.02 | (0.17) | -0.18 | (0.14) | 0.71\* | (0.33) | 0.68 | (0.50) | 0.30 | (0.24) | 0.43 | (0.29) |
| 5 years | 0.34 | (0.40) | 0.36 | (0.45) | 0.07 | (0.20) | 0.27 | (0.18) | 0.79 | (0.50) | 0.49 | (0.38) | 0.17 | (0.31) | 0.44 | (0.34) |
| 6 years | 0.75 | (0.50) | 0.88 | (0.55) | 0.09 | (0.29) | 0.23 | (0.21) | 1.00\* | (0.44) | 1.12\* | (0.51) | 0.68+ | (0.39) | 0.79\* | (0.33) |
| 7 years | 0.88 | (0.55) | 0.16 | (0.63) | 0.06 | (0.22) | 0.16 | (0.22) | 0.95\* | (0.45) | 0.79\* | (0.40) | 0.46 | (0.36) | 0.41 | (0.34) |
| 8 years | 0.11 | (0.62) | 0.43 | (0.67) | 0.38 | (0.30) | 0.39 | (0.32) | 0.55 | (0.46) | 0.44 | (0.45) | 0.15 | (0.34) | 0.43 | (0.32) |
| 9 years | -0.06 | (0.60) | -0.23 | (0.58) | 0.11 | (0.27) | 0.01 | (0.24) | 0.38 | (0.52) | 0.35 | (0.51) | 0.21 | (0.35) | 0.11 | (0.36) |
| 10 years | -0.29 | (0.72) | 0.29 | (0.63) | -0.07 | (0.27) | -0.17 | (0.31) | 0.61 | (0.57) | 0.73 | (0.51) | 0.27 | (0.40) | 0.55 | (0.34) |
| 11 years | -0.39 | (0.75) | -0.43 | (0.81) | 0.28 | (0.37) | -0.17 | (0.28) | 0.44 | (0.62) | 0.71 | (0.62) | 0.10 | (0.41) | 0.29 | (0.40) |
| 12 years | -1.08 | (0.73) | -0.73 | (0.72) | 0.01 | (0.33) | 0.23 | (0.38) | 0.09 | (0.64) | 0.24 | (0.56) | -0.07 | (0.39) | -0.17 | (0.37) |
| 13 years | -1.03 | (0.81) | -1.37+ | (0.73) | 0.06 | (0.32) | -0.17 | (0.35) | 0.14 | (0.67) | 0.10 | (0.59) | -0.03 | (0.45) | -0.30 | (0.40) |
| 14 years | -0.87 | (0.77) | -0.71 | (0.73) | 0.06 | (0.36) | -0.11 | (0.31) | -0.14 | (0.63) | 0.07 | (0.63) | -0.56 | (0.41) | -0.26 | (0.42) |
| 15 years | -1.17 | (0.85) | -1.12 | (0.93) | 0.34 | (0.41) | 0.06 | (0.48) | -0.62 | (0.62) | -0.48 | (0.65) | -0.61 | (0.42) | -0.59 | (0.45) |
| 16 years | -0.85 | (0.84) | -0.62 | (0.88) | 0.03 | (0.42) | 0.13 | (0.43) | -0.40 | (0.62) | 0.02 | (0.63) | -0.60 | (0.42) | -0.55 | (0.45) |
| 17 years | -1.22 | (0.87) | -0.77 | (0.82) | 0.34 | (0.42) | -0.07 | (0.38) | -0.87 | (0.66) | -0.16 | (0.66) | -0.72 | (0.45) | -0.28 | (0.45) |
| 18 years | -0.42 | (0.96) | -0.58 | (1.03) | 0.20 | (0.50) | 0.05 | (0.53) | -0.33 | (0.74) | -0.38 | (0.70) | -0.34 | (0.67) | -0.51 | (0.51) |
| 19 years | -1.16 | (1.09) | -0.25 | (1.20) | 0.19 | (0.61) | 0.17 | (0.51) | -0.70 | (0.74) | 0.07 | (0.78) | -0.40 | (0.53) | -0.13 | (0.61) |
| 20 years | 0.99 | (1.61) | 1.61 | (1.24) | 0.58 | (0.74) | 0.86 | (0.56) | 0.87 | (1.31) | 0.65 | (1.09) | 0.88 | (1.06) | 0.28 | (0.75) |
| 21 years | -0.51 | (1.22) | 1.09 | (1.37) | 0.50 | (0.62) | 1.02+ | (0.60) | -0.63 | (0.89) | 0.04 | (1.07) | -0.21 | (0.66) | 0.29 | (0.82) |
| 22 years | -0.08 | (1.46) | 0.65 | (1.41) | 0.67 | (1.04) | 0.43 | (0.64) | -0.32 | (0.98) | 0.55 | (1.05) | 0.04 | (0.70) | 0.65 | (0.83) |
| 23 years | 0.54 | (1.50) | -0.45 | (1.57) | 1.32 | (0.84) | -0.01 | (0.70) | 0.00 | (1.12) | -0.01 | (1.10) | 0.13 | (0.75) | 0.25 | (0.86) |
| *N* | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  |
| F | 2.30 |  | 2.30 |  | 6.22 |  | 6.22 |  | 10.08 |  | 10.08 |  | 8.29 |  | 8.29 |  |
| *Adj.R2* | 0.23 |  | 0.23 |  | 0.39 |  | 0.39 |  | 0.26 |  | 0.26 |  | 0.37 |  | 0.37 |  |
| Excluding composite dishes |
|  | Total Fruit and vegetable portions | Vegetable portions | Fruit portionsa | Fruit portionsb |
|  | Male | Female | Male | Female | Male | Female | Male | Female |
|  | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE |
| 2 years | (base) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 years | 0.10 | (0.45) | 0.36 | (0.25) | -0.17\* | (0.07) | 0.10\* | (0.05) | 0.34 | (0.35) | 0.42\* | (0.19) | 0.24 | (0.21) | 0.24 | (0.23) |
| 4 years | 0.79\*\* | (0.28) | 0.49 | (0.52) | 0.08 | (0.07) | -0.10 | (0.07) | 0.54+ | (0.32) | 0.70 | (0.45) | 0.29 | (0.25) | 0.37 | (0.28) |
| 5 years | 0.45 | (0.41) | 0.52 | (0.53) | 0.14 | (0.11) | 0.20\*\* | (0.07) | 0.77 | (0.49) | 0.55 | (0.35) | 0.20 | (0.30) | 0.43 | (0.31) |
| 6 years | 0.51 | (0.47) | 0.96+ | (0.54) | 0.09 | (0.17) | 0.42\*\* | (0.12) | 0.85+ | (0.46) | 1.08\* | (0.54) | 0.56 | (0.39) | 0.69+ | (0.35) |
| 7 years | 0.80 | (0.56) | 0.32 | (0.56) | 0.06 | (0.13) | 0.23\* | (0.11) | 0.99\* | (0.45) | 0.78+ | (0.40) | 0.39 | (0.35) | 0.26 | (0.32) |
| 8 years | 0.28 | (0.60) | 0.37 | (0.54) | 0.38\* | (0.15) | 0.05 | (0.15) | 0.52 | (0.43) | 0.47 | (0.43) | 0.07 | (0.35) | 0.37 | (0.32) |
| 9 years | 0.30 | (0.56) | -0.01 | (0.57) | 0.12 | (0.15) | 0.00 | (0.13) | 0.28 | (0.49) | 0.34 | (0.54) | 0.18 | (0.35) | 0.10 | (0.37) |
| 10 years | 0.15 | (0.64) | 0.47 | (0.60) | 0.13 | (0.15) | -0.07 | (0.20) | 0.59 | (0.53) | 0.69 | (0.53) | 0.18 | (0.40) | 0.46 | (0.34) |
| 11 years | 0.20 | (0.69) | 0.31 | (0.78) | 0.23 | (0.25) | -0.07 | (0.19) | 0.54 | (0.60) | 0.66 | (0.60) | 0.04 | (0.39) | 0.14 | (0.39) |
| 12 years | -0.74 | (0.65) | -0.14 | (0.62) | -0.26 | (0.22) | 0.19 | (0.26) | 0.10 | (0.59) | 0.22 | (0.53) | -0.17 | (0.40) | -0.26 | (0.37) |
| 13 years | -0.62 | (0.72) | -0.84 | (0.71) | -0.01 | (0.21) | -0.31 | (0.21) | 0.12 | (0.64) | 0.08 | (0.57) | -0.19 | (0.43) | -0.40 | (0.39) |
| 14 years | -0.80 | (0.72) | -0.74 | (0.68) | -0.12 | (0.25) | -0.00 | (0.20) | -0.02 | (0.64) | 0.06 | (0.61) | -0.66 | (0.41) | -0.44 | (0.41) |
| 15 years | -1.43+ | (0.75) | -1.07 | (0.72) | -0.23 | (0.26) | -0.04 | (0.23) | -0.56 | (0.61) | -0.51 | (0.62) | -0.78+ | (0.41) | -0.82+ | (0.42) |
| 16 years | -0.90 | (0.71) | -0.71 | (0.86) | -0.20 | (0.24) | 0.05 | (0.30) | -0.48 | (0.61) | -0.09 | (0.62) | -0.79+ | (0.41) | -0.74+ | (0.43) |
| 17 years | -1.55+ | (0.88) | -0.54 | (0.74) | -0.25 | (0.38) | -0.09 | (0.29) | -0.85 | (0.63) | -0.14 | (0.62) | -0.93\* | (0.44) | -0.50 | (0.43) |
| 18 years | -0.54 | (0.87) | -0.89 | (0.80) | 0.28 | (0.31) | -0.22 | (0.32) | -0.28 | (0.74) | -0.43 | (0.65) | -0.62 | (0.65) | -0.72 | (0.49) |
| 19 years | -1.49+ | (0.88) | -0.39 | (0.97) | -0.45 | (0.38) | 0.01 | (0.44) | -0.49 | (0.68) | 0.02 | (0.77) | -0.54 | (0.50) | -0.40 | (0.58) |
| 20 years | 0.32 | (1.56) | 0.57 | (1.36) | -0.26 | (0.49) | 0.26 | (0.47) | 0.91 | (1.21) | 0.68 | (1.01) | 0.74 | (1.07) | 0.04 | (0.73) |
| 21 years | -0.44 | (1.17) | 0.04 | (1.34) | 0.13 | (0.49) | 0.18 | (0.46) | -0.52 | (0.84) | 0.15 | (1.00) | -0.42 | (0.64) | 0.10 | (0.82) |
| 22 years | -1.24 | (1.27) | -0.15 | (1.34) | -0.56 | (0.51) | -0.49 | (0.55) | -0.32 | (0.91) | 0.66 | (1.01) | -0.18 | (0.69) | 0.53 | (0.84) |
| 23 years | -0.38 | (1.57) | -0.63 | (1.40) | -0.53 | (0.49) | -0.40 | (0.51) | 0.17 | (1.07) | 0.04 | (1.07) | -0.16 | (0.72) | 0.02 | (0.88) |
| *N* | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  |
| F | 2.30 |  | 2.30 |  | 6.22 |  | 6.22 |  | 10.08 |  | 10.08 |  | 8.29 |  | 8.29 |  |
| *Adj.R2* | 0.23 |  | 0.23 |  | 0.39 |  | 0.39 |  | 0.26 |  | 0.26 |  | 0.37 |  | 0.37 |  |

Estimates from the regression of fruit and vegetables portions on age controlling for cohort effects, normalized year effects and total energy intake from food. Models with interaction effects between the age dummies and sex with the corresponding reference category for each model (boys and girls, respectively). SE = HC2 robust standard errors. Data from year 1 to year 4 of the rolling program of the National Diet and Nutrition Survey.

aIncluding fruit juice bExcluding fruit juice \* Significant at the 0.05 level, + Significant at the 0.10 level.

## Change in intake of fruit and vegetable portions across cohorts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Composite dishes |  |  | Not from composite dishes |
|  | Total Fruit and vegetable portions | Vegetable portions | Fruit portionsa | Fruit portionsb | Total Fruit and vegetable portions | Vegetable portions | Fruit portionsa | Fruit portionsb |
|  | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE | β | SE |
| cohort 1 | (base) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| cohort 2 | -0.00 | (0.28) | 0.12 | (0.27) | -0.61+ | (0.32) | -0.52+ | (0.27) | -0.65 | (0.49) | 0.15 | (0.13) | -0.59+ | (0.35) | -0.44+ | (0.24) |
| cohort 3 | -0.33 | (0.35) | -0.03 | (0.24) | -0.75\*\* | (0.23) | -0.54\* | (0.22) | -0.83\* | (0.34) | 0.11 | (0.13) | -0.74\*\* | (0.25) | -0.51\*\* | (0.16) |
| cohort 4 | 0.05 | (0.29) | 0.08 | (0.23) | -0.42+ | (0.23) | -0.48\* | (0.20) | -0.39 | (0.33) | 0.18 | (0.13) | -0.39+ | (0.23) | -0.39\* | (0.17) |
| cohort 5 | 0.04 | (0.39) | 0.04 | (0.26) | -0.58+ | (0.33) | -0.54\* | (0.27) | -0.57 | (0.40) | 0.10 | (0.14) | -0.49 | (0.33) | -0.41+ | (0.23) |
| cohort 6 | -0.29 | (0.47) | 0.22 | (0.26) | -1.10\*\* | (0.39) | -0.80\* | (0.32) | -0.56 | (0.46) | 0.17 | (0.15) | -1.04\* | (0.41) | -0.62\* | (0.29) |
| cohort 7 | -0.20 | (0.48) | 0.06 | (0.28) | -1.00\* | (0.40) | -0.78\* | (0.31) | -0.55 | (0.53) | 0.12 | (0.16) | -0.96\* | (0.41) | -0.79\*\* | (0.27) |
| cohort 8 | -0.13 | (0.58) | 0.09 | (0.29) | -0.78+ | (0.46) | -0.75\* | (0.36) | -0.13 | (0.55) | 0.12 | (0.17) | -0.65 | (0.46) | -0.57 | (0.36) |
| cohort 9 | -0.35 | (0.59) | 0.19 | (0.29) | -1.10\* | (0.44) | -1.01\*\* | (0.35) | -0.58 | (0.57) | 0.11 | (0.17) | -1.04\* | (0.45) | -0.86\* | (0.33) |
| cohort 10 | 0.10 | (0.70) | 0.20 | (0.35) | -1.06\* | (0.49) | -0.92\* | (0.36) | -0.42 | (0.60) | 0.15 | (0.19) | -0.99\* | (0.48) | -0.82\* | (0.34) |
| cohort 11 | -0.10 | (0.67) | 0.29 | (0.34) | -1.15\* | (0.52) | -1.13\*\* | (0.37) | -0.73 | (0.61) | 0.22 | (0.21) | -1.06\* | (0.51) | -0.94\*\* | (0.35) |
| cohort 12 | 0.39 | (0.81) | 0.51 | (0.35) | -1.14+ | (0.62) | -0.93\* | (0.43) | -0.28 | (0.73) | 0.35 | (0.23) | -1.05+ | (0.60) | -0.71+ | (0.41) |
| cohort 13 | 0.06 | (0.77) | 0.41 | (0.40) | -1.30\* | (0.61) | -1.20\*\* | (0.42) | -0.60 | (0.69) | 0.28 | (0.24) | -1.36\* | (0.58) | -0.93\* | (0.40) |
| cohort 14 | 0.29 | (0.79) | 0.41 | (0.38) | -0.90 | (0.62) | -0.80+ | (0.43) | -0.12 | (0.72) | 0.25 | (0.27) | -0.88 | (0.60) | -0.53 | (0.41) |
| cohort 15 | 0.22 | (0.82) | 0.11 | (0.42) | -1.04+ | (0.62) | -0.68 | (0.44) | -0.05 | (0.74) | 0.13 | (0.26) | -0.89 | (0.61) | -0.35 | (0.42) |
| cohort 16 | 0.60 | (0.88) | 0.76 | (0.47) | -1.03 | (0.66) | -0.84+ | (0.47) | -0.17 | (0.77) | 0.39 | (0.28) | -0.91 | (0.64) | -0.50 | (0.45) |
| cohort 17 | 0.34 | (0.93) | 0.29 | (0.49) | -0.89 | (0.67) | -0.67 | (0.49) | -0.27 | (0.83) | 0.35 | (0.33) | -0.92 | (0.66) | -0.40 | (0.47) |
| cohort 18 | 0.15 | (0.95) | 0.32 | (0.49) | -1.11 | (0.70) | -0.84 | (0.53) | -0.33 | (0.85) | 0.30 | (0.34) | -1.03 | (0.67) | -0.54 | (0.50) |
| cohort 19 | 0.97 | (1.00) | 0.92+ | (0.53) | -0.63 | (0.76) | -0.49 | (0.59) | -0.40 | (0.93) | 0.18 | (0.37) | -0.68 | (0.75) | -0.13 | (0.58) |
| cohort 20 | -1.53 | (1.19) | -0.37 | (0.60) | -1.51+ | (0.88) | -1.40+ | (0.71) | -1.04 | (1.07) | 0.17 | (0.40) | -1.45+ | (0.84) | -1.08 | (0.70) |
| cohort 21 | -1.26 | (1.25) | -0.06 | (0.61) | -1.51 | (0.98) | -1.39+ | (0.79) | -0.99 | (1.20) | 0.33 | (0.47) | -1.41 | (0.93) | -1.06 | (0.77) |
| cohort 22 | -0.07 | (1.46) | 0.72 | (0.67) | -1.20 | (1.13) | -1.47+ | (0.82) | -0.50 | (1.43) | 0.79 | (0.52) | -1.31 | (1.04) | -1.16 | (0.81) |
| cohort 23 | -0.60 | (1.44) | 0.14 | (0.81) | -1.38 | (1.02) | -1.46+ | (0.77) | -0.66 | (1.30) | 0.37 | (0.48) | -1.28 | (0.96) | -1.13 | (0.75) |
| cohort 24 | -0.26 | (1.57) | 0.39 | (0.72) | -0.75 | (1.13) | -0.65 | (0.89) | 0.07 | (1.41) | 1.01+ | (0.53) | -0.91 | (1.08) | -0.57 | (0.91) |
| cohort 25 | 0.46 | (1.58) | 1.11 | (0.78) | -1.19 | (1.16) | -1.02 | (0.88) | -1.04 | (1.97) | 0.56 | (0.62) | -1.49 | (1.33) | -1.00 | (0.94) |
| *N* | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  | 175 |  |
| F | 2.30 |  | 6.22 |  | 10.08 |  | 8.29 |  | 3.59 |  | 3.24 |  | 7.59 |  | 21.15 |  |
| r2\_a | 0.23 |  | 0.39 |  | 0.26 |  | 0.37 |  | 0.11 |  | 0.10 |  | 0.28 |  | 0.34 |  |

Estimates from the regression of fruit and vegetables portions on cohorts controlling for age effects, normalized year effects and total energy intake from food. SE = HC2 robust standard errors. Data from year 1 to year 4 of the rolling program of the National Diet and Nutrition Survey. aIncluding fruit juice bExcluding fruit juice \*Significant at the 0.05 level, +Significant at the 0.10 level.

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