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An Estimate of the Number of Vegetarians in the World

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An Estimate of the Number of Vegetarians in the World

Methane is the second-most important anthropogenic greenhouse gas. Ruminant livestock are a major source of emissions. The expansion of pasture is one of the main drivers of deforestation, one of the larger sources of carbon dioxide emissions. An understanding of dietary choice is needed for scenario building and for assessing policy options. This paper focuses on those who eat no meat whatsoever. We estimate that there are one and half billion vegetarians. Only 75 million are vegetarians of choice, a number that will gradually grow with increasing affluence and education. The other 1,450 million are vegetarians of necessity. They will start to eat meat as soon as they can afford it.

The importance of diet and particularly the amount of red meat in diet, for global environmental change has long been acknowledged *(1)*. Pasture land has expanded by 10% between 1961 and 2005 *(2)*. Meat consumption has increased by 250% between 1960 and 2002 *(2)*. The world population has doubled in that time *(2)*, so that average meat consumption per head has grown by three-quarters.

There has been intense study of diets *(3-7)*. It is well-established that the very poor have a limited intake of animal protein *(8)*. Meat consumption, whether measured in calories *(9)* or expenditures *(10)*, initially goes up as people grow richer. Meat consumption levels off at higher incomes, first when measured in calories and later when measured in expenditures, as consumers become satiated. At middle and high income levels, excessive meat consumption is a health concern *(11-15)*. Given the importance of diet, it is surprising that the global number of vegetarians has not been estimated. Research has focussed on average diets and expenditures and on identifying those with unhealthy eating habits, but no one has counted those that do not eat meat.

Anecdotally, vegetarianism is an increasingly popular life style choice for those concerned about animal welfare, poverty, health, and the environment. There is limited scope for reducing methane from ruminants by technical measures *(16)*. With present technologies, deep emission reduction cuts require a smaller size of the herd, and this

implies a change in diet. An understanding of the trends in the number of vegetarians provides insight into the (in)feasibility of curbing methane emissions from livestock.

We count the number of vegetarians in the following manner. See Methods and Materials for further detail. We use surveys of households' budgets, expenditures, and living standards for 29 countries, which together represent some 54% of the world population. We have surveys covering more than one year for many of these countries, so that we have a total of 139 samples. The average sample size is 5,000. Our database thus contains almost 700,000 observations. The surveys typically record purchases, gifts and subsistence production of food per item over a two week period. We excluded those households that acquired an unusually small amount of food (compared to their peer group) in the sample period. This is particularly prevalent in the USA, where many households appear to buy groceries less than once per fortnight. Given this data, the number of households that do not consume any meat is easily identified. We refer to these as all-vegetarian households.

There are mixed households as well. Using the consumption patterns of one-person households and the estimated economies-of-scale of food consumption, we conditionally predict the share of meat in total food consumption for multi-person households given the number of vegetarians. We then use the observed meat share to test the hypotheses that there are one, two, … vegetarians in the household. We impute the number of vegetarians from the first rejection. That is, if the hypothesis is rejected that there is (are) one (two, three) vegetarian(s), we impute zero (one, two) vegetarians.

In sample, we find that 18% of people are vegetarian. This amounts to 680 million people in the countries for which we have observations. See Table 1. Figure 1 displays the share of vegetarians and all-vegetarian households against per capita income (corrected for purchasing power). Figure 1 also shows the best quadratic fit. As expected, there are more vegetarians in low income countries. More strikingly, there is enormous variation. In Vietnam, more than 99% of the population eats meat, while in East Timor less than half does. The fraction of vegetarians rapidly falls until average income reaches $15,000 per person per year.

There are no obvious patterns in the data for low income countries. For instance, more than 80% of the people in India and Nepal are Hindu; 34% of Indians are vegetarian, and 7.4% of Nepalis. Local availability of meat, and the relative price of meat most likely play a role in explaining the differences between countries, but reliable data is not readily available.

At higher incomes, the differences between countries are less pronounced. The fraction of vegetarians slightly increases with income. Figure 2 illustrates this for the United Kingdom, the country for which data are best. In the 1960s, less than 0.5% of the population was a vegetarian. Forty years later, more than 2.0% is.

Figure 3 "validates" our results. As noted above, this is the first estimate of the number of vegetarians using a consistent methodology for a number of countries. However, there are estimates of the number of vegetarians for individual countries. Figure 3 plots our results against such estimates. The results presented here are consistent with earlier estimates, but the match is not perfect.

As a further check on our data and methods, we computed the fraction of households that do not consume any animal products ("vegans") and those that do not consume either fish or meat ("strict vegetarians"). Figure 4 compares these numbers to the fraction of households that do not consume meat ("vegetarians"). Figure 4 reveals the pattern one would expect: There are fewer vegans than there are strict vegetarians. In turn, there are fewer strict vegetarians than there are vegetarians. This is true in general and for every single country/year in the sample.

Using the quadratic curve in Table 1, we tentatively extrapolate the estimate of the number of vegetarians to the whole world. This rough method suggests that 22% of the world population is a vegetarian. This amounts to one and a half billion people. Of these, 95% lie on the downward sloping part of the curve. We deem these to be vegetarians of necessity. Only 5% are on the upward sloping part of the curve. These we call vegetarians of choice.

The implications of these numbers are profound. As the current poor grow to middle income levels, many more of them will start to eat meat. As the current rich grow richer still, more will become vegetarian. The latter process is much slower, and starts from a

lower base. In the medium term, therefore, one should expect a dramatic drop in the number of vegetarians. Methane emissions will continue to rise and forests will be converted to pasture. Only in the longer term, when affluence becomes more widespread, can we expect these trends to level off.

Table 1: Global number of vegetarians

	Number of countries	Number of people (mln)	Number of vegetarians (mln)	Share of vegetarians
In sample	28	3,707	678	18.3%
Out of sample	176	3,145	813	25.8%
Total	204	6,851	1,490	21.8%

Figure 1. Vegetarianism and income per capita (gross domestic product per person per year in Geary-Khamis dollars)
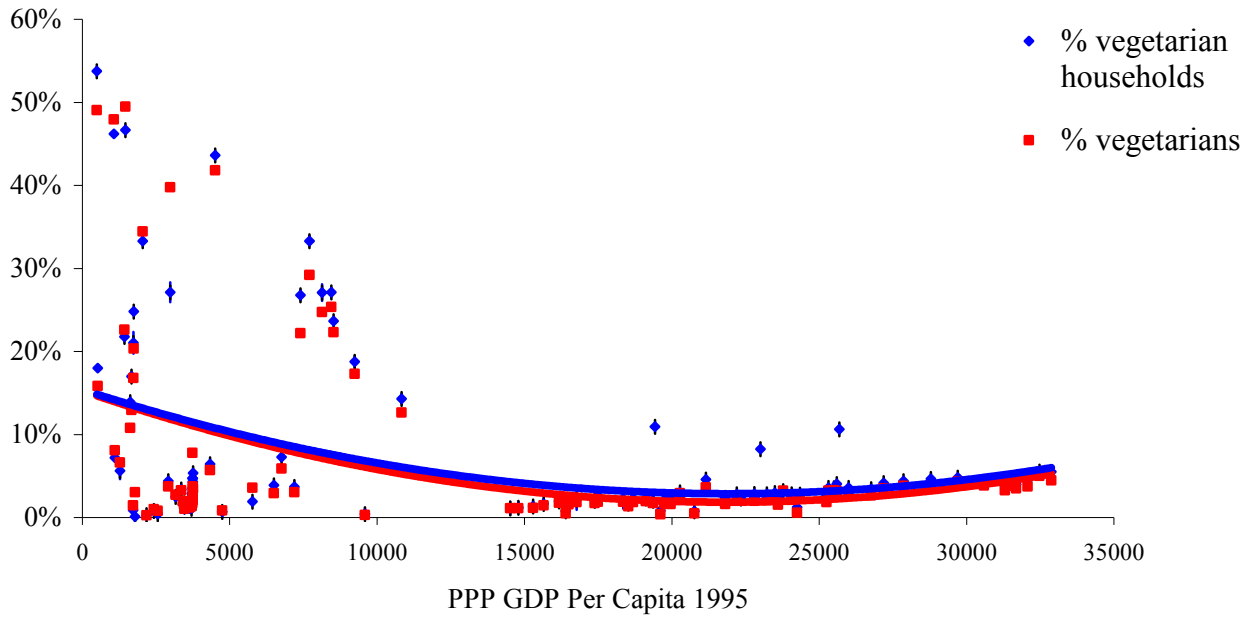
Figure 2. Vegetarianism over time in the United Kingdom
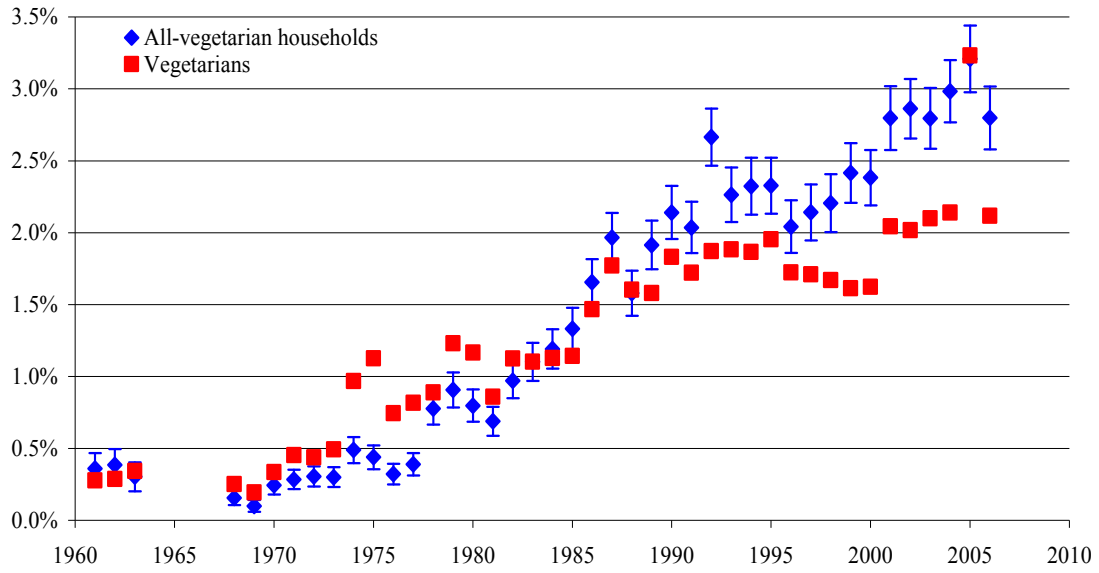
Figure 3. The fraction of vegetarians in the population as estimated here versus earlier estimates
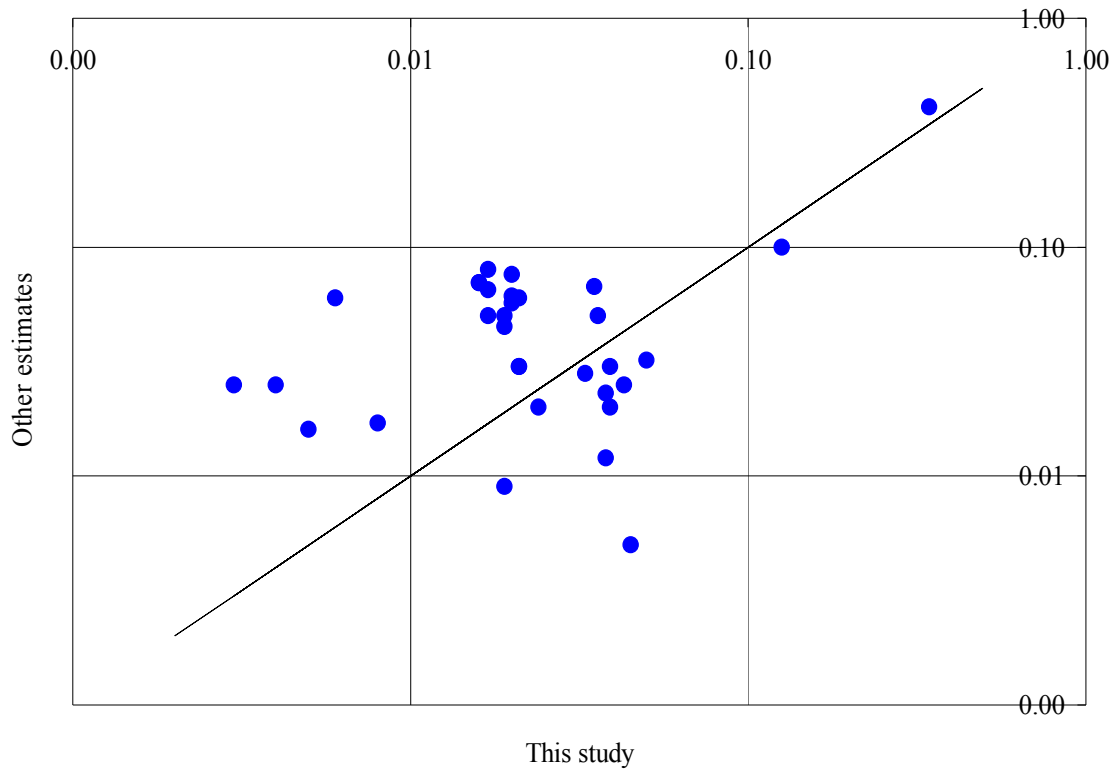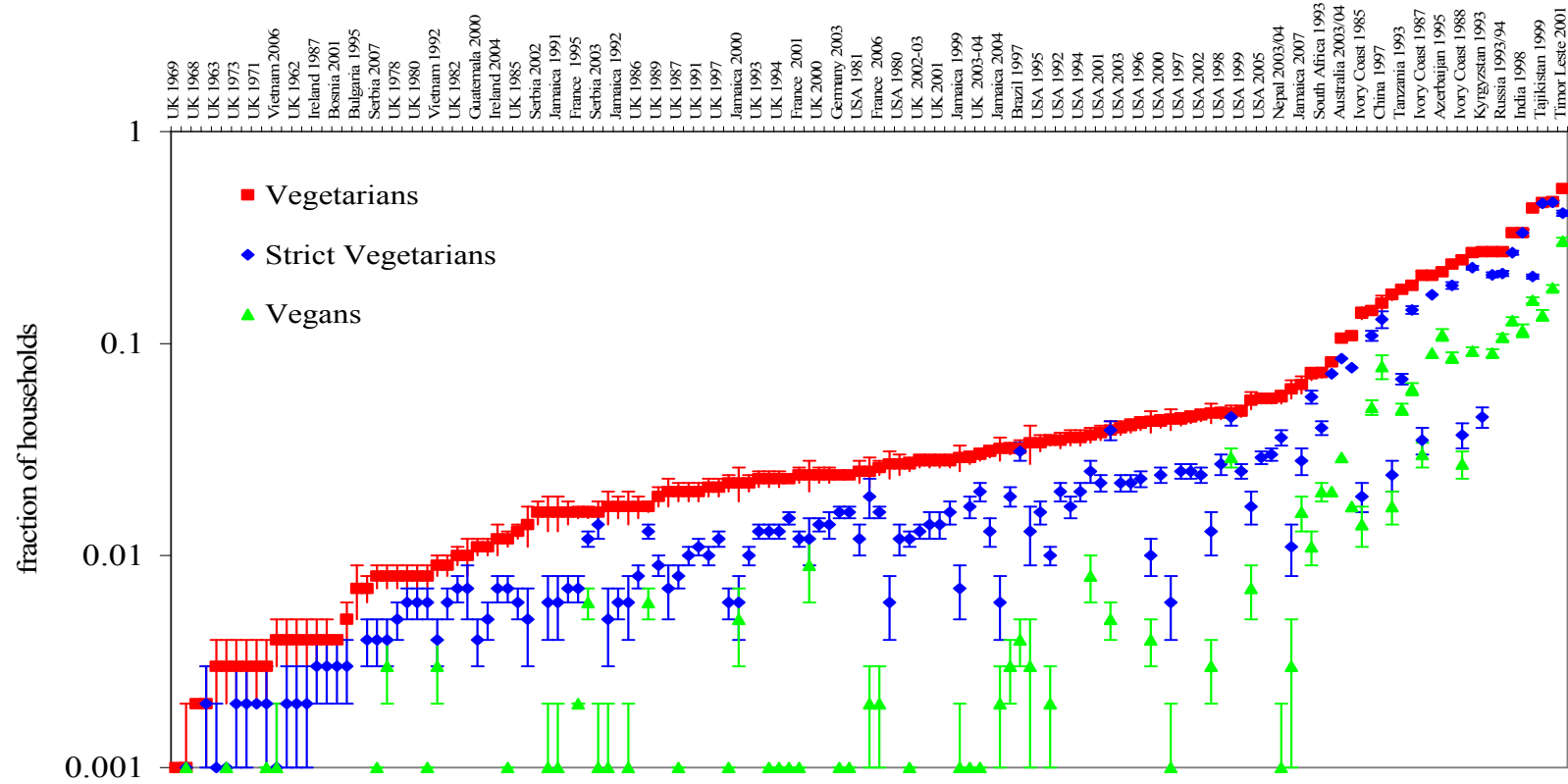
Figure 4. Share of vegetarian, strict vegetarian and vegan households by country

Materials and Methods

Data

Household expenditure surveys provide a detailed account of all of the expenditures incurred by a large sample of individual households over a specified time period. Household expenditure surveys have a similar structure across countries. Often, these datasets also provide information on household income and other socio-economic variables. Most of the datasets used in this paper are from the Living Standard Measurement Studies (LSMS), which are available from the World Bank website (*17*). We used these data to estimate levels of vegetarianism in Albania, Azerbaijan, Bosnia and Herzegovina, Brazil, Bulgaria, China, Guatemala, India, Ivory Coast, Kosovo, Kyrgyzstan, Papua New Guinea, Peru, Serbia, South Africa, Tajikistan, Tanzania and Timor Leste. The remaining data were obtained from statistical offices in individual countries. Data for the U.S.A (*18*), Russia (*19*), Nepal (*20*), Ireland (*21*), Vietnam (*22*), France (*23*), the UK (*24, 25*) and Jamaica (*26*) were obtained in this manner. We did not have direct access to the microdata for Singapore (*27*), Germany (*28*) or Australia (*29*) but the analyses we required (for households) were carried out by the relevant statistical offices to our specifications. In the case of Singapore, analyses were carried out on uncooked meat items only.

Where available, we used data on all meat consumed in the household, be it from purchases, home production, gifts or in-kind payments. For other countries, only data on meat expenditures were available. Table A1 indicates which measure was used in each case. Where possible we used household disposable income. However, on some occasions, net or gross income had to be used. Where available, the value of income received in kind was included in the income variable. For some countries, income was not available or was inconsistent with reported levels of expenditure. In such instances, total household expenditure was used as a proxy for income. Table A1 specifies which income measure was used. In almost all cases the total household food consumption variable was composed of all food bought for home consumption by the household. Food purchases which occurred while eating out, in cafes and restaurants for example, were excluded because we were not able to determine what proportion of this consumption

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related to meat products. Purchases of alcohol, cigarettes and tobacco were also excluded but non-alcoholic beverages were included.

Infrequency of purchase

Expenditures are normally recorded in a diary for a specified period. For surveys with a short diary period, individual households' responses may not always reflect their "normal" purchasing patterns with respect to individual goods or categories of goods. We filter the data to exclude observations where infrequency of purchase is likely to have led to an unrepresentative expenditure pattern in the period surveyed. That is, we exclude from the analysis all those households that appeared to have not purchased enough food, relative to income and household size in the defined period. We do this by estimating food share *F,* which is the share of food consumption (or expenditure) as a percentage of income (or total expenditure) for every household in the sample:

$$(1) \quad F_j = \frac{C_j \big/ N_j^d}{Y_j^q}$$

where *C* denotes total food consumption of household *j*; *N* number of people in household *j* (raised to the power *d*); and *Y* income of household *j* (raised to the power *q*). We thus control for the number of people in the household as well as for economies of scale in household consumption through the equivalization factor *d*. Income is also equivalized using the elasticity *q*. The income elasticity for food varies between 0.2 and 0.4 for the countries in the sample; small changes in *q* have little impact on results. So, we set $q = 0.3$. We then find the mean and the standard deviation of food share *F* for each income decile in each country. Any household whose food share is less than the average minus the standard deviation for the relevant income decile is omitted from the analysis.

There is another adjustment required for United States data. The Consumer Expenditure Survey (CES), which is the microdata we use for the USA, is carried out on an annual basis and asks respondents to list all food items purchased over a weekly period. The majority of households stay in the sample for two weeks. We found that the number of zero observations on food expenditures was much higher in the CES than was the case for other countries. We have 19 years of cross sectional data and this pattern appeared

throughout. As a result, we applied another measure to identify those households that did not shop frequently enough for us to include them in the analysis. One of the CES data files had already amalgamated food products into different categories. We further reduced the number of categories to leave nine food groups in total. These are cereal and bakery products, meat products, fish products, eggs, milk and dairy products, processed fruit and vegetables, fresh fruit and vegetables, sweets, non-alcoholic beverages and miscellaneous food and oils. If households reported zero expenditures in six or more of these food groups we omitted them. We also omitted those households that reported expenditures for one week only. The remaining samples for the USA consisted of 5,122 households per annum on average.

Mixed households

Where there are two or more residents and the household reports some level of meat consumption, we estimate the probabilities that there are different numbers of vegetarians in that household. We refer to these as mixed households because they can contain both vegetarians and meat eaters. Since the expenditure data we are using is recorded on a household rather than on an individual basis, we derive expected meat and non-meat consumption based on equivalised income and number of members for all possible combinations of vegetarians and non-vegetarians in the household. The predicted share of meat in total food consumption, conditional on the household structure, is then compared to the observed meat share. We then sequentially test the hypotheses that there are 0, 1, 2, … vegetarians; and impute the lowest number that is not rejected.

Divide total food expenditure C_i for person i into three components: consumption of non-meat items if the person is a vegetarian C^{vv}, consumption of non-meat items if the person is a meat-eater C^{vm}, and consumption of meat items if the person eats meat C^{mm}:

(2) $C_i \equiv C_i^{vv} + C_i^{vm} + C_i^{mm}$

Segment the population into two types, vegetarian ($v_i=1$) and non-vegetarian ($v_i=0$). Now assume that all persons of a given type (vegetarian or non-vegetarian) have homogeneous demand for each component of food. Food demand is a fixed sum per person scaled by the level of household income per capita, using an equivalisation factor

that accounts for economies of scale in household consumption. This specifies the following:

(3a) $\quad C_i^{vv} = W_i \left(\dfrac{Y_j}{N_j^d} \right)^q \quad i \in j$

(3b) $\quad C_i^{vm} = V_i \left(\dfrac{Y_j}{N_j^d} \right)^r \quad i \in j$

(3c) $\quad C_i^{mm} = M_i \left(\dfrac{Y_j}{N_j^d} \right)^s \quad i \in j$

where Y is household disposable income of household j and q, r and s are the elasticities of demand with respect to equivalised income for the relevant food types. N is the number of persons in the household and $0 < d \leq 1$ is the equivalisation factor. W, V and M are per capita expenditures on the relevant food types by those who consume them.

By restricting the sample of households examined, we can obtain regression equations that allow us to recover the values of the structural parameters d, q, r, s, W, X and Y.

First consider single-person vegetarian households, which would allow one to estimate W and q:

(4a) $\quad C_i^T = W_i Y_j^q \quad \forall \; v_i = 1, \; N_j = 1$

Taking logs of both sides yields an equation that can be estimated with OLS regression:

(4b) $\quad \ln C_i^T = \ln W_i + q \ln Y_j \quad \forall \; v_i = 1, \; N_j = 1$

One can get more general results of these parameters (plus an estimate of d) using data on vegetarian households of all sizes:

(5a) $\quad C_i^T = N_j^d W_i \left(\dfrac{Y_j}{N_j^d} \right)^q \quad \Leftrightarrow \quad \ln C_i^T = \ln W_i + q \ln Y_j + d(1-q) \ln N_j \quad \forall \; v_i = 1, \; N_j \geq 1$

Equation (5a) is estimated as

(5b) $\quad \ln C_i^T = a + q \ln Y_j + b \ln N_j \Rightarrow \ln W_i = \hat{a}; \hat{d} = \dfrac{\hat{b}}{1 - \hat{q}}$

The standard deviation of d is estimated by developing the first order Taylor approximation around the estimated parameter

(6)
$$d = \frac{b}{1-q} \approx \frac{\hat{b}}{1-\hat{q}} + \frac{1}{1-\hat{q}}(b-\hat{b}) + \frac{\hat{b}}{(1-\hat{q})^2}(q-\hat{q})$$

and computing the variance of that

(7)
$$\sigma_d^2 \approx \iint_{b,q} \left[\frac{\hat{b}}{1-\hat{q}} + \frac{1}{1-\hat{q}}(b-\hat{b}) + \frac{\hat{b}}{(1-\hat{q})^2}(q-\hat{q}) - \frac{\hat{b}}{1-\hat{q}} \right]^2 f(b,q) \mathrm{d}b \mathrm{d}q$$
$$= \frac{1}{(1-\hat{q})^2} \sigma_b^2 + \frac{\hat{b}^2}{(1-\hat{q})^4} \sigma_q^2 + \frac{2\hat{b}}{(1-\hat{q})^3} \sigma_{bq}$$

The estimates of r, s, V and M are based on data on single person meat-eating households:

(8) $\quad C_i^{vm} = V_i Y_j^r \Leftrightarrow \ln C_i^{vm} = \ln V_i + r \ln Y_j \ \forall \ v_i = 0, \ N_j = 1$

(9) $\quad C_i^{mm} = M_i Y_j^s \Leftrightarrow \ln C_i^{mm} = \ln M_i + s \ln Y_j \ \forall \ v_i = 0, \ N_j = 1$

Our goal is to estimate the number of vegetarians in a given household. For households that do not buy meat, we declare all members to be vegetarian: $v_i = 1$. For single-person household, there is therefore no uncertainty. For multi-person households, we proceed as follows. We predict the expected share of meat in total food consumption S, conditional on the hypothesized number of vegetarians in the household:

(10a) $\quad \mathrm{E}\left[S_j \mid N_j^V\right] = \dfrac{N_j^M \hat{C}_i^{mm}}{N_j^M \left(\hat{C}_i^{mm} + \hat{C}_i^{vm}\right) + N_j^V \hat{C}_i^{vv}}$

with

(10b) $\quad N_j^V := \sum_{i \in j} v_i; N_j^M := N_j - N_j^V$

Using the standard errors of the regressions (4), (8) and (9) and a second-order Taylor approximation of (10), we find that

(11)
$$\mathrm{Var}\left[S_j \mid N_j^V\right] = \frac{N_j^M \hat{C}_i^{vm} + N_j^V \hat{C}_i^{vv} - N_j^M \hat{C}_i^{mm}}{\left(N_j^M \left(\hat{C}_i^{mm} + \hat{C}_i^{vm}\right) + N_j^M \hat{C}_i^{vv}\right)^3} N_j^{M^2} \sigma_{mm}^2 +$$
$$\frac{N_j^{M^2} \hat{C}_i^{mm}}{\left(N_j^M \left(\hat{C}_i^{mm} + \hat{C}_i^{vm}\right) + N_j^V \hat{C}_i^{vv}\right)^4} \left(N_j^{M^2} \left(\sigma_{mm}^2 + \sigma_{vm}^2\right) + N_j^{V^2} \sigma_{vv}^2\right)$$

Assuming a lognormal distribution, we compute the relative probabilities of the hypotheses N^V=0, 1, …, N_j-1. We then impute the number of vegetarians $\tilde{N}$ as the smallest $\tilde{N}$ for which $p(\tilde{N}^V > N^V) \geq 0.95$.

Aggregation

The number of households in the sample that report no meat consumption or purchase, is readily estimated. Sample weights are used where available to estimate the fraction of all-vegetarian households. We estimate the total number of vegetarians in a country as the number of vegetarians in each household in our sample, again applying a weight for representativeness where appropriate. For households that report no meat consumption, the number of vegetarians is equal to the number of household members.

Table A1: Share of vegetarians and vegetarian households by country

Country	Year	% vegetarian households	Std. Error vegetarian households	Households	Weight	% vegetarians	Number of people	Household income measure	Consumption measure	Data
Albania	2005	0.047	0.004	3275	✓	0.078	13734	Net income	expenditure	LSMS
Azerbaijan	1995	0.218	0.010	1864	✓	0.226	9281	Total declared income	consumption	LSMS
Brazil	1997	0.019	0.003	2838	✓	0.036	11917	Net income	expenditure	LSMS
Bulgaria	2003	0.037	0.003	3012	✗	0.031	8152	Total declared income	consumption	LSMS
Bulgaria	2001	0.039	0.004	2359	✗	0.029	6618	Total expenditure	consumption	LSMS
Bulgaria	1995	0.007	0.002	2264	✗	0.008	6448	Total expenditure	consumption	LSMS
France	2006	0.026	0.002	8970	✓	0.019	21891	Net income	expenditure	EBF
France	2001	0.024	0.002	8956	✓	0.015	22265	Gross income	expenditure	EBF
France	1995	0.016	0.001	9099	✓	0.009	23462	Total expenditure	consumption	EBF
France	1985	0.017	0.001	9814	✓	0.014	32251	Gross income	expenditure	EBF
France	1979	0.016	0.001	9406	✓	0.010	28413	Total expenditure	expenditure	EBF
Guatemala	2000	0.011	0.001	6078	✓	0.014	31155	Gross income	expenditure	LSMS
India	1998	0.333	0.012	1527	✓	0.344	9903	Total declared income	consumption	LSMS
Ireland	2004	0.012	0.002	5266	✓	0.006	15934	Disposable income	consumption	HBS
Ireland	1999	0.008	0.001	6700	✓	0.004	20918	Disposable income	consumption	HBS
Ireland	1994	0.008	0.001	6958	✓	0.005	22311	Disposable income	consumption	HBS
Ireland	1987	0.004	0.001	6909	✓	0.003	24161	Disposable income	consumption	HBS
Ivory Coast	1988	0.248	0.011	1523	✓	0.203	9266	Total declared income	consumption	LSMS
Ivory Coast	1987	0.210	0.010	1560	✓	0.168	10666	Total declared income	consumption	LSMS
Ivory Coast	1986	0.170	0.010	1546	✓	0.130	11803	Total declared income	consumption	LSMS
Ivory Coast	1985	0.139	0.009	1522	✓	0.108	12124	Total declared	consumption	LSMS

Country	Year	% vegetarian households	Std. Error vegetarian households	Households	Weight	% vegetarians	Number of people	Household income measure	Consumption measure	Data
								income		
Jamaica	2007	0.064	0.006	1783	✓	0.057	5787	Total expenditure	expenditure	JSLC
Jamaica	2006	0.054	0.005	1678	✓	0.035	5268	Total expenditure	expenditure	JSLC
Jamaica	2005	0.047	0.005	1698	✓	0.025	5679	Total expenditure	expenditure	JSLC
Jamaica	2004	0.032	0.004	1755	✓	0.021	6020	Total expenditure	expenditure	JSLC
Jamaica	2003	0.043	0.005	1781	✓	0.037	5930	Total expenditure	expenditure	JSLC
Jamaica	2002	0.035	0.002	6165	✓	0.021	20847	Total expenditure	consumption	JSLC
Jamaica	2001	0.027	0.004	1436	✓	0.017	4727	Total expenditure	consumption	JSLC
Jamaica	2000	0.022	0.004	1570	✓	0.016	5447	Total expenditure	consumption	JSLC
Jamaica	1999	0.029	0.004	1633	✓	0.015	5480	Total expenditure	consumption	JSLC
Jamaica	1998	0.022	0.002	6461	✓	0.014	22409	Total expenditure	consumption	JSLC
Jamaica	1997	0.020	0.003	1743	✓	0.017	6086	Total expenditure	consumption	JSLC
Jamaica	1996	0.017	0.003	1608	✓	0.016	5867	Total expenditure	consumption	JSLC
Jamaica	1995	0.016	0.003	1715	✓	0.012	6191	Total expenditure	consumption	JSLC
Jamaica	1994	0.017	0.003	1708	✓	0.017	5815	Total expenditure	consumption	JSLC
Jamaica	1993	0.014	0.003	1710	✓	0.010	6058	Total expenditure	consumption	JSLC
Jamaica	1992	0.017	0.002	3843	✓	0.016	13679	Total expenditure	consumption	JSLC
Jamaica	1991	0.016	0.003	1576	✓	0.020	5813	Total expenditure	consumption	JSLC
Jamaica	1990	0.034	0.007	703	✓	0.033	2468	Total expenditure	consumption	JSLC
Jamaica	1989	0.025	0.004	1256	✓	0.027	5381	Total expenditure	consumption	JSLC
Jamaica	1988	0.044	0.005	1648	✓	0.037	6225	Total expenditure	consumption	LSMS
Kosovo	2000	0.061	0.006	1373	✓	0.062	8975	Total declared income	consumption	LSMS
Kyrgyzstan	1993	0.271	0.010	1894	✗	0.398	9338	Total declared income	consumption	LSMS
Nepal	2003/04	0.056	0.004	3431	✓	0.066	18174	Total expenditure	expenditure	NLSS
Nepal	1996	0.072	0.005	3014	✓	0.081	17095	Total expenditure	consumption	NLSS
Peru	1985	0.436	0.007	4615	✗	0.418	23470	Total expenditure	consumption	LSMS
Russia	2002	0.143	0.006	2962	✓	0.126	10908	Gross income	expenditure	RLMS
Russia	2001	0.188	0.007	2950	✓	0.173	10504	Gross income	expenditure	RLMS
Russia	2000	0.237	0.008	2843	✓	0.223	9526	Gross income	expenditure	RLMS
Russia	1993/94	0.271	0.006	5224	✗	0.254	13422	Gross income	expenditure	RLMS

Country	Year	% vegetarian households	Std. Error vegetarian households	Households	Weight	% vegetarians	Number of people	Household income measure	Consumption measure	Data
Russia	1993	0.271	0.006	5388	✘	0.247	14260	Gross income	expenditure	RLMS
Russia	1992/93	0.333	0.006	5296	✘	0.292	14556	Gross income	expenditure	RLMS
Russia	1992	0.268	0.006	5946	✘	0.222	15985	Gross income	expenditure	RLMS
Serbia	2007	0.008	0.001	4708	✓	0.004	14657	Net income	consumption	LSMS
Serbia	2002	0.016	0.002	5956	✓	0.010	17914	Net income	consumption	LSMS
South Africa	1993	0.073	0.004	4776	✓	0.059	20517	Net income	consumption	LSMS
Tajikistan	2003	0.467	0.008	3620	✓	0.495	21915	Total declared income	consumption	LSMS
Tajikistan	1999	0.462	0.012	1818	✘	0.480	12265	Total declared income	expenditure	LSMS
Tanzania	1993	0.180	0.006	4844	✓	0.159	26705	Total declared income	consumption	LSMS
Timor Leste	2001	0.538	0.012	1596	✓	0.491	7699	Total expenditure	consumption	LSMS
UK	2006	0.028	0.002	5713	✓	0.021	13547	Disposable income	expenditure	EFS
UK	2005-06	0.028	0.002	5889	✓	0.024	13859	Disposable income	expenditure	EFS
UK	2004-05	0.032	0.002	5759	✓	0.032	13518	Disposable income	expenditure	EFS
UK	2003-04	0.030	0.002	6152	✓	0.021	14628	Disposable income	expenditure	EFS
UK	2002-03	0.028	0.002	6037	✓	0.021	14293	Disposable income	expenditure	EFS
UK	2001-02	0.029	0.002	6520	✓	0.020	15661	Disposable income	expenditure	EFS
UK	2001	0.028	0.002	5537	✓	0.020	12868	Disposable income	expenditure	FES
UK	2000	0.024	0.002	6225	✓	0.016	14589	Disposable income	expenditure	FES
UK	1999	0.024	0.002	5469	✓	0.016	12888	Disposable income	expenditure	FES
UK	1998	0.022	0.002	5315	✓	0.017	12461	Disposable	expenditure	FES

Country	Year	% vegetarian households	Std. Error vegetarian households	Households	Weight	% vegetarians	Number of people	Household income measure	Consumption measure	Data
UK	1997	0.021	0.002	5537	✓	0.017	13515	Disposable income	expenditure	FES
UK	1996	0.020	0.002	5973	✗	0.017	14560	Disposable income	expenditure	FES
UK	1995	0.023	0.002	6018	✗	0.020	14529	Disposable income	expenditure	FES
UK	1994	0.023	0.002	5811	✗	0.019	13881	Disposable income	expenditure	FES
UK	1993	0.023	0.002	6143	✗	0.019	15180	Disposable income	expenditure	FES
UK	1992	0.027	0.002	6569	✗	0.019	15916	Disposable income	expenditure	FES
UK	1991	0.020	0.002	6237	✗	0.017	15041	Disposable income	expenditure	FES
UK	1990	0.021	0.002	6167	✗	0.018	15226	Disposable income	expenditure	FES
UK	1989	0.019	0.002	6583	✗	0.016	16399	Disposable income	expenditure	FES
UK	1988	0.016	0.002	6331	✗	0.016	15897	Disposable income	expenditure	FES
UK	1987	0.020	0.002	6463	✗	0.018	16420	Disposable income	expenditure	FES
UK	1986	0.017	0.002	6399	✗	0.015	16348	Disposable income	expenditure	FES
UK	1985	0.013	0.001	6155	✗	0.011	15853	Disposable income	expenditure	FES
UK	1984	0.012	0.001	6294	✗	0.011	16385	Disposable income	expenditure	FES
UK	1983	0.011	0.001	6171	✗	0.011	16414	Disposable income	expenditure	FES
UK	1982	0.010	0.001	6491	✗	0.011	17435	Disposable income	expenditure	FES
UK	1981	0.007	0.001	6680	✗	0.009	18172	Net income	expenditure	FES

Country	Year	% vegetarian households	Std. Error vegetarian households	Households	Weight	% vegetarians	Number of people	Household income measure	Consumption measure	Data
UK	1980	0.008	0.001	6141	✗	0.012	16706	Net income	expenditure	FES
UK	1979	0.009	0.001	6068	✗	0.012	16494	Net income	expenditure	FES
UK	1978	0.008	0.001	6182	✗	0.009	16886	Net income	expenditure	FES
UK	1977	0.004	0.001	6428	✗	0.008	17890	Net income	expenditure	FES
UK	1976	0.003	0.001	6205	✗	0.007	16909	Net income	expenditure	FES
UK	1975	0.004	0.001	6373	✗	0.011	17936	Net income	expenditure	FES
UK	1974	0.005	0.001	5935	✗	0.010	16827	Net income	expenditure	FES
UK	1973	0.003	0.001	6320	✗	0.005	17806	Net income	expenditure	FES
UK	1972	0.003	0.001	6231	✗	0.004	18034	Net income	expenditure	FES
UK	1971	0.003	0.001	6328	✗	0.005	18109	Net income	expenditure	FES
UK	1970	0.002	0.001	5731	✗	0.003	16642	Net income	expenditure	FES
UK	1969	0.001	0.000	5995	✗	0.002	17019	Net income	expenditure	FES
UK	1968	0.002	0.000	6408	✗	0.003	18746	Net income	expenditure	FES
UK	1963	0.003	0.001	2972	✗	0.003	8710	Total expenditure	expenditure	FES
UK	1962	0.004	0.001	3114	✗	0.003	9040	Total expenditure	expenditure	FES
UK	1961	0.004	0.001	3057	✗	0.003	9027	Total expenditure	expenditure	FES
USA	2006	0.055	0.003	5098	✓	0.045	14610	Net income	expenditure	CES
USA	2005	0.055	0.003	6151	✓	0.050	17758	Net income	expenditure	CES
USA	2004	0.045	0.003	5941	✓	0.038	17043	Net income	expenditure	CES
USA	2003	0.040	0.003	4152	✓	0.035	11762	Net income	expenditure	CES
USA	2002	0.046	0.003	5424	✓	0.038	15678	Net income	expenditure	CES
USA	2001	0.038	0.003	5496	✓	0.033	15942	Net income	expenditure	CES
USA	2000	0.043	0.003	5357	✓	0.039	15608	Net income	expenditure	CES
USA	1999	0.048	0.003	5260	✓	0.043	15193	Net income	expenditure	CES
USA	1998	0.047	0.003	4155	✓	0.039	11994	Net income	expenditure	CES
USA	1997	0.044	0.003	4100	✓	0.038	11952	Net income	expenditure	CES
USA	1996	0.042	0.003	4061	✓	0.035	11764	Net income	expenditure	CES
USA	1995	0.034	0.003	3875	✓	0.026	11260	Net income	expenditure	CES
USA	1994	0.036	0.003	4251	✓	0.028	12374	Net income	expenditure	CES
USA	1993	0.041	0.003	4764	✓	0.032	13738	Net income	expenditure	CES
USA	1992	0.035	0.003	4745	✓	0.033	13814	Net income	expenditure	CES

Country	Year	% vegetarian households	Std. Error vegetarian households	Households	Weight	% vegetarians	Number of people	Household income measure	Consumption measure	Data
USA	1991	0.036	0.003	5112	✓	0.032	14969	Net income	expenditure	CES
USA	1990	0.031	0.002	4830	✓	0.029	14159	Net income	expenditure	CES
USA	1981	0.025	0.003	3794	✗	0.024	11687	Gross income	expenditure	CES
USA	1980	0.027	0.003	4002	✗	0.024	12428	Gross income	expenditure	CES
Vietnam	2006	0.004	0.001	2620	✓	0.008	34006	Total expenditure	consumption	VHLSS
Vietnam	2004	0.008	0.001	8268	✓	0.010	32180	Total expenditure	consumption	VHLSS
Vietnam	2002	0.003	0.000	26589	✓	0.003	113557	Total expenditure	consumption	VHLSS
Vietnam	1998	0.001	0.000	4989	✓	0.030	24192	Total expenditure	consumption	VHLSS
Vietnam	1992	0.009	0.001	4331	✗	0.015	20503	Total expenditure	consumption	VHLSS
Australia	2003/04	0.106	0.001	6957	✓	na	na	na	expenditure	AHES
Australia	1998/99	0.082	0.000	6893	✓	na	na	na	expenditure	AHES
Australia	1993/94	0.109	na	8,389	✓	na	na	na	expenditure	AHES
Bosnia	2004	0.010	0.002	2959	✗	na	na	na	consumption	LSMS
Bosnia	2001	0.004	0.000	5335	✓	na	na	na	consumption	LSMS
China	1997	0.155	0.013	787	✗	na	na	na	expenditure	LSMS
Germany	2003	0.024	0.001	11831	✓	na	na	na	expenditure	EVS
Germany	1998	0.024	0.001	12680	✓	na	na	na	expenditure	EVS
Germany	1993	0.023	0.001	15825	✓	na	na	na	expenditure	EVS
Papua New Guinea	1996	0.024	0.004	1336	✗	na	na	na	consumption	LSMS
Serbia	2003	0.016	0.002	2548	✓	na	na	na	consumption	LSMS
Singapore	2003	0.210	na	6749	✓	na	na	na	expenditure	SHES

Table A2. The share of vegetarians according to this and other studies.

Country	Year	This study	Other studies	Remarks and source
Brazil	1997	3.6%	5%	(Brazilian Vegetarian Society, 2004)
France	2006	1.9%	1.7%	15-75 year olds (Alliance Végétarienne, 1996, 2002)
France	2001	1.5%	0.9%	(International Vegetarian Union)
India	1998	34.4%	40%	(Hindu -CNN-IBN State of the Nation Survey, 2006)
India			42%	Households (National Sample Survey consumption data, 2005-06)
India			20-30%	(United States Department of Agriculture, 2004)
Ireland	2004	0.6%	6%	(Vegetarian Society of Ireland)
Ireland	1999	0.4%	>2.5%	(Irish Times, Oct 8 2004)
Ireland	1994	0.5%	1.6%	(Foley in Hotel and Catering Review, 1998)
Ireland	1987	0.3%	2-3%	(Corbett in The Irish Vegetarian, 1997)
Russia	2002	12.6%	>10%	(Euroasian Vegetarian Society, 2002)
UK	2006	2.1%	3%	Adults (Food Standards Agency, 2009)
UK	2005-06	2.4%	2%	Adults (Food Standards Agency, 2008)
UK	2004-05	3.2%	3%	(Defra survey of attitudes, knowledge and behaviour in relation to the environment, 2007)
UK	2003-04	2.1%	3%	Adults (Food Standards Agency, 2007)
UK	2002-03	2.1%	6%	(Mintel, 2006)
UK	2001-02	2.0%	6.1%	(International Vegetarian Union)
UK	2001	2.0%	7.6%	>15 years of age (BMBR Access Panel Research, 2004)
UK	2000	1.6%	7%	(Vegetarian Society)
UK	1999	1.6%	7%	Adults (Food and Drink Federation, 2003)
UK	1998	1.7%	8%	Students (JMA Marketing & Research Survey for Scolarest, 2003)
UK	1997	1.7%	5%	>19 years of age (National Diet and Nutrition Survey, 2001)
UK	1996	1.7%	6.5%	(TGI Annual Survey, 2001)
UK	1995	2.0%	5.7%	(Mintel, 2001)
UK	1994	1.9%	5%	Adults (Taylor Nelson poll for RSPCA, 2000)
UK	1993	1.9%	4.5%	(Mintel, 1996)
USA	2006	4.5%	0.5%	<17 years of age (Centre for Disease Control and Prevention, 2009)
USA	2005	5.0%	3.2%	Adults (Harris Interactive Service Bureau on behalf of Vegetarian Times, 2008)
USA	2004	3.8%	2.3%	>18 years (Vegetarian Resource Group, 2006)

Country	Year	This study	Other studies	Remarks and source
USA	2003	3.5%	6.7%	>18 years (VRG, 2006)
USA	2002	3.8%	1.4%	Vegan (VRG, 2006)
USA	2001	3.3%	2.8%	>17 years (VRG, 2004)
USA	2000	3.9%	<3%	Adults (American Dietetic Association, 2003)
USA	1999	4.3%	2.5%	>17 years (VRG, 2000)
USA	1998	3.9%	2%	Adults (VRG, 1997)
USA	1997	3.8%	1.2%	Adults (VRG, 1997)

Table A3. Share of vegetarian, strict vegetarian and vegan households by country

Country	Year	Households	Weight	Vegetarians	Std. Error vegetarians	Strict Vegetarians	Std. Error strict vegetarians	Vegans	Std. Error vegans
Albania	2005	3275	✓	0.047	0.004	0.045	0.004	0.029	0.003
Azerbaijan	1995	1864	✓	0.218	0.01	na	na	0.110	0.007
Brazil	1997	2838	✓	0.032	0.003	0.031	0.003	0.004	0.001
Bulgaria	2003	3012	✗	0.037	0.003	0.025	0.003	0.008	0.002
Bulgaria	2001	2359	✗	0.039	0.004	0.039	0.004	0.005	0.001
Bulgaria	1995	2264	✗	0.007	0.002	0.000	0.000	0.000	0.000
France	2006	8970	✓	0.026	0.002	0.016	0.001	0.002	0.001
France	2001	8956	✓	0.024	0.002	0.012	0.001	0.001	0.000
France	1995	9099	✓	0.016	0.001	0.007	0.001	0.002	0.000
France	1985	9814	✓	0.017	0.001	0.013	0.001	0.006	0.001
France	1979	9406	✓	0.016	0.001	0.012	0.001	0.006	0.001
Guatemala	2000	6078	✓	0.011	0.001	0.004	0.001	0.000	0.000
India	1998	1527	✓	0.333	0.012	0.333	0.012	0.115	0.008
Ireland	2004	5266	✓	0.012	0.002	0.007	0.001	0.000	0.000
Ireland	1999	6700	✓	0.008	0.001	0.006	0.001	0.000	0.000
Ireland	1994	6958	✓	0.008	0.001	0.006	0.001	0.001	0.000
Ireland	1987	6909	✓	0.004	0.001	0.003	0.001	0.000	0.000
Ivory Coast	1988	1523	✓	0.248	0.011	0.037	0.005	0.027	0.004
Ivory Coast	1987	1560	✓	0.210	0.010	0.035	0.005	0.030	0.004
Ivory Coast	1986	1546	✓	0.170	0.010	0.024	0.004	0.017	0.003
Ivory Coast	1985	1522	✓	0.139	0.009	0.019	0.003	0.014	0.003
Jamaica	2007	1783	✓	0.064	0.006	0.028	0.004	0.016	0.003
Jamaica	2006	1678	✓	0.054	0.005	0.017	0.003	0.007	0.002
Jamaica	2005	1698	✓	0.047	0.005	0.013	0.003	0.003	0.001
Jamaica	2004	1755	✓	0.032	0.004	0.006	0.002	0.002	0.001
Jamaica	2003	1781	✓	0.043	0.005	0.010	0.002	0.004	0.001
Jamaica	2002	6165	✓	0.035	0.002	0.010	0.001	0.002	0.001
Jamaica	2001	1436	✓	0.027	0.004	0.006	0.002	0.000	0.001
Jamaica	2000	1570	✓	0.022	0.004	0.006	0.002	0.005	0.002
Jamaica	1999	1633	✓	0.029	0.004	0.007	0.002	0.001	0.001
Jamaica	1998	6461	✓	0.022	0.002	0.006	0.001	0.001	0.000

Country	Year	Households	Weight	Vegetarians	Std. Error vegetarians	Strict Vegetarians	Std. Error strict vegetarians	Vegans	Std. Error vegans
Jamaica	1997	1743	✓	0.020	0.003	0.007	0.002	0.000	0.000
Jamaica	1996	1608	✓	0.017	0.003	0.005	0.002	0.001	0.001
Jamaica	1995	1715	✓	0.016	0.003	0.006	0.002	0.001	0.001
Jamaica	1994	1708	✓	0.017	0.003	0.006	0.002	0.001	0.001
Jamaica	1993	1710	✓	0.014	0.003	0.005	0.002	0.000	0.000
Jamaica	1992	3843	✓	0.017	0.002	0.006	0.001	0.000	0.000
Jamaica	1991	1576	✓	0.016	0.003	0.006	0.002	0.001	0.001
Jamaica	1990	703	✓	0.034	0.007	0.013	0.004	0.003	0.002
Jamaica	1989	1256	✓	0.025	0.004	0.019	0.004	0.002	0.001
Jamaica	1988	1648	✓	0.044	0.005	0.006	0.002	0.001	0.001
Kosovo	2000	1373	✓	0.061	0.006	0.011	0.003	0.003	0.002
Kyrgyzstan	1993	1894	✗	0.271	0.010	0.045	0.005	0.000	0.000
Nepal	2003/04	3431	✓	0.056	0.004	0.036	0.003	0.001	0.001
Nepal	1996	3014	✓	0.072	0.005	0.056	0.004	0.011	0.002
Peru	1985	4615	✗	0.436	0.007	0.207	0.005	0.160	0.005
Russia	2002	2962	✓	0.143	0.006	0.109	0.006	0.050	0.004
Russia	2001	2950	✓	0.188	0.007	0.144	0.006	0.061	0.004
Russia	2000	2843	✓	0.237	0.008	0.188	0.007	0.086	0.005
Russia	1993/94	5224	✗	0.271	0.006	0.214	0.006	0.107	0.004
Russia	1993	5388	✗	0.271	0.006	0.211	0.006	0.090	0.004
Russia	1992/93	5296	✗	0.333	0.006	0.268	0.006	0.128	0.005
Russia	1992	5946	✗	0.268	0.006	0.228	0.005	0.092	0.004
Serbia	2007	4708	✓	0.008	0.001	0.004	0.001	0.001	0.000
Serbia	2002	5956	✓	0.016	0.002	0.000	0.000	0.000	0.000
South Africa	1993	4776	✓	0.073	0.004	0.040	0.003	0.020	0.002
Tajikistan	2003	3620	✓	0.467	0.008	0.463	0.008	0.183	0.006
Tajikistan	1999	1818	✗	0.462	0.012	0.459	0.012	0.136	0.008
Tanzania	1993	4844	✓	0.180	0.006	0.068	0.004	0.049	0.003
Timor Leste	2001	1596	✓	0.538	0.012	0.412	0.012	0.304	0.012
UK	2006	5713	✓	0.028	0.002	0.016	0.002	0.000	0.000
UK	2005-06	5889	✓	0.028	0.002	0.014	0.002	0.000	0.000
UK	2004-05	5759	✓	0.032	0.002	0.019	0.002	0.003	0.001
UK	2003-04	6152	✓	0.030	0.002	0.020	0.002	0.001	0.000

Country	Year	Households	Weight	Vegetarians	Std. Error vegetarians	Strict Vegetarians	Std. Error strict vegetarians	Vegans	Std. Error vegans
UK	2002-03	6037	✓	0.028	0.002	0.013	0.001	0.000	0.000
UK	2001-02	6520	✓	0.029	0.002	0.017	0.002	0.001	0.000
UK	2001	5537	✓	0.028	0.002	0.014	0.002	0.000	0.000
UK	2000	6225	✓	0.024	0.002	0.014	0.001	0.000	0.000
UK	1999	5469	✓	0.024	0.002	0.014	0.002	0.000	0.000
UK	1998	5315	✓	0.022	0.002	0.010	0.001	0.000	0.000
UK	1997	5537	✓	0.021	0.002	0.012	0.001	0.000	0.000
UK	1996	5973	✗	0.020	0.002	0.010	0.001	0.000	0.000
UK	1995	6018	✗	0.023	0.002	0.013	0.001	0.001	0.000
UK	1994	5811	✗	0.023	0.002	0.013	0.001	0.001	0.000
UK	1993	6143	✗	0.023	0.002	0.013	0.001	0.000	0.000
UK	1992	6569	✗	0.027	0.002	0.012	0.001	0.001	0.000
UK	1991	6237	✗	0.020	0.002	0.011	0.001	0.000	0.000
UK	1990	6167	✗	0.021	0.002	0.010	0.001	0.000	0.000
UK	1989	6583	✗	0.019	0.002	0.009	0.001	0.000	0.000
UK	1988	6331	✗	0.016	0.002	0.007	0.001	0.000	0.000
UK	1987	6463	✗	0.020	0.002	0.008	0.001	0.001	0.000
UK	1986	6399	✗	0.017	0.002	0.008	0.001	0.000	0.000
UK	1985	6155	✗	0.013	0.001	0.006	0.001	0.000	0.000
UK	1984	6294	✗	0.012	0.001	0.007	0.001	0.001	0.000
UK	1983	6171	✗	0.011	0.001	0.005	0.001	0.000	0.000
UK	1982	6491	✗	0.010	0.001	0.007	0.001	0.000	0.000
UK	1981	6680	✗	0.007	0.001	0.004	0.001	0.000	0.000
UK	1980	6141	✗	0.008	0.001	0.006	0.001	0.000	0.000
UK	1979	6068	✗	0.009	0.001	0.006	0.001	0.000	0.000
UK	1978	6182	✗	0.008	0.001	0.005	0.001	0.000	0.000
UK	1977	6428	✗	0.004	0.001	0.002	0.001	0.000	0.000
UK	1976	6205	✗	0.003	0.001	0.002	0.001	0.001	0.000
UK	1975	6373	✗	0.004	0.001	0.003	0.001	0.000	0.000
UK	1974	5935	✗	0.005	0.001	0.003	0.001	0.000	0.000
UK	1973	6320	✗	0.003	0.001	0.002	0.001	0.000	0.000
UK	1972	6231	✗	0.003	0.001	0.002	0.001	0.000	0.000
UK	1971	6328	✗	0.003	0.001	0.002	0.000	0.000	0.000

Country	Year	Households	Weight	Vegetarians	Std. Error vegetarians	Strict Vegetarians	Std. Error strict vegetarians	Vegans	Std. Error vegans
UK	1970	5731	✗	0.002	0.001	0.002	0.001	0.000	0.000
UK	1969	5995	✗	0.001	0.000	0.000	0.000	0.000	0.000
UK	1968	6408	✗	0.002	0.000	0.000	0.000	0.000	0.000
UK	1963	2972	✗	0.003	0.001	0.001	0.001	0.000	0.000
UK	1962	3114	✗	0.004	0.001	0.002	0.001	0.000	0.000
UK	1961	3057	✗	0.004	0.001	0.002	0.001	0.000	0.000
USA	2006	5098	✓	0.055	0.003	0.030	0.002	0.000	0.000
USA	2005	6151	✓	0.055	0.003	0.029	0.002	0.000	0.000
USA	2004	5941	✓	0.045	0.003	0.025	0.002	0.000	0.000
USA	2003	4152	✓	0.040	0.003	0.022	0.002	0.000	0.000
USA	2002	5424	✓	0.046	0.003	0.024	0.002	0.000	0.000
USA	2001	5496	✓	0.038	0.003	0.022	0.002	0.000	0.000
USA	2000	5357	✓	0.043	0.003	0.024	0.002	0.000	0.000
USA	1999	5260	✓	0.048	0.003	0.025	0.002	0.000	0.000
USA	1998	4155	✓	0.047	0.003	0.027	0.003	0.000	0.000
USA	1997	4100	✓	0.044	0.003	0.025	0.002	0.000	0.000
USA	1996	4061	✓	0.042	0.003	0.023	0.002	0.000	0.000
USA	1995	3875	✓	0.034	0.003	0.016	0.002	0.000	0.000
USA	1994	4251	✓	0.036	0.003	0.020	0.002	0.000	0.000
USA	1993	4764	✓	0.041	0.003	0.022	0.002	0.000	0.000
USA	1992	4745	✓	0.035	0.003	0.020	0.002	0.000	0.000
USA	1991	5112	✓	0.036	0.003	0.017	0.002	0.000	0.000
USA	1990	4830	✓	0.031	0.002	0.013	0.002	0.000	0.000
USA	1981	3794	✗	0.025	0.003	0.012	0.002	0.000	0.000
USA	1980	4002	✗	0.027	0.003	0.012	0.002	0.000	0.000
Vietnam	2006	2620	✓	0.004	0.001	0.001	0.001	0.001	0.001
Vietnam	2004	8268	✓	0.008	0.001	0.004	0.001	0.003	0.001
Vietnam	2002	26589	✓	0.003	0.001	0.001	0.000	0.001	0.000
Vietnam	1998	4989	✓	0.001	0.001	0.001	0.000	0.001	0.000
Vietnam	1992	4331	✗	0.009	0.001	0.004	0.001	0.003	0.001
Australia	2003/04	6957	✓	0.106	na	0.085	na	0.029	na
Australia	1998/99	6893	✓	0.082	na	0.072	na	0.020	na

Country	Year	Households	Weight	Vegetarians	Std. Error vegetarians	Strict Vegetarians	Std. Error strict vegetarians	Vegans	Std. Error vegans
Australia	1993/94	8,389	✓	0.109	na	0.077	na	0.017	na
Bosnia	2004	2959	✗	0.010	0.002	0.007	0.002	0.000	0.000
Bosnia	2001	5335	✓	0.004	0.000	0.003	0.001	0.000	0.000
China	1997	787	✗	0.155	0.013	0.130	0.012	0.078	0.010
Germany	2003	11831	✓	0.024	0.001	0.016	0.001	0.001	0.000
Germany	1998	12680	✓	0.024	0.001	0.016	0.001	0.001	0.000
Germany	1993	15825	✓	0.023	0.001	0.015	0.001	0.001	0.000
Papua New Guinea	1996	1336	✗	0.024	0.004	0.012	0.003	0.009	0.003
Serbia	2003	2548	✓	0.016	0.002	0.014	0.002	0.001	0.001
Singapore	2003	6749	✓	0.210	na	0.170	na	0.090	na

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