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Web Appendix 1: USDA Adult Food Security Survey Module and Survey Variables

USDA Adult Food Security Survey Module[1]

These next questions are about the food eaten in your household in the last 12 months, since (current month) of last year and whether you were able to afford the food you need.		
Stage 1: In the last 12 months, can you tell me if these statements were true for you?		
1	"We worried whether our food would run out before we got money to buy more."	Often true Sometimes true Never true
2	"The food that we bought just didn't last, and we didn't have money to get more."	Often true Sometimes true Never true
3	"We couldn't afford to eat balanced meals."	Often true Sometimes true Never true
Stage 2 (if one or more Stage 1 Adult/Household questions affirmed): In the last 12 months…		
4a	Did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?	Yes No
4b	If yes: How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	Almost every month Some months but not every month Only 1 or 2 months
5	Did you ever eat less than you felt you should because there wasn't enough money for food?	Yes No
6	Were you every hungry but didn't eat because there wasn't enough money for food?	Yes No
7	Did you lose weight because there wasn't enough money for food?	Yes No
Stage 3 (if one or more Stage 2 Adult/Household questions affirmed): In the last 12 months…		
8a	Did (you/you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?	Yes No
8b	If yes: How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?	Almost every month Some months but not every month Only 1 or 2 months

Source: https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement/

Web Appendix 2: Sample characteristics of adults in Low Income Diet and Nutrition Survey (2003-2005) and adults in the lowest income quartile from Food and You Survey (2016).

	F&Y (n=3,100)	F&Y- bottom income quartile only (n=334)	LIDNS (n=2465)	p value
Gender				0.294
Male	39.6	36.5	33.6	
Female	60.4	63.5	66.4	
Age				<0.0001
16-24	7.14	7.8	10.4	
25-34	13.5	9.6	15.1	
35-44	15.3	11.4	17.0	
45-54	16.8	19.8	13.6	
55-64	17.3	14.1	15.0	
65+	30.1	37.4	28.9	
Ethnicity				0.94
White	91.9	92.2	92.3	
Other ethnic group	8.08	7.78	7.67	
Any educational qualifications				<0.0001
No	20.9	39.8	61.3	
Yes	79.1	60.2	38.7	
Marital status				<0.0001
Married/cohabitating	54.4	16.8	32.7	
Single/Widowed/Divorced/Separated/Other	45.6	83.2	67.3	

Long-term health problem/disability					0.436
	No	63.7	45.2	43.0	
	Yes	36.4	54.8	57.0	
Work status					<0.0001
	In work	50.7	19.8	12.3	
	Retired	32.1	39.2	28.9	
	Unemployed/Other	17.3	41.0	58.8	
Children under 16 in the household					<0.0001
	Yes	25.5	19.2	34.2	
	No	74.5	80.8	65.8	
Household size					<0.0001
	One	30.0	62.0	35.7	
	Two	36.0	20.7	33.1	
	Three	15.0	9.6	15.2	
	Four or more	19.0	7.8	16.1	
Region					<0.0001
	England	67.7	62.9	73.2	
	Wales	15.7	18.0	13.2	
	Northern Ireland	16.5	19.2	13.6	

Notes: Data are unweighted sample proportions. Sample restricted to respondents with non-missing values for all variables. Food and You survey respondents only include those in bottom income quartile. P value for chi square.

Web Appendix 3 Variables used in analyses of Food and You Survey (2016) and modifications necessary to combine with Low Income Diet and Nutrition Survey (2003-2005).

Variables used in analysis of Food and You Survey	Modifications to match Food and You Survey to Low Income Diet and Nutrition Survey
Gender	No modifications.
Men	
Women	
Age	Only respondents aged 16+ from LIDNS survey included. Continuous age variable from LIDNS coded into age ranges.
16-24	
25-34	
35-44	
45-54	
55-64	
65+	
Self-assigned ethnicity	No modifications.
White British/White	
Other/mixed ethnicity	
Marital status	No modifications.
Married/cohabiting	
Single/Widowed/Divorced/Separated/Other	
Children in household	Only binary variable indicating whether or not any children under 16 included in combined analysis.
No children in household	
Children under 16, but none under 6	
Children under 6 and possibly older children	
Qualifications	Multiple levels of education provided in both surveys collapsed into an indication of any qualifications or none.
No qualifications identified	
O level/GCSE, CSE, NVQ level 2 or below[1]	
Diplomas in higher education[2]	
Undergrad degree/postgrad diplomas[3]	
Higher degree/postgraduate qualifications	
Other qualifications (including overseas)	
Work status	LIDNS categories indicated were: working, in full-time education, or not working at present.
In work	No modifications.

Retired	In LIDNS, if indicated not working at present and respondent retirement age, classified as retired to match Food and You survey.
Unemployed	All unemployed and not working for other reasons in Food and You combined with not working for other reasons and adults in full-time education in LIDNS, with exception of respondents of retired age (as above)
Other	See above.
Long-term health problem/disability	Additional information on impact on daily activities not available in LIDNS.
None/no impact on daily activities	Changed to binary question - long standing illness or disability or none, regardless of impact on daily activities.
Yes, reduces daily activities a little	Information not included in combined analysis.
Yes, reduces daily activities a lot	Information not included in combined analysis.
Region	Respondents from LIDNS in Scotland excluded to match sample from Food and You.
England	LIDNS: 9 regions in England combined into one category.
Wales	None
Northern Ireland	None
Urban/rural classification	Not available in LIDNS. Not included in combined analysis.
Urban	
Rural	
Household income	
<£10,399	Only adults from lowest income quartile from Food and You Survey included in combined analysis.
£10,400-£25,999	
£26,000-£51,999	
>£52,000	
Missing	
Household size	LIDNS values up to 10. Reduced to match Food and You categories.
1	
2	
3	
4	

5+	

Web Appendix 4: Description of the matching procedure

Coarsened Exact Matching (CEM) is a partial matching procedure. There were only 335 respondents in the Food and You that were in the bottom quartile of the income distribution whereas the Food and You survey contained 2608 respondents (2,943 matched respondents in total). Our matching procedure found matches for 239 respondents in the Food & You data (trimming 96 respondents). These were 'matched' with 923 respondents from the LIDNS data (trimming 1685 respondents).

CEM splits all variables into bins or categories and we simply allow these bins or categories to reflect the pre-defined categories of all the variables included in the model (e.g., male and female). We match respondents on the following variables: employment status, long-standing illness or disability, age, gender, presence of children in household, household size, marital status, ethnicity, region, and any education qualifications

Adding all these variables together creates 1107 different possible combinations (or strata) and the CEM algorithm seeks to match the LIDNS survey data to those strata (or combinations) where respondents from the Food & You survey are found. Only 116 strata have matched individuals. It is possible to have more than one match in each strata and so the matching is weighted to reflect the uneven distribution of the data across these strata. CEM is usually assessed using a global fit statistic ζ_1 (or L_1). This fit statistic tells us how imbalanced the data sets are before the matching procedure (1 = completely separable or no-overlap while 0 = perfectly balanced).

In our analysis, before the matching procedure, ζ_1 is 0.907 while after the matching procedure ζ_1 has fallen to 0.665, which we regard as a significant improvement. If we look at the differences between specific variables we can see that on some variables the matching has been somewhat successful, removing some of the differences between the distribution of these variables (e.g., Work Status and Disability). On most variables the degree of imbalance was already low and so matching has made little difference (e.g., Gender, Children in Household, Household Size, Marital Status, Region, and Ethnicity). On one variable it has been less successful and may have slightly increased imbalance in our education variable, but this is offset by the gains elsewhere. The matching is not perfect, of course, but CEM is by definition an improvement over the imbalance observed in the raw data.

Web Table A3: Balance between key covariates before and after matching

Variable	Variable specific measure of imbalance (ζ_x)	Difference in means before matching	Difference in means after matching
Work status	0.232	-0.843	-0.132
Age	0.305	0.179	-0.512
Long-term health problem/disability	0.168	-0.214	-0.168

Gender	0.031	-0.076	0.031
Children under 16 in the household	0.002	-0.078	-0.002
Household size	0.058	0.058	0.126
Marital status	0.083	-0.236	0.083
Ethnicity	0.039	-0.008	0.039
Region	0.019	0.103	0.295
Any educational qualifications	0.468	0.425	0.468

Web Appendix 5: Logistic regression analyses comparing odds of food insecurity in 2003-2005 to 2016.

	Food insecurity (Odds Ratio (95% CI)			
	(1)	(2)	(3)	(4)
Survey year				
2003-2005	Referent	Referent	Referent	Referent
2016	**2.20 (1.76-2.7)**	**1.67 (0.84-3.31)**	**2.38 (1.87-3.04)**	**1.61 (1.13-2.30)**
Employment status				
In work	---	Referent	---	---
Retired	---	0.17 (0.09-0.33)	---	---
Unemployed or Other	---	1.17 (0.63-2.19)	---	---
Retired*2016 interaction term	---	0.54 (0.23-1.25)	---	---
Unemployed/other*2016 interaction term	---	1.32 (0.61-2.85)	---	---
Any children <16				
No	---	---	Referent	---
Yes	---	---	3.39 (2.30-5.00)	---
Children*2016 interaction term	---	---	0.72 (0.38-1.37)	---
Long standing illness or disability				
No	---	---	---	Referent
Yes	---	---	---	1.03 (0.76-1.41)
Illness/disability*2016 interaction term	---	---	---	**1.84 (1.16-2.92)**
Observations	1,147	1,147	1,147	1,147

Notes: Logistic regression models adjusted for sample characteristics using coarsened exact matching. Matching criteria include employment status, age, disability, gender, any children, household size, marital status, ethnicity, country, and any qualifications.

Web Appendix 6: Probability of food insecurity by employment status for lowest income groups in England, Wales, and Northern Ireland in 2003-2005 versus 2016.
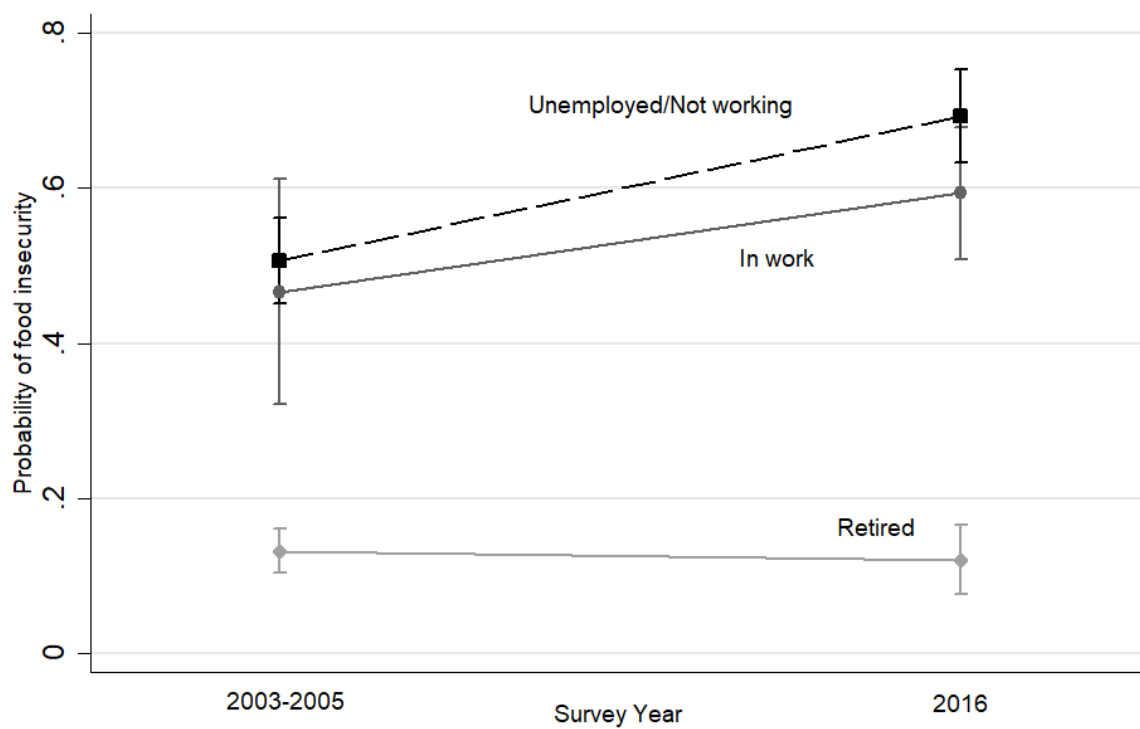
Notes: Data are a matched sample of participants from the 2003-2005 Low Income Diet and Nutrition Survey (LIDNS) and 2016 Food and You Survey. Matching criteria include employment status, age, disability, gender, any children, household size, marital status, ethnicity, country, and any qualifications.

Web Appendix 7: Estimates of the proportion of food insecure adults helped by Trussell Trust food banks

Based on the nomis.co.uk data on the number of adults living in England, Wales, and Northern Ireland in 2016 (n=48,769,174), we estimate that about 10.2 million adults experience some level of food insecurity in the UK (this is, based on the estimate of 21% of people who are food insecure). Based on the prevalence of severe food insecurity (2.72%), an estimated 1,326,521 adults are severely food insecure.

In 2016/17, The Trussell Trust distributed 746,016 food parcels to adults in England, Wales, and NI in 2016/17 (see regional breakdown data available from https://www.trusselltrust.org/news-and-blog/latest-stats/end-year-stats/#fy-2016-2017). These data are not a count of unique individuals, however. The Trussell Trust estimates that people receive about two food parcels each, on average, so we divide 746,016 by two to estimate that about 324, 053 adults received help from Trussell Trust food banks in 2016/17.

Thus, the proportion of food insecure adults in England, Wales, and Northern Ireland who could have accessed Trussell Trust food banks is: 324,053/10,241,526, which is 3.1%. As a proportion of severely food insecure adults, (i.e. 324,053/1,326,521), possibly about 24.4% could have received help from Trussell Trust food banks.