Supplemental Nutrition Assistance Program (SNAP) Imputation

Current Population Survey (CPS) provides Supplemental Nutrition Assistance Program (SNAP) micro-data on a household level, but total number of household recipients, as well as their overall weighted-sum benefit, falls below official data provided by United States Department of Agriculture (USDA). We augmented total number of household recipients, as well as individual recipients, and their dollar amount of benefits from CPS 2014 March Supplement to match the 2014 SNAP reports provided on USDA website.

Since CPS provides SNAP data on a household base, our imputation follows the same train of thoughts. In addition to match household recipients number and total benefits, we tried to maintain CPS original micro-data distribution by utilizing USDA current distribution and SNAP rules. However, CPS data is insufficient in many ways. In order to augment data, a number of assumptions are made. This report illustrates details those assumptions and explains imputation procedure.

CPS micro-data and SNAP targets

CPS data on SNAP

SNAP, previously known as Food Stamp, is reported on a household level, rather than an individual level, on CPS March Supplement. According to 2014 CPS March Supplement, all members from same household report same recipient status, same benefit amounts and same length of receiving benefits. In other words, if one of the member reports as a SNAP recipient who receives $1,000 for 4 months, all other members from his or her household will report exactly same, saying $1,000 for 4 months.

Targets for imputation

The targets for imputation come from SNAP official data. In Fiscal Year 2014, an average of 22.74 million(Appendix: Table 1) of household claims roughly 70 billion benefits. The monthly average benefits for each household is 256.41 (Appendix: Table 4). Furthermore, data across states is available. So, for our imputation, CPS March Supplement data is sub-grouped by state for a better measurement.

CPS does not include residents living in Guam and Virgin Island. [1]

Here is the summary of dollar benefit targets for each state:

State	CPS total benefits (in million, monthly)	Admin total benefits (in million, monthly)
Alabama	72.3154	109.8445
Alaska	7.9036	14.5202
Arizona	119.9596	123.0635
Arkansas	39.7310	55.3099

---

[1] For Guam, administrative data: 15,480 household and 108,433,869 benefits; for Virgin Island, administrative data: 12,478 household and 55,099,458 benefits.

California	322.9665	617.6236
Colorado	46.3731	63.8114
Connecticut	41.3462	58.1196
Delaware	13.5626	18.3627
District of Columbia	10.0727	18.5503
Florida	238.6994	456.0695
Georgia	110.8866	235.6545
Hawaii	21.6736	43.7832
Idaho	13.5493	24.6386
Illinois	138.2676	266.8758
Indiana	75.9690	109.2890
Iowa	30.6504	44.3404
Kansas	25.1812	32.9342
Kentucky	75.1375	97.5825
Louisiana	58.0122	107.3597
Maine	20.2867	26.7959
Maryland	55.9049	94.4280
Massachusetts	69.5713	106.0815
Michigan	161.9309	214.6804
Minnesota	39.7863	55.8502
Mississippi	62.1454	76.0821
Missouri	53.0618	103.0371
Montana	9.2086	14.6808
Nebraska	13.3359	19.9087
Nevada	23.5846	44.7259
New Hampshire	7.3558	11.7266
New Jersey	61.4274	107.5574
New Mexico	29.3099	52.4300
New York	261.7214	433.3965
North Carolina	125.1930	198.6310
North Dakota	6.8089	6.3138
Ohio	151.2553	215.2298
Oklahoma	42.8957	72.0875
Oregon	59.2938	96.8226
Pennsylvania	136.9388	214.4715
Rhode Island	17.4587	23.3203
South Carolina	63.3067	102.9747
South Dakota	7.4918	12.4115
Tennessee	118.8067	162.6599
Texas	317.4155	444.2209
Utah	19.9953	26.3893
Vermont	7.1864	10.8604

Virginia	57.1865	108.6068
Washington	77.5723	128.9622
West Virginia	23.4764	39.6778
Wisconsin	61.0965	92.7484
Wyoming	3.9771	4.1060

Imputation Procedure

We follow a similar two-step procedure as SSI imputation. First, we add up the household weight in the recipient pool to reach the administrative level for each state. Second, we impute and get the adjust ratio for benefits amount to match the dollar benefit total.

Step I: impute recipient

A basic linear regression model is built up for analyzing the likelihood of being a recipient. Following SNAP rules, only net income is used as independent variable.

Net income estimation is also consistent with program rule:

1) We get the gross income for each household by summing up all members earned and unearned incomes;

2) A 20% deduction of earned income;

3) According to household size, do the following deduction:

Household Size	Less or equal to 3	4	5	More or equal to 6
Deduction Amount	155	168	197	226

4) For household with member age over 60 or disabled, a deduction of Medical Expenses over $35 if they are not paid by insurance or someone else;

5) A deduction of legally child support;

6) Deductions of dependent cares and shelter costs: we use the average official number $10 and $290 per month.

Some of the variables we choose may not be the same as what SNAP officially uses, but they are good proxies as estimation. For dependent cares and shelter costs, CPS does not cover relative variables. So the average official number from USDA is used.

$$SNAP\ indicator = \alpha +\ \beta * net\ income + \varepsilon$$

We run the model on a subset of CPS dataset. Because household with higher income are not eligible for joining SNAP, those with monthly income higher than $5,490 are dropped. The drop line comes from SNAP rule: the highest net income test line for a household with 14 members is $5,490. We use this as our drop line.

Then we rank all recipients by their fitted probability. For each state's sub-group, we sum-up their weights until the weights reach administrative level. Our final target is match the individual recipients number, while our model is based on household level. According to CPS and USDA, the gaps between CPS reported recipients and administrative recipients are 10.2 million and 10 million, individual and household respectively. As a result, during ranking the probability of being a recipient,

the size of household is limited to only 1 person. Only in this way can both individual and household numbers match the administrative. As shown in Appendix: Table 3, households with single number are sufficient to fill in the gaps.

Step II:

For each imputed household recipient, we assign the average benefit amount for correspondent state. Then we calculate the total dollar benefits again for each state, and compare the new dollar benefits with SNAP administrative data. Conditions vary among states, and we can get the adjustment ratios by dividing administrative benefits to imputed benefits(Appendix: Table 5). Most adjustment ratios nearly equal to 1. We use the adjustment ratios to augment or shrink each household's benefits.

Appendix

Table 1: Household recipients' numbers by state

State	CPS total household recipient (monthly, in thousand)	Admin total household recipient (monthly, in thousand)
Alabama	225.5801	419.5520
Alaska	20.0439	36.9972
Arizona	327.8051	449.6398
Arkansas	151.8973	221.4462
California	964.3651	2019.2723
Colorado	142.9684	234.0977
Connecticut	131.2968	242.9821
Delaware	39.8634	71.4080
District of Columbia	38.2384	80.3602
Florida	814.8540	1920.6973
Georgia	403.7458	882.1148
Hawaii	46.6441	98.8299
Idaho	47.8386	90.1612
Illinois	432.2913	1021.1498
Indiana	222.8906	404.5751
Iowa	113.0834	193.3723
Kansas	86.9585	132.8254
Kentucky	240.9178	399.2068
Louisiana	200.1865	396.4278
Maine	84.1373	122.6904
Maryland	195.4621	403.7813
Massachusetts	281.2241	489.0394
Michigan	529.4268	872.5383
Minnesota	169.3773	260.4370
Mississippi	227.0717	302.2018
Missouri	272.7559	403.9128
Montana	35.3736	59.0970
Nebraska	47.1048	76.9186
Nevada	108.6703	188.7390
New Hampshire	31.9841	53.5590
New Jersey	226.9598	439.6945
New Mexico	81.4954	195.2583
New York	970.2162	1698.5593
North Carolina	438.1660	761.1046
North Dakota	25.6700	25.0112
Ohio	633.9179	851.9723
Oklahoma	132.0333	279.6055
Oregon	214.2253	448.8554
Pennsylvania	489.1600	889.7252

Rhode Island	66.2441	101.0023
South Carolina	262.7989	395.2085
South Dakota	25.4692	44.0389
Tennessee	404.0362	650.2508
Texas	969.9927	1607.6693
Utah	62.6108	90.5701
Vermont	25.4495	48.5747
Virginia	202.7035	443.6066
Washington	259.1494	585.1045
West Virginia	94.3608	176.0287
Wisconsin	228.8431	420.8331
Wyoming	12.8036	15.2494

Table 2: Individual recipients' numbers by state

State	**CPS total individual recipient (monthly, in thousand)**	**Admin total individual recipient (monthly, in thousand)**
Alabama	711.1293	902.0730
Alaska	55.3652	87.4860
Arizona	1083.2985	1044.3100
Arkansas	436.6457	491.9650
California	3521.5850	4349.6340
Colorado	403.7825	505.1690
Connecticut	346.1339	438.5590
Delaware	111.0431	150.2320
District of Columbia	99.2918	142.7070
Florida	2491.1530	3526.3110
Georgia	1145.3357	1942.6890
Hawaii	158.7221	194.2640
Idaho	139.8796	211.7810
Illinois	1349.6801	2015.3030
Indiana	611.5381	892.6990
Iowa	329.1892	408.0700
Kansas	231.0810	293.4560
Kentucky	707.8148	828.0760
Louisiana	516.3077	877.3400
Maine	211.6054	230.5360
Maryland	543.4459	787.5970
Massachusetts	692.8883	863.4120
Michigan	1476.3548	1679.4210
Minnesota	419.3134	533.7430
Mississippi	650.6578	656.8710
Missouri	670.6117	858.4160
Montana	100.7455	124.9060

Nebraska	140.8715	173.5300
Nevada	320.3516	383.6220
New Hampshire	78.1968	111.7010
New Jersey	586.7767	883.4340
New Mexico	293.4955	431.4940
New York	2460.4610	3122.8790
North Carolina	1238.9898	1575.6760
North Dakota	69.2523	53.7530
Ohio	1471.0856	1752.1350
Oklahoma	414.7715	608.4920
Oregon	613.8577	802.1900
Pennsylvania	1329.9496	1796.1540
Rhode Island	166.3527	178.5180
South Carolina	648.6531	834.5110
South Dakota	64.8707	100.9380
Tennessee	1153.2383	1312.5050
Texas	3308.8545	3852.6750
Utah	203.3729	229.9110
Vermont	60.8699	93.0000
Virginia	572.4012	918.9020
Washington	730.8639	1095.5510
West Virginia	273.4819	362.5010
Wisconsin	592.1050	841.5330
Wyoming	30.0111	35.8710

Table 3: Household distribution in CPS

Household size	Household number	Percentage	Accumulative number	Accumulative percentage
1	33,912,952	10.82	33,912,952	10.82
2	85,020,936	27.13	118,933,887	37.95
3	60,294,087	19.24	179,227,974	57.19
4	66,525,465	21.23	245,753,439	78.42
5	38,010,522	12.13	283,763,961	90.55
6	16,798,098	5.36	300,562,060	95.91
7	7,456,948	2.38	308,019,007	98.28
8	2,819,113	0.90	310,838,120	99.18
9	1,396,485	0.45	312,234,605	99.63
10	596,576	0.19	312,831,181	99.82
11	323,183	0.10	313,154,364	99.92
12	118,749	0.04	313,273,113	99.96
13	63,014	0.02	313,336,127	99.98
14	59,295	0.02	313,395,422	100.00

Table 4: Average household benefits by state

State	Average household benefit
Alabama	261.81
Alaska	392.47
Arizona	273.69
Arkansas	249.77
California	305.86
Colorado	272.58
Connecticut	239.19
Delaware	257.15
District of Columbia	230.84
Florida	237.45
Georgia	267.15
Hawaii	443.02
Idaho	273.27
Illinois	261.35
Indiana	270.13
Iowa	229.3
Kansas	247.95
Kentucky	244.44
Louisiana	270.82
Maine	218.4
Maryland	233.86
Massachusetts	216.92
Michigan	246.04
Minnesota	214.45
Mississippi	251.76
Missouri	255.1
Montana	248.42
Nebraska	258.83
Nevada	236.97
New Hampshire	218.95
New Jersey	244.62
New Mexico	268.52
New York	255.16
North Carolina	260.98
North Dakota	252.44
Ohio	252.63
Oklahoma	257.82
Oregon	215.71
Pennsylvania	241.05
Rhode Island	230.89

South Carolina	260.56
South Dakota	281.83
Tennessee	250.15
Texas	276.31
Utah	291.37
Vermont	223.58
Virginia	244.83
Washington	220.41
West Virginia	225.41
Wisconsin	220.39
Wyoming	269.26

Table 5: Adjustment ratios by state

State	Imputed	Admin	adjust ratio
Alabama	1,430,721,739	1,318,133,562	0.9213
Alaska	162,101,772	174,241,813	1.0749
Arizona	1,490,130,942	1,476,761,898	0.9910
Arkansas	621,093,029	663,719,268	1.0686
California	7,406,260,900	7,411,483,685	1.0007
Colorado	792,913,464	765,737,085	0.9657
Connecticut	767,260,201	697,435,672	0.9090
Delaware	242,414,945	220,352,805	0.9090
District of Columbia	229,164,736	222,604,041	0.9714
Florida	5,724,384,579	5,472,834,001	0.9561
Georgia	2,779,511,639	2,827,853,876	1.0174
Hawaii	518,598,901	525,397,960	1.0131
Idaho	278,187,422	295,662,973	1.0628
Illinois	3,320,679,649	3,202,509,863	0.9644
Indiana	1,351,435,546	1,311,468,403	0.9704
Iowa	541,671,657	532,085,213	0.9823
Kansas	382,292,134	395,209,994	1.0338
Kentucky	1,266,584,623	1,170,989,948	0.9245
Louisiana	1,279,085,772	1,288,316,273	1.0072
Maine	330,255,130	321,550,513	0.9736
Maryland	1,161,529,042	1,133,135,874	0.9756
Massachusetts	1,332,113,792	1,272,977,488	0.9556
Michigan	2,752,848,619	2,576,165,148	0.9358
Minnesota	656,177,070	670,202,668	1.0214
Mississippi	935,111,450	912,985,504	0.9763
Missouri	1,004,144,177	1,236,444,630	1.2313
Montana	167,620,699	176,169,543	1.0510
Nebraska	227,844,843	238,904,358	1.0485

Nevada	492,468,639	536,711,313	1.0898
New Hampshire	138,120,339	140,718,624	1.0188
New Jersey	1,322,564,104	1,290,688,313	0.9759
New Mexico	680,352,628	629,160,453	0.9248
New York	5,190,232,257	5,200,758,093	1.0020
North Carolina	2,383,087,886	2,383,571,501	1.0002
North Dakota	72,117,160	75,765,024	1.0506
Ohio	2,289,650,004	2,582,757,967	1.1280
Oklahoma	891,033,331	865,049,765	0.9708
Oregon	1,249,284,367	1,161,871,005	0.9300
Pennsylvania	2,629,001,487	2,573,657,445	0.9789
Rhode Island	276,190,677	279,843,287	1.0132
South Carolina	1,119,356,005	1,235,696,260	1.1039
South Dakota	140,339,520	148,938,276	1.0613
Tennessee	2,001,628,926	1,951,918,832	0.9752
Texas	5,512,513,061	5,330,650,619	0.9670
Utah	294,535,905	316,671,764	1.0752
Vermont	142,835,505	130,324,476	0.9124
Virginia	1,289,999,951	1,303,281,631	1.0103
Washington	1,670,964,687	1,547,545,882	0.9261
West Virginia	495,562,445	476,134,200	0.9608
Wisconsin	1,169,221,379	1,112,980,884	0.9519
Wyoming	51,070,995	49,272,569	0.9648