Errors in Survey Reporting and Imputation and their Effects on Estimates of Food Stamp Program Participation

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Declining Quality of Survey Data

- Both unit and item nonresponse have been rising in most surveys

- The error in responses conditional on obtaining one (measurement error) has risen

- Both have been shown to bias common analyses and violate the assumptions of corrections (CME and MAR)

- We don't really know why: declining public spirit, people are over-surveyed?

- These patterns have implications for much that is done by the statistical agencies, other government agencies and outside empirical researchers and for public policy.

Past Work: Food Stamps and Underreporting

- Food Stamps/SNAP expanding rapidly.
- Aggregate data indicates high rates of underreporting
- Most previous studies of the impact of the FSP on poverty, inequality, etc. have not addressed underreporting. Jolliffe et al. (2005) a partial exception.
- Some work that incorporates underreporting in takeup analyses. Bollinger and David (1997, 2001).

Matched Microdata Analyes

- We match administrative microdata for food stamps in IL and MD to ACS, CPS and SIPP.

- The approach eliminates some worries about aggregate comparisons
    - unit nonresponse bias that weighting doesn't solve
    - universe differences
    - Overreporting may offset some underreporting

- Allows us to examine how microdata analyses using program receipt might be biased.

- Can examine how errors vary by observables & reasons for errors (haven't focused on this yet)

Administrative Food Stamp Data

- IL and MD food stamp data.

- Contains monthly indicators of receipt

- Data matched using a Protected Identification Key or PIK (transformation of SSN).

- Food stamp data are supposed to have verified SSNs for all those in assistance unit. The SSNs are converted to PIKs for 96.4 percent of all records in IL, 97.8 percent in MD.

ACS Data

- 2001 SS01 (ACS).

- Census Bureau uses name, address, DOB to create PIKs. Successful for at least one member of 92.7 percent of households in IL, 94.9 percent of households in MD.

- PIKs not missing at random. We multiply the survey weights by the inverse of the probability of having a PIK

CPS Data

- CPS ASEC
  - 2002-5 in IL
  - 2002-4 in MD
- PIK rates lower in CPS than ACS; 68 percent for IL, 81 percent for MD
- PIKs not missing at random. Survey weights multiplied by inverse of probability of having a PIK

SIPP Data

- ## SIPP 2001 Panel
  - Late 2001-2003 IL
  - Late 2001-2003 in MD

- ## SIPP 2004 Panel
  - 2004 and part of 2005 in IL

- PIK rates low in 2001 panel, then rise in 2004 panel when survey moves to passive consent.

- PIKs not missing at random. Survey weights multiplied by inverse of probability of having a PIK

Implications of transfer misreporting

- Misreporting has important effects
- If transfers are under-reported as aggregate data suggest:
  - the income distribution appears worse,
  - the effects of transfers in improving the distribution is understated,
  - program takeup is biased downward, and
  - analyses of other program effects are biased.
  - Here, we will see that the determinants of program receipt are biased.

Reporting Errors

- **ACS**
  - False Negative rates: 32% in IL, 37% in MD.
  - False Positive rates: 0.8% in IL, 0.5% in MD.
  - Net understatement: 23% in IL, 29% in MD.
- **CPS**
  - False Negative rates: 48% in IL, 53% in MD.
  - False Positive rates: 1.0% in IL, 0.4% in MD.
  - Net understatement: 39% in IL, 46% in MD.
  - IL error rates higher in last year, MD much higher in last year

Reporting Errors

- ## SIPP
  - False Negative rate: 23% in combined IL and MD data
  - False Positive rate: 1.6% in combined data
  - Small net overstatement of food stamp receipt?

- ## For each of the surveys, the samples include imputed observations.
  - Informative on biases in substantive analyses that usually use imputed data, but maybe not best sample to determine reasons for mis-reporting.

Results: error determinants in ACS

- Probits conditioning on administrative receipt status
- False negatives more common for
  - older households
  - non-whites
  - higher income households
  - those with fewer FSP months received
  - those without reported PA receipt.
  - the urban
  - those not imputed
  - in IL if male and more educated
  - in MD if unemployed
- Many other explanatory variables examined: language, CATI, CAPI, etc.
- False positives also vary with characteristics

Results: participation determinants.

- Two approaches:
    - Just survey data (standard approach).
    - Survey and administrative data combined. Use administrative dependent variable.

- We estimate probit models using the two approaches.

- We compare the coefficients and the average derivatives estimated from the two approaches.

Does it matter?

- Test statistics always reject that the survey data and the combined data give you the same answer.

- A more important question is whether the results are substantively different.

ACS substantive differences

- If you follow the standard approach and use only survey data, you would sharply understate participation by

  - single parents and non-whites in both states,

  - older households, native speakers, and those with small families in IL, and

  - those with low incomes in MD.

- In the ACS you would also get the patterns of multiple program participation wrong, but the errors are multidimensional and differ across states.

Half Empty or Half Full: Half Full

- One might wonder if the ACS and CPS provide useful information on food stamps given false negatives of one-third or one-half. Even with lower error rates in the SIPP you might worry.

- The information that one learns about receipt though is very similar using the administrative data. Almost all signs are unchanged, and statistical significance is mostly the same.

- This result is likely to be analysis specific.

- Other analyses affected more severely, e.g. find substantive differences in analyses of distributional consequences using data from NY.

Imputation Summary

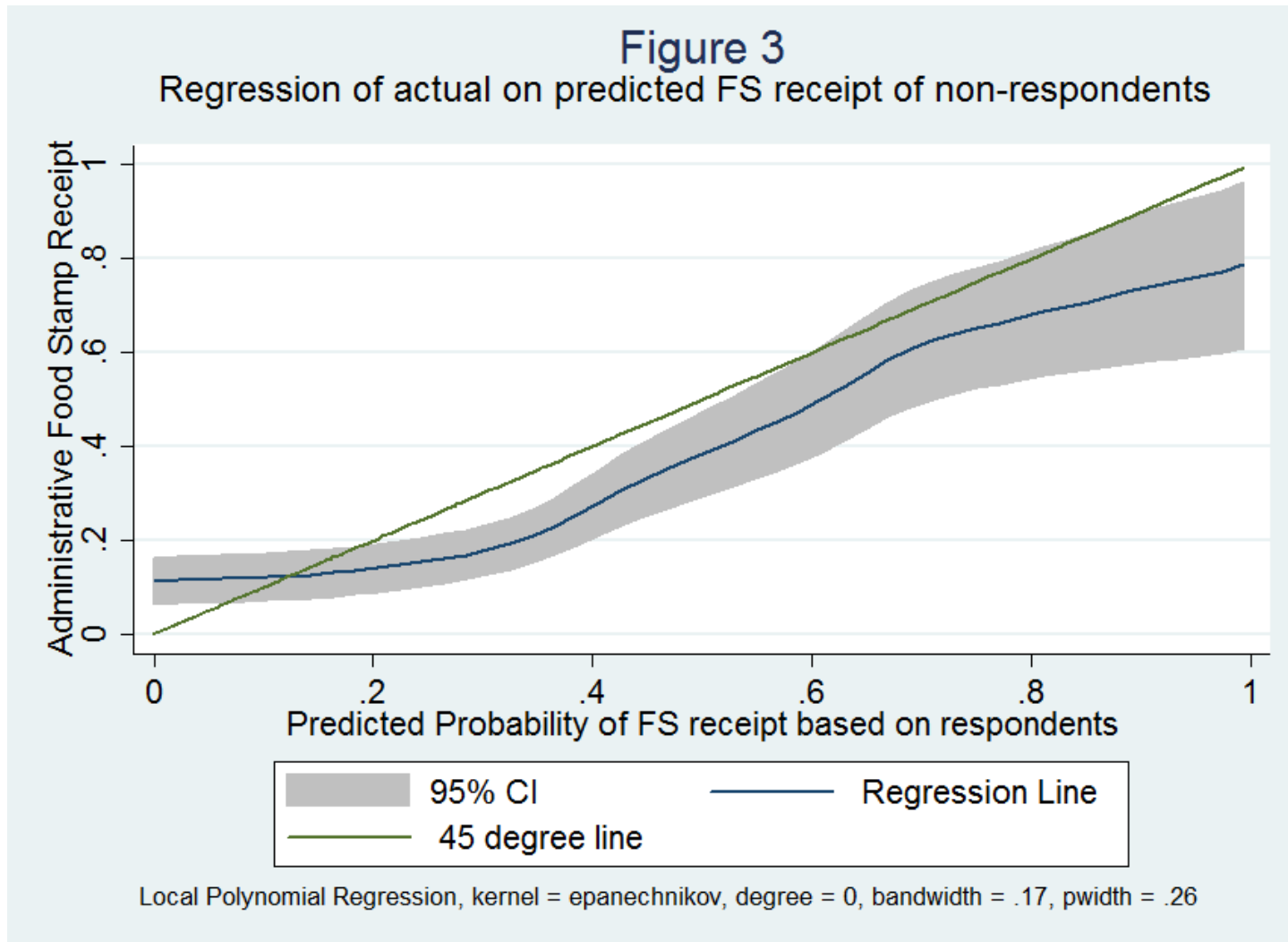- Imputation rates are high and rising. They are typically over 20 percent, but are often quite a bit higher for certain years and surveys.

- Dollar and month imputation are similar.

- Recipiency (yes/no) often imputed, generally responsible for about 10 percent of dollars.

- Imputation higher in SIPP (less true for FSP months) than CPS, so narrows the data quality difference between them somewhat.

Nonresponse: Conditionally Random?

- Test missing conditionally at random using the SIPP
- First, estimate take-up model for respondents and non-respondents separately using administrative receipt
- χ^2 - test rejects coefficient equality (p-value=0.00001)
- Predict probability of receipt for non-respondents using take-up model of respondents
- Regress actual receipt on the predicted probability for non-respondents
- If MAR holds (for the administrative measure) this should yield a 45-degree line

Nonresponse: Conditionally Random?

Figure 3
Regression of actual on predicted FS receipt of non-respondents

Local Polynomial Regression, kernel = epanechnikov, degree = 0, bandwidth = .17, pwidth = .26

Should one use the imputed observations?

- Many researchers drop imputed observations. Should they?

- We have a measure of truth so we should be able to answer this question.

- Are we closer to the combined participation estimates when the survey only estimates use or do not use the imputed observations?

Results on imputations

- Construct chi-square stat for the difference between the combined (admin dependent variable) and survey only estimates.

- For the ACS better off including the imputed observations.

- For the CPS, not very different when include or exclude them.

- For the SIPP, much better off including the imputed observations.

Conclusions

- Error rates high for food stamp reports in surveys.
- Errors matter for estimates of the determinants of program participation, but maybe not as much as might have thought.
- Survey and administrative data can be usefully combined.
- Results supportive of aggregate analyses of errors being meaningful
- Mixed support for assumptions of some correction methods that do not rely on matched data.
- Matched data can be used to examine imputations.
  - Underlying assumptions violated
  - Imputed values improve estimates in some cases.
- Because survey data are important for so many policy questions, the general issue of declining survey quality has many implications that we have just begun to work on.

Imperfect Linking and Biases

- Partly PIKed households (14% in ACS, approx. 20% in CPS); state movers follow same argument.

- Let the 2 x 2 matrix of row probabilities be:

  Survey

  p_{00} p_{01}

  Admin

  p_{10} p_{11}

  Row probabilities sum to 1; 0= don't receive, 1=receive.

  Let p_1 be the probability of reporting receipt for people

  affected (moved into the first row) by this issue.

  Let p' be the matrix for those unaffected.

  Then, if $p'_{11} > p_1 > p'_{01}$, false negatives biased down,

  false positives biased up.

- Outright PIKing errors (when information wrong) have different bias. Could lead to overstatement of false negatives.

Table 1 – Mis-reporting of Food Stamp Receipt, 2001 ACS, Full Sample			
	ACS Report		
Administrative Receipt	No Food Stamps	Food Stamps	Total
Illinois			
No Food Stamps	19,630	88	19,718
	4,193,387	34,883	4,228,270
	91.15	0.76	91.91
	99.18	0.83	100.00
	97.24	12.10	91.91
Food Stamps	321	728	1,049
	118,834	253,289	372,123
	2.58	5.51	8.09
	31.93	68.07	100.00
	2.76	87.90	8.09
Total	19,951	816	20,767
	4,312,222	288,172	4,600,393
	93.74	6.26	100.00
	93.74	6.26	100.00
	100.00	100.00	100.00

Notes: The entries in each cell from top to bottom are sample count, population estimate, overall %, row %, column %. Estimates are weighted by household weight adjusted for PIK probability.

Table 1 – Mis-reporting of Food Stamp Receipt, 2001 ACS, Full Sample			
	ACS Report		
Administrative Receipt	No Food Stamps	Food Stamps	Total
Maryland			
No Food Stamps	9,042	33	9,075
	1,880,871	9,615	1,890,485
	93.39	0.48	93.86
	99.49	0.51	100.00
	97.66	10.92	93.86
Food Stamps	163	296	459
	45,121	78,454	123,574
	2.24	3.90	6.14
	36.51	63.49	100.00
	2.34	89.08	6.14
Total	9,205	329	9,534
	1,925,991	88,069	2,014,060
	95.63	4.37	100.00
	95.63	4.37	100.00
	100.00	100.00	100.00

Notes: The entries in each cell from top to bottom are sample count, population estimate, overall %, row %, column %. Estimates are weighted by household weight adjusted for PIK probability.

Table 3 – Mis-reporting of Food Stamp Receipt, CPS, Full Sample			
	CPS Report		
Administrative Receipt	No Food Stamps	Food Stamps	Total
Illinois 2002-2005			
No Food Stamps	6,836	78	6,914
	17,267,477	170,642	17,438,119
	89.32	0.88	90.21
	99.02	0.98	100.00
	94.98	14.84	90.21
Food Stamps	452	459	911
	912,736	980,703	1,918,714
	4.72	5.07	9.80
	48.21	51.79	100.00
	5.02	85.18	9.80
Total	7,288	537	7,825
	18,180,213	1,151,345	19,331,558
	94.04	5.96	100.00
	94.04	5.96	100.00
	100.00	100.00	100.00

Notes: The entries in each cell from top to bottom are sample count, population estimate, overall %, row %, column %. Estimates are weighted by household weight adjusted for PIK probability.

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Table 3: Misreporting of Food Stamp Receipt, SIPP, Full Sample

	SIPP Report		
Administrative Receipt	No Food Stamps	Food Stamps	Total
No Food Stamps	54731963	912735	55644698
	0.925	0.015	0.941
	0.984	0.016	1.000
	0.986	0.251	0.941
	9973	189	10162
Food Stamps	803748	2718842	3522590
	0.014	0.046	0.060
	0.228	0.772	1.000
	0.014	0.749	0.060
	165	628	793
Total	55535712	3631577	59167288
	0.939	0.061	1.000
	0.939	0.061	1.000
	1.000	1.000	1.000
	10138	817	10955

Notes: The entries in each cell from top to bottom are sample count, population estimate, overall %, row %, column %. Estimates are weighted by household weight adjusted for PIK probability.

Results: error determinants in CPS

- **False negatives more common for**
  - older households in IL, reverse MD
  - higher income households (IL)
  - those with fewer FSP months received
  - those without reported PA or housing benefit receipt.
  - those with true TANF receipt
  - those imputed
  - those surveyed in most recent years (strong in MD)
- **Smaller samples in CPS mean less precision**
- **Many other determinants examined**
- **False positives also vary with characteristics**

Results: errors in the SIPP

- **False negatives more common for**
  - higher income households
  - Non-white households
  - those with fewer FSP months received
  - those with longer time since received.
  - Certain family types
  - those who do not report TANF receipt or housing assistance receipt (not conditional on admin receipt)
- **Smaller samples in the SIPP mean less precision**
- **Many other determinants examined**
- **False positives also vary with characteristics**

	Survey data with imputed	Survey data without imputed	Combined Data	Equality Test p-value, with imputed	Equality test p-value, without imputed
Single, with children	0.1076	0.0991	0.1429	0.0941	0.0424
	(0.0247)	(0.0252)	(0.0272)		
Number of members under 18	0.0188	0.0130	-0.0066	0.0420	0.1415
	(0.0099)	(0.0100)	(0.0145)		
Number of members 18 or older	0.0027	0.0026	-0.0201	0.0562	0.0529
	(0.0111)	(0.0106)	(0.0138)		
Number of members PIKed	0.0145	0.0148	0.0692	0.0000	0.0000
	(0.0076)	(0.0078)	(0.0131)		
Age 50-59	-0.0981	-0.0943	-0.0405	0.0245	0.0440
	(0.0261)	(0.0256)	(0.0294)		
Age 60-69	-0.1144	-0.1005	-0.0806	0.2454	0.5427
	(0.0278)	(0.0272)	(0.0320)		
Age >= 70	-0.1641	-0.1407	-0.1619	0.9656	0.3037
	(0.0313)	(0.0307)	(0.0329)		
White	-0.0380	-0.0418	-0.0801	0.0053	0.0153
	(0.0178)	(0.0178)	(0.0191)		
Poverty index	-0.0007	-0.0007	-0.0007	0.5801	0.8840
	(0.0001)	(0.0001)	(0.0001)		
Reported public assistance receipt	0.3189	0.2970	0.2386	0.0197	0.0969
	(0.0240)	(0.0240)	(0.0315)		
Reported housing assistance receipt	0.1461	0.1322	0.1811	0.0457	0.0068
	(0.0184)	(0.0180)	(0.0217)		
Observations	4,591	4,379	4,146		
Joint significance test P-value				0.0000	0.0000

Table 7 – Food Stamp Receipt in Survey Data and Combined Data, 2001 Illinois ACS, Probit Average Derivatives, Households with Income less than Twice the Poverty Line

CPS substantive differences

- If you follow the standard approach and use only survey data you would sharply understate participation by
  - single parents, non-whites, and those with low incomes in IL, and
  - those with young children in MD.
- Many other CPS differences are substantial, but not significant or only weakly so.
- In the CPS, you would get the time trend badly wrong, i.e. you would miss that participation is increasing over time.

SIPP substantive differences

- If you follow the standard approach and use only survey data you would understate food stamp participation by
  - households with few adults
  - those not 30-39,
  - nonwhites,
  - those not employed,
  - the disabled,
  - those not reporting TANF receipt.
- Strongly reject model of receipt determinants that uses only survey data.

Hot Deck Imputation Methods

- Match observations with missing data to a donor observation

- ACS: HHs (not in group quarters) put in 20 cells defined by full interactions of

  - Family type
  - Presence of children
  - Poverty status
  - Race of reference person

- Done by State and lowest level of geography available

- CPS: 648 cells, but at national level.

- SIPP: haven't investigated methods yet.