

Measurement Error in the CE: Monitoring the Quality of the Estimates

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Methods Symposium

Roger Tourangeau, Lucilla Tan, Brian Meekins
and Brandon Kopp, July 15, 2014

Introduction

- Based on our review of the state of knowledge about the error in the Consumer Expenditure Survey (CE), we concluded that less was known than was desirable
- In addition, we should be able to track how well the CE is doing over time
- As a practical matter, most of the measures proposed track overall error in the CE, not just measurement error

MMMI approach

- Many methods have been used to assess error in the CE, each with their strengths and weaknesses
- We recommend an multi-method-multi-indicators (MMMI) approach that consists of three main categories:
 - Internal indicators (based solely on CE data or paradata)
 - External indicators (compare estimates from the CE to an external data source)
 - Comparison of CE production estimates with “gold standard” interviews

MMMI approach—II

- Precisely because no one approach is perfect, we think coming at this from several angles will provide a much more comprehensive picture of the CE quality
- It is time to move away from reliance on the PCE estimates as the main basis for evaluating the CE

Criteria for External Indicators

- **Comparability:** Is the external estimate comparable to the CE
- **Consistency:** Do the estimates show a similar magnitude difference from CE estimates over repeated survey administrations?
- **Ease of producing the estimate:** How difficult are the benchmark estimates to produce? Can they be produced in a timely manner without undue burden on the CE Survey staff?
- **Timeliness and periodicity of the benchmark estimate:** What is the elapsed time between data collection and publication of the benchmark estimate? How frequently are the data collected?
- **Comprehensiveness:** Taken together do the various benchmarks provide an overall picture of error in CE estimates (across multiple sections, waves, and time periods)?

External Indicators

- Comparison to external data sources
- Two main external sources
 - Personal Consumption Expenditures from NIPA (National Income and Product Accounts)
 - Compare CE estimates with other surveys (e.g., MEPS, PSID, RECS)
- Weakness—Although PCE covers many categories and a lot of work has gone into establishing “concordance” of PCE/CE categories, errors in PCE are not well established; not clear external benchmarks are really more accurate than the CE

Some Candidate Indicators

CE Category	MEPS	PSID	NHEA
Physician Services	X		X
Dental Services	X		X
Eyecare services	X		
Nonphysician services (excluding dental and eyecare)	X		X
Hospital-inpatient	X	X	X
Prescription drugs	X	X	X
Vision aids	X		

Some Candidate Indicators--2

CE Category	ACS	AHS	RECS	PSID	PCE
Electricity	X	X	X	X	X
Natural Gas	X	X	X		X
Total Other Fuels	X	X	X		
Fuel Oil		X	X		
Propane/LPG			X		
Kerosene			X		
Other Fuels (Wood, Coal, etc.)		X			
Water/Sewer	X	X		X	X
Garbage		X			X
Primary Mortgage	X	X		X	
Rent	X	X		X	
Homeowner's Insurance	X	X		X	X
Property Tax	X	X		X	

External Indicators

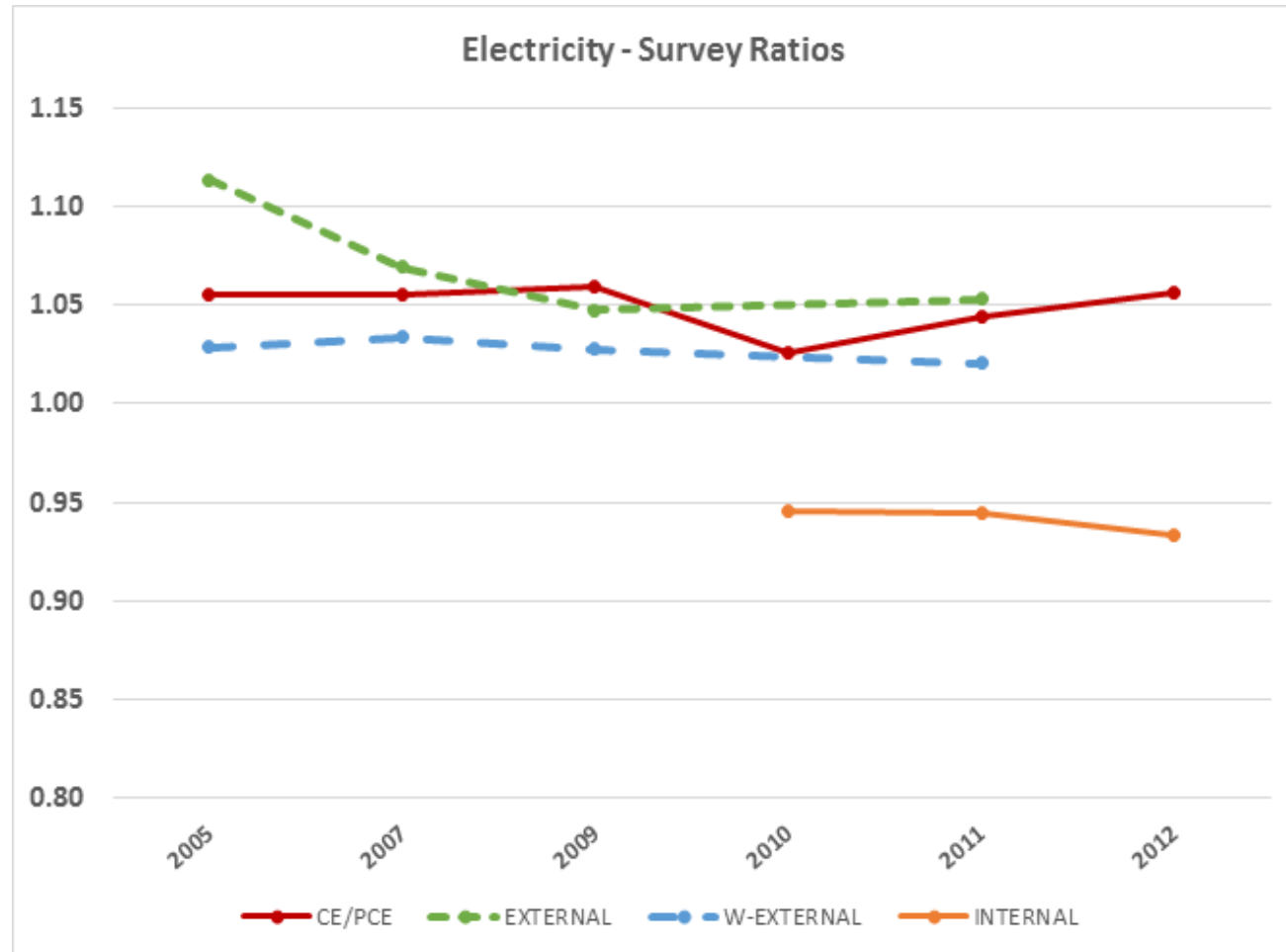
Expenditure Shares for our 3 illustrative examples

CE Category	Expenditure Share (2011)
Electricity	2.9%
Rent	6.1%
Prescription Drugs	1.0%
Average Annual Spending	\$49,705

Combining External Indicators

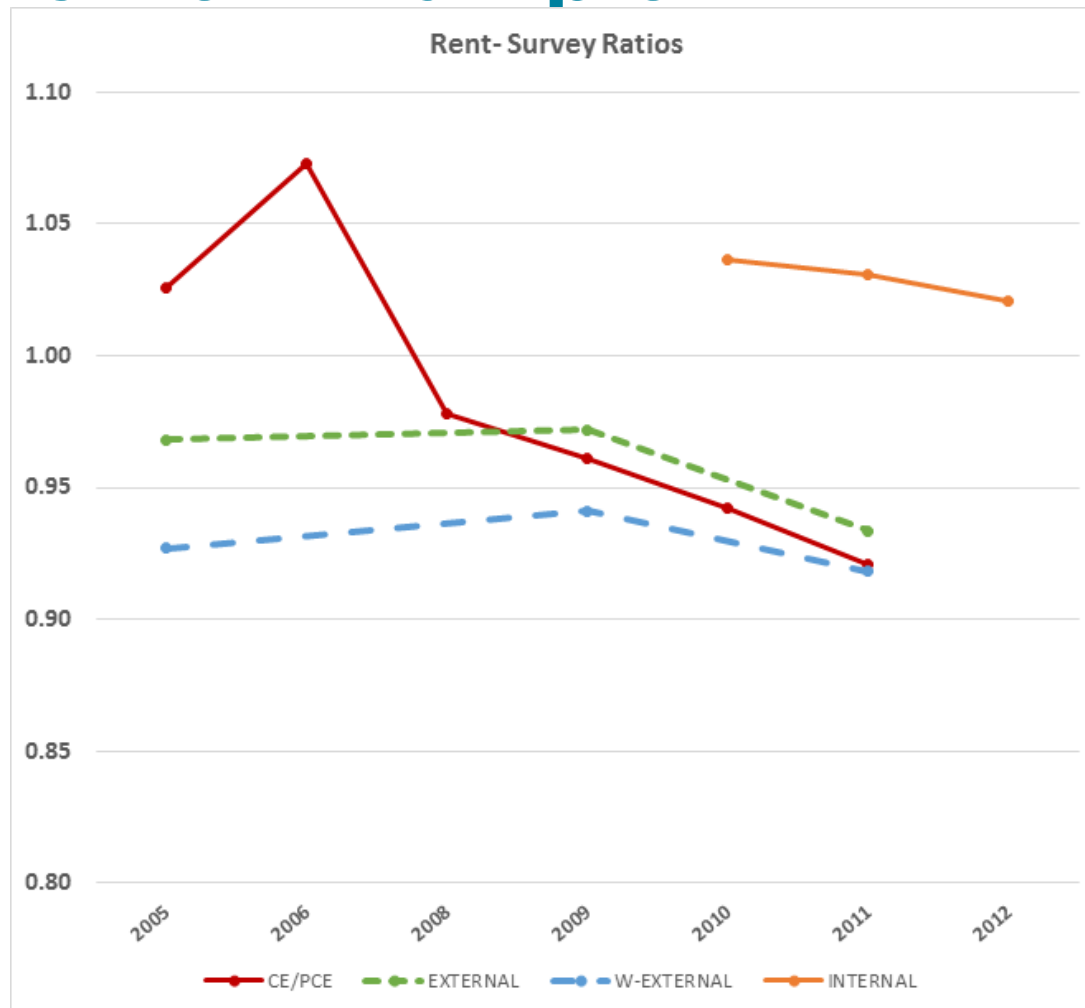
- To increase the robustness of the external comparisons, we recommend taking weighted averages of the external estimates for the commodity
- The weights would reflect the reliability of the ratio of the CE estimate to the external indicator over time and would downweight estimates that show large fluctuations over time
- For a given commodity category, a ratio $r_{j,t}$ is constructed for each selected implementation from source j (t), dividing the CE estimate for the commodity with the external source estimate.
- An average of the ratios is taken, where $\bar{r}_j = (\sum^T r_{j,t})/T$, where T is the total number of time points from external source j . Next a variance is computed, $s_j^2 = \sum^T (r_{j,t} - \bar{r}_j)^2$ for each external source j . The estimates from all external sources are then combined using a weighted average at each time, t .
- Where the weighted average is given by, $WR_t = \frac{\sum_{j=1}^J (\bar{r}_j * 1/s_j^2)}{\sum_{j=1}^J 1/s_j^2}$, where J is the total number of external sources

An Example



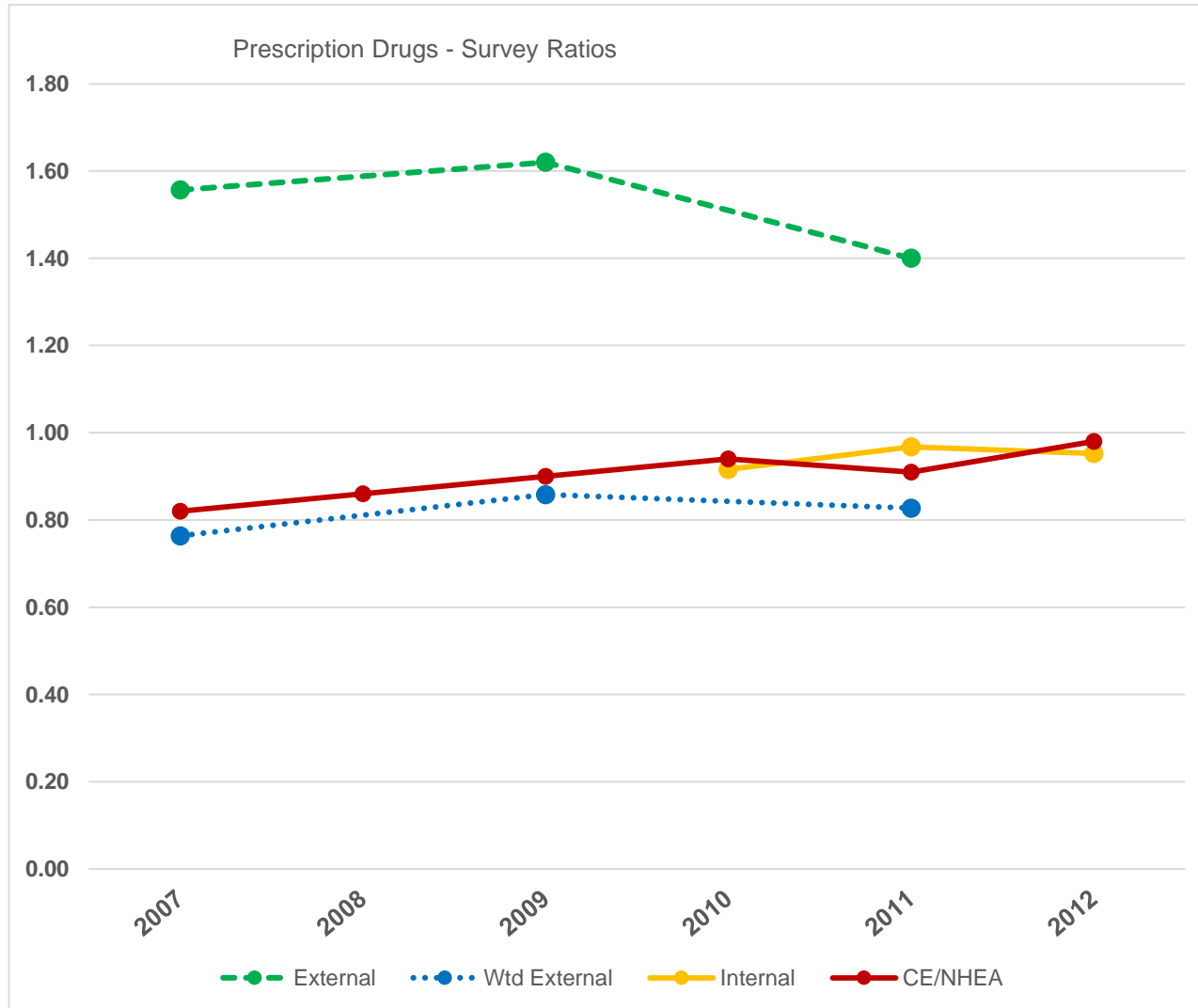
- The external sources for electricity are PCE, ACS, AHS, RECS, and PSID.

Another Example



- The external sources for rent are PCE, ACS, and AHS.

One More



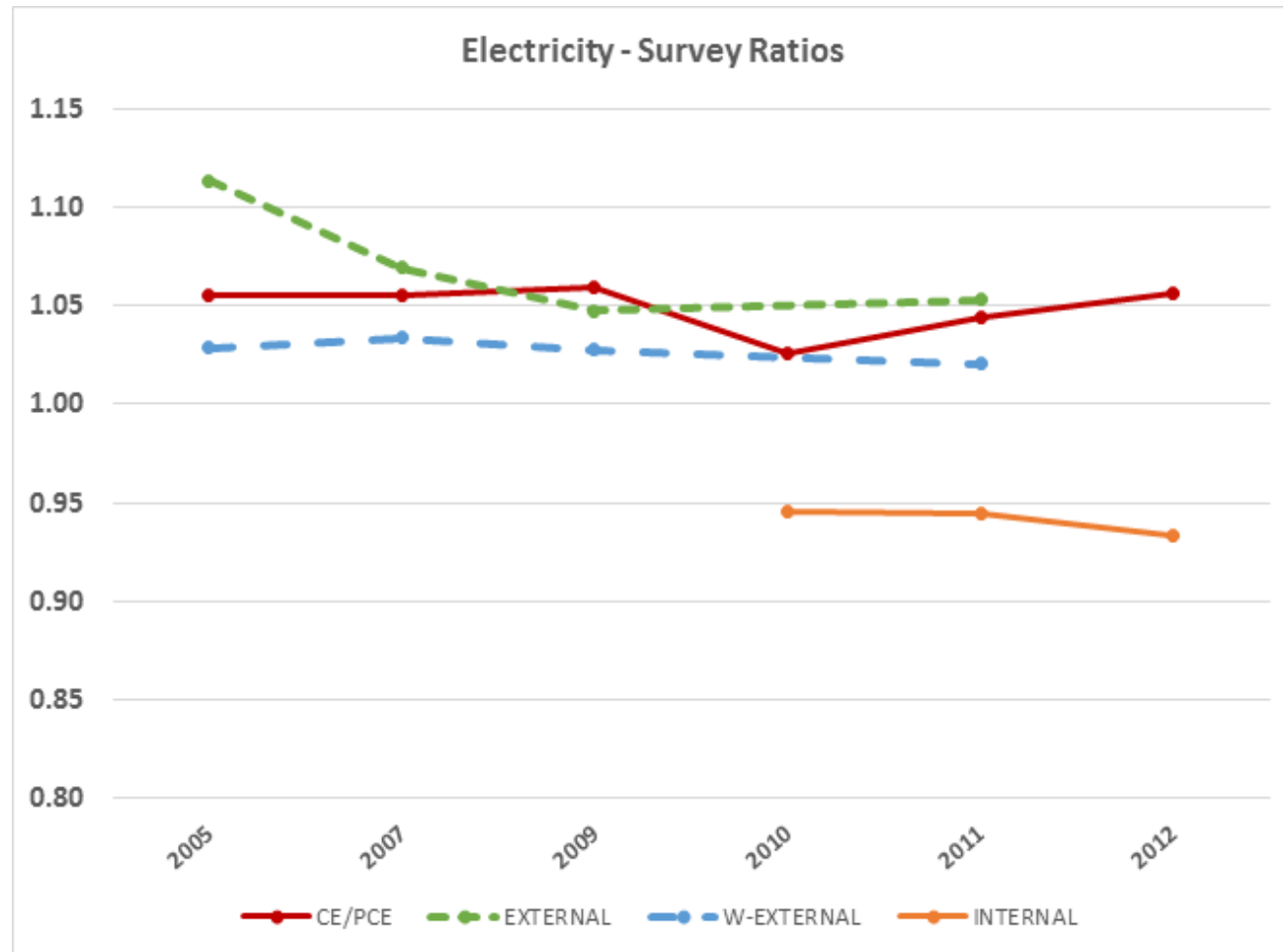
Internal Indicators

- Internal indicators should be robust, easy to interpret, and based on similar metric to the external indicators.
- Candidate indicators include both commodity- or section-specific indicators and interview-level indicators.
 - Section specific indicators:
 - ✦ record use
 - ✦ section interview time
 - General indicators
 - ✦ Willingness to provide income data
 - ✦ The number of attempts required to complete and interview
 - The indicators are then evaluated by examining their relationship with the reported expenditure of the commodity category. Those showing no relationship or a weak relationship with expenditure are discarded.

Latent Class Models for Combining Internal Indicators

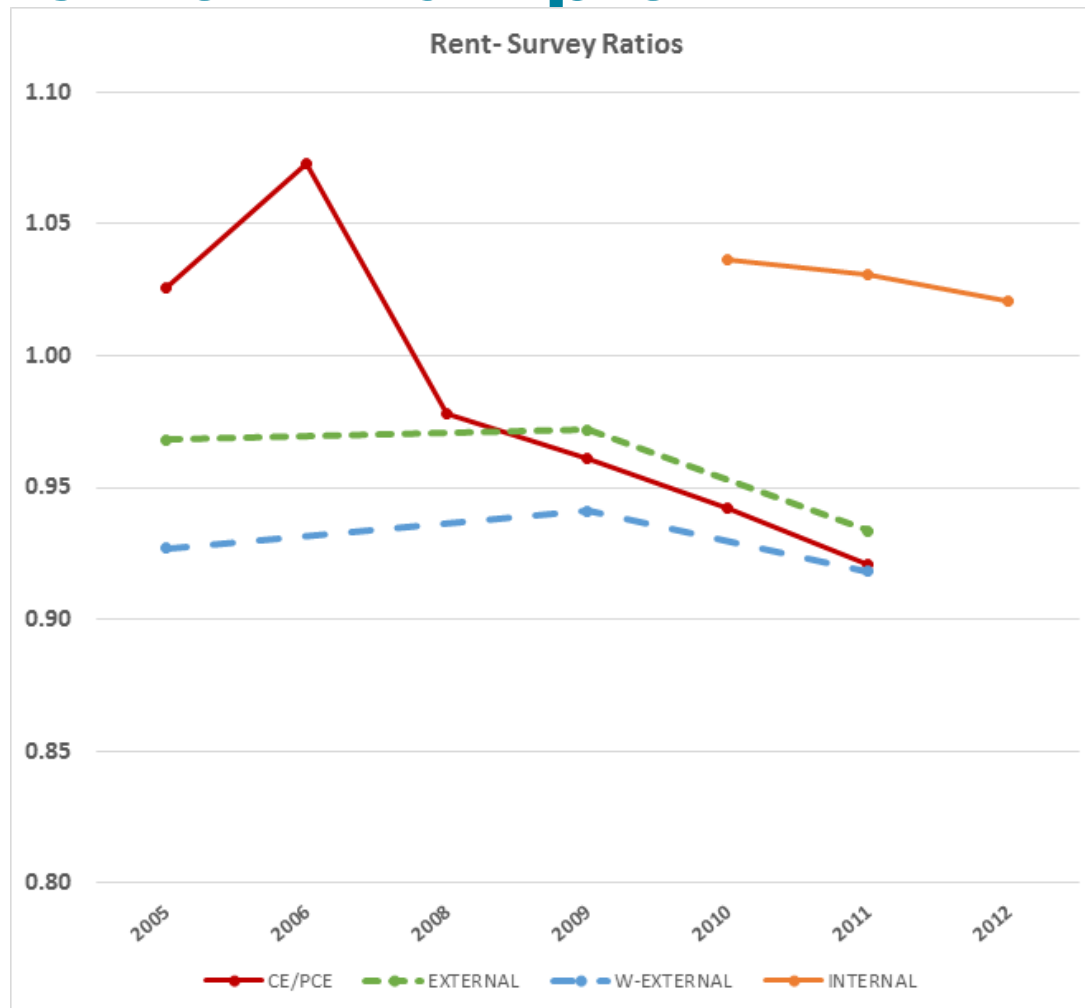
- Four variables seem to have strong relation to reporting across a number of commodity categories:
 - Use of the infobook (+);
 - Whether the interview is done by telephone (-);
 - Whether R used records (+);
 - Commodity-specific time (+)
- Classify respondents into one of two latent classes based on these variables
- Construct ratios of mean expenditures reported by all reporters over “good reporters”

An Example



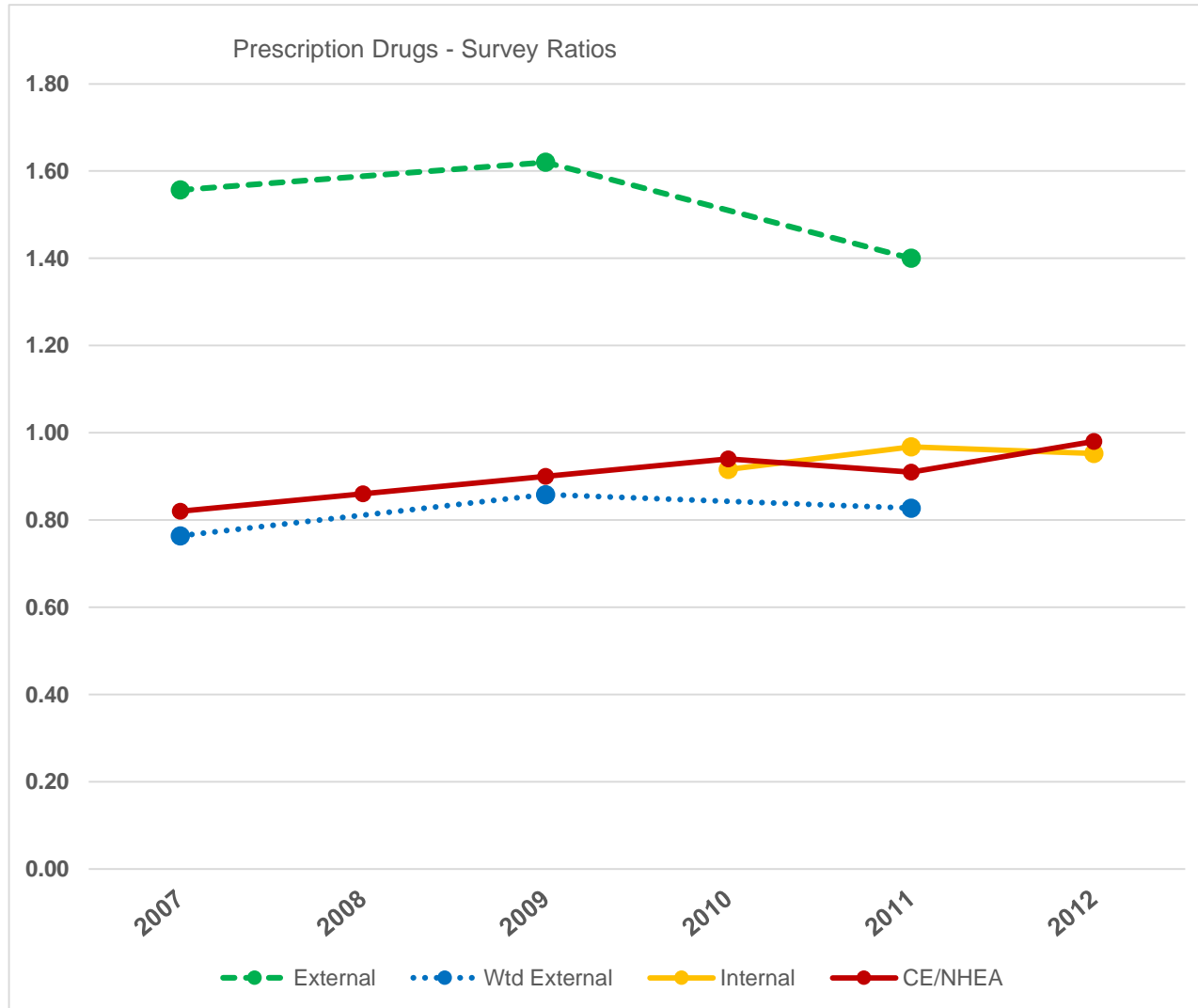
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Gold Standard Interview

- Key to assessing validity of internal and external indicators—Are the ratios in the internal and external indicators for a given commodity category similar (e.g., <1) to those from the gold standard interview (that is, $GS\ estimate/production\ estimate$)?
- Also, key to establishing level and direction of errors
- Borrows many features of the proposed new CE interview
- Five key features:
 - Initial bounding interview
 - Short reference period
 - Reliance on aided recall (records, diaries); prospective collection of records
 - Reduced burden
 - Contingent incentives

Some Topics for Research

- We see at least four factors as critical for successful gold standard interview
 - Incentives for records collection or diary keeping
 - Other inducements for encouraging record keeping
 - Length of reference period (burden versus stability of estimates)
 - Selection of commodity categories

Conclusions

- No one approach is perfect
- We recommend building on past efforts
- Develop a time series with multiple indicators
 - Internal indicators
 - External indicators
 - These are both inexpensive
 - Still, given the flaws, they should be supplemented with periodic (but regular) gold standard interview studies
 - Have overlapping expenditure categories to assess convergence across methods