Controlling for Prices before Estimating SPM Thresholds and the Impact on SPM Poverty Statistics

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2018 Federal Committee on Statistical Methodology Research and Policy Conference, Concurrent Session C-3

Washington, DC

March 7, 2018

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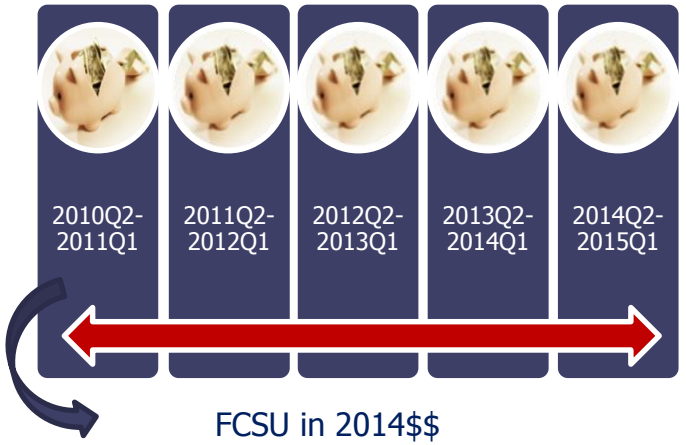
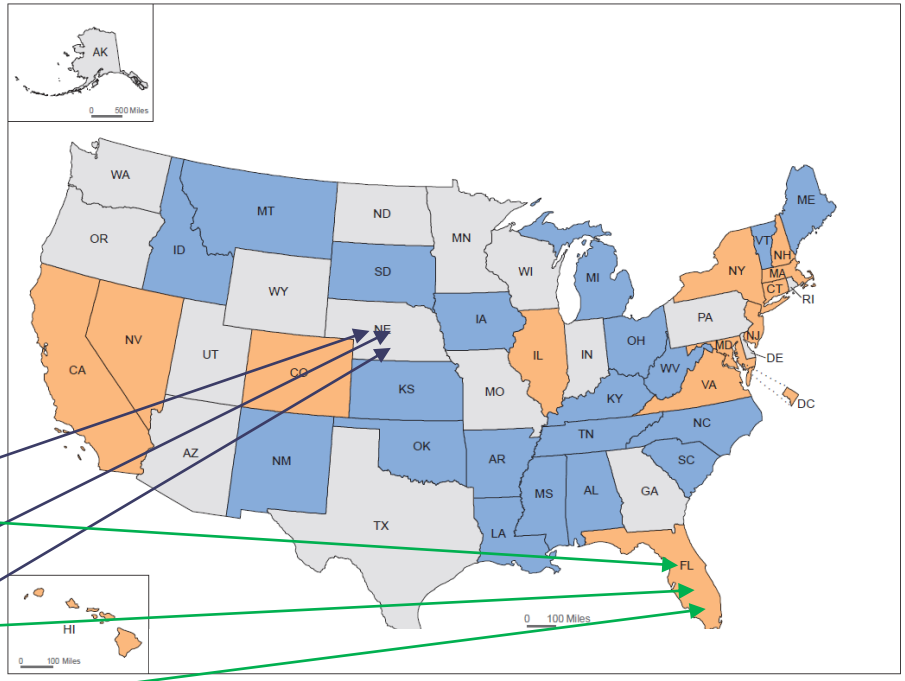
The Role of Prices in SPM Thresholds

Over Time to "Year"



from National to Geographic Areas



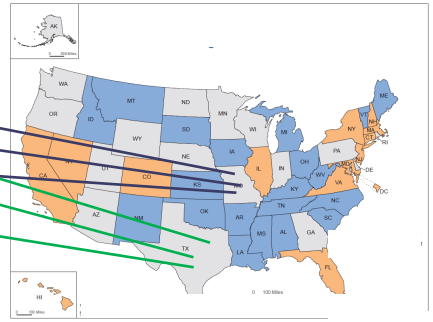
- 2A+2C Thresholds for 2014
  - Owners with mortgages
  - Owners without Mortgages
  - Renters

The Role of Prices

- *Currently…*
  1. *Converting 5 years of expenditures to threshold year dollars* using All Urban Consumers (CPI-U) for the U.S. City Average at ***CU level*** , ***prices across time***
  2. *Creating geographic area thresholds using* Median Rent Index (MRI) applied at ***threshold level*** to allow for *differences in* ***prices across area***

- *But*, spatial differences in shelter and utility costs are already embedded in the 2A+2C SPM thresholds (Bishop, Lee, and Zeager 2017)

- As currently published, *no attempt to account for spatial differences in housing costs* before producing "national average" SPM thresholds
  - Owners with mortgages
  - Owners without mortgages
  - Renters



- This Study
  - Is this a problem?
  - If yes, how to account for these differences before producing the thresholds?

Thresholds Production

- At the ***Consumer Unit Level***

$$FCSU_{i,yr} = F_i + C_i + S_i + U_i$$

$$FCSU_{i,2014} = \left(\frac{CPI_{2014}}{CPI_{yr}}\right) * FCSU_{i,yr}$$

  - Equivalize 2-Child $FCSU_{i,2014}$ expenditures to 2 Adults+2 Children (2A+2C) expenditures
  - Rank CUs by equivalized 2A+2C $FCSU_{i,2014}$ expenditures

- At ***2A+2C Level*** produce housing tenure-specific thresholds based on ***means within*** 30th-36th percentile range of $FCSU_{i,2014}$

$$SPM_{j,2014} = 1.2 * FCSU_{A,2014} - SU_A + SU_j$$

$$\frac{SU_j}{SPM_j} = \alpha_j = housing\ \ share\ of\ 2A{+}2C\ SPM\ j\ threshold$$

- At ***threshold level,*** apply geographical price adjustment (MRI) for sub-national thresholds

$$SPM_{sgj,2014} = [(\alpha_j * MRI_{sg}) + (1 - \alpha_j)] * SPM_{j,2014}$$

Proposal: Adjust for Spatial Differences in Housing Costs at the CU Level

Add Step before Thresholds Production

- At ***Consumer Unit Level***, move telephone to $F_i + C_i$ and out of housing $(S_i + U_i)$
- At ***Housing Group j Level for All CUs***, produce quality-adjusted normalized housing prices *(as owner or renter)* for $(S_i + U_i)$ for areas *a* $(QANP_{a,j})$
- At ***Consumer Unit Level***, adjust housing expenditures to reflect "national" dollars

$$FCSU'_{i,yr} = F_i + C_i + Tele_i + \frac{S_i + Ui}{QANP_{a,j}}$$

$$FCSU'_{i,2014} = \left(\frac{CPI_{2014}}{CPI_{yr}}\right) * FCSU'_{i,yr}$$

Continue as before….

Plan

- At BLS
  - Estimate regression models to produce quality-adjustment normalized prices (expenditures) for housing units *j*
    - Renter: rents + utilities
    - Owner with mortgage: shelter expenditures including for mortgage+ utilities
    - Owner without mortgage: shelter expenditures + utilities
  - Produce new "national average" 2A+2C SPM thresholds

- At Census Bureau (Trudi)
  - Produce subnational geographic areas thresholds using MRI (plus for other CU types)
  - Compare poverty rates with and without "price adjustment" at CU level

Advantages of Using CE Data for Initial Adjustment to CU-level S+U

- Quality-adjusted normalized prices based on same data as SPM thresholds
  - Consumer units
  - Housing units
  - Expenditures
  - Geographic areas
- Out-of-pocket expenditures, as basis of price adjustment, consistent with SPM concept of spending
- Quality adjustment based on large number of shelter unit characteristics
- Able to produce separate quality-adjusted normalized prices for
  - Owners with mortgages
  - Owners without mortgages
  - Renters

Data and Methods

- CE Interview Survey data 2010Q2-2015Q1
- Hedonic log housing (S+U) expenditures model with 42 areas (self-representing PSUs with other areas regrouped) and shelter unit characteristics
  - Based on model and approach of Martin, Aten, Figueroa (MAF, 2011) analyzing CPI Housing Survey and ACS data of rent and same geographic areas, first stage for RPPs
  - Separate models for owners with and without mortgages and renters
- Model specification

$$lnP_{ij} = a_0 + \sum_{i=1}^{M} a_i A_{ij} + \sum_{n=1}^{N} \sum_{j=1}^{J(n)} B_j^n Z_{ij}^n + e_{ij}$$

A_{ij}	set of area dummies
Z_{ij}^n	set of shelter unit characteristics
$i=1,\ldots M$	geographic areas
$j=1,\ldots, J(n)$	classifications
$n=1,\ldots,N$	characteristics

- Quality-adjusted S+U prices are function of a_0 and a_i; controlling for characteristics (~ holding shelter characteristics at average values); geometric means
- Quality-adjusted normalized S+U prices for each area with respective to U.S. Average (= 1.0) based on consumer unit population weights

Areas for which CE Quality-Adjusted Normalized Prices Produced			
In CPI Housing Survey Sample and CE Sample		**In CPI Housing Survey Sample and CE Sample**	
A102	Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD	D200	Midwest nonmetropolitan urban
A103	Boston-Brockton-Nashua, MA-NH-ME-CT	D300	South nonmetropolitan urban
A104	Pittsburgh, PA	D400	West nonmetropolitan urban
A109	New York City	X100	Northeast small metroplitan
A110	New York-Connecticut Suburbs	X200	Midwest small metropolitan
A111	New Jersey-Pennsylvania Suburbs	X300	South small metropolitan
A207	Chicago-Gary-Kenosha, IL-IN-WI	X499	West small metropolitan
A208	Detroit-Ann Arbor-Flint, MI		
A209	St. Louis, MO-IL	**In CE Sample Only**	
A210	Cleveland-Akron, OH	R100	Northeast rural
A211	Minneapolis-St. Paul, MN-WI	R200	Midwest rural
A212	Milwaukee-Racine, WI	R300	South rural
A213	Cincinnati-Hamilton, OH-KY-IN	R400	West rural
A214	Kansas City, MO-KS		
A312	Washington, DC-MD-VA-WV		
A313	Baltimore, MD		
A316	Dallas-Fort Worth, TX		
A318	Houston-Galveston-Brazoria, TX		
A319	Atlanta, GA		
A320	Miami-Fort Lauderdale, FL		
A321	Tampa-St. Petersburg-Clearwater, FL		
A419	Los Angeles-Long Beach, CA		
A420	Los Angeles Suburbs, CA		
A422	San Francisco-Oakland-San Jose, CA		
A423	Seattle-Tacoma-Bremerton, WA		
A424	San Diego, CA		
A425	Portland-Salem, OR-WA		
A426	Honolulu, HI		
A427	Anchorage, AK		
A429	Phoenix-Mesa, AZ		
A433	Denver-Boulder-Greeley, CO		

Housing Unit Characteristics

Renter and Owner Models

- Type of structure
- Number of bedrooms
- Number of full baths
- Number of half baths
- Total number of rooms
- Dwelling year of construction
- Central AC
- Off-street parking
- Survey years

Renter Model Only

- Energy utilities in rent
- Water, trash pickup in rent
- Public housing
- Subsidy received
- Rent as pay

Alternative Owner with Mortgage Model

- Number of mortgages
- Max number of months remaining to pay

Regression Results and Quality-Adjusted Normalized "Prices"

Overall Fit of Log-Linear Weight Regression Models Using CE Pooled Data 2010Q2-2015Q1

All Consumer Units		
Dependent Variable	**R Square**	**Un-weighted Observations**
Rent plus utilities	0.424	44,457
Owner with mortgages plus utilities	0.372	46,638
Owner without mortgages plus utilities	0.316	32,236

Consumer Units with 2 Children		
Dependent Variable	**R Square**	**Un-weighted Observations**
Rent plus utilities	0.509	5,123
Owner with mortgages plus utilities	0.448	8,092
Owner without mortgages plus utilities	0.481	1,471

Due to sample size concerns, use quality-adjusted normalized prices based on All CUs for thresholds

Comparing Quality-Adjusted Normalized "Prices"

	This Study for 2014			MAF (2011)		Renwick (2017)
	Renter S+U	Owner with Mortgage S+U	Owner without Mortgage S+U	CPI Housing Survey Rents (2005-2009)	ACS Rents (2005-2009)	MRI 2014[a]
Maximum	1.79	1.78	2.29	1.67	1.50	1.78
Minimum	0.61	0.72	0.68	0.60	0.62	0.59
Range	1.18	1.06	1.61	1.06	0.88	1.19
Ratio of Max to Min	2.93	2.47	3.36	2.78	2.42	3.02

[a] Based on 5-year American Community Survey median rents for 2-bedroom apartments with complete kitchens and full baths (Renwick 2017).

Example: Applying CE Normalized Quality-Adjusted Prices to Housing Expenditures at CU Level for 2A+2C

			Monthly Housing Expenditures for CUs with 2 Children	
		CE Quality-Adjusted Normalized "Prices" (all)	Unadjusted	Adjusted
Washington, DC-MD-VA-WV				
	Renter	1.461	$1,419	$971
	Owner with Mortgage	1.211	$2,544	$2,101
	Owner without Mortgage	1.234	$734	$595
Rural South				
	Renter	0.615	$487	$792
	Owner with Mortgage	0.721	$932	$1,293
	Owner without Mortgage	0.683	$294	$430

Example: Using CE Normalized Quality-Adjusted Prices to Adjust Housing Expenditures at CU Level for 2A+2C

$$FCSU'_{i,yr} = F_i + C_i + Tele_i + \frac{S_i + U_i}{QANP_{a,j}}$$

		Monthly Housing Expenditures		F+C+Telep Expenditures	FCSU $_i$	
		Unadjusted	Adjusted	Unadjusted	Unadjusted	With Adjusted SU
Washington, DC-MD-VA-WV						
	Renter	$1,419	$971	$500	$1,919	$1,471
	Owner with Mortgage	$2,544	$2,101	$500	$3,044	$2,601
	Owner without Mortgage	$734	$595	$500	$1,234	$1,095
Rural South						
	Renter	$487	$792	$500	$987	$1,292
	Owner with Mortgage	$932	$1,293	$500	$1,432	$1,793
	Owner without Mortgage	$294	$430	$500	$794	$930

Thresholds and Housing Shares

Impact of not Including Telephone in Housing on 2014 2A+2C SPM Thresholds and Housing Shares

- Important for Census Bureau geographic (MRI) adjustment for sub-national thresholds

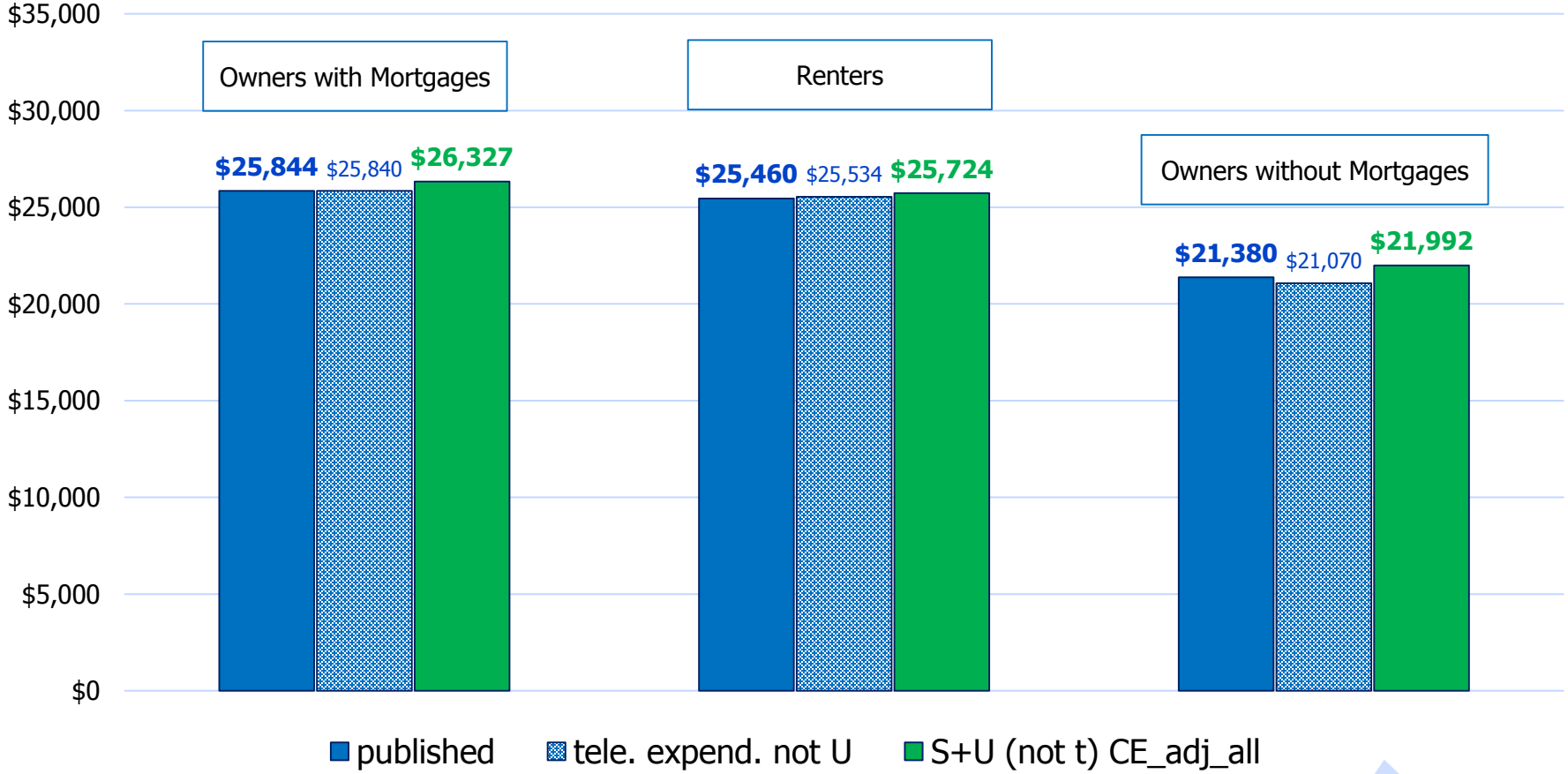
$$Published: \quad SPM_{j,2014} = 1.2 * FCSU_{A,2014} - SUt_{A,2014} + SUt_{j,2014}$$

$$Alternative: \quad SPM_{j,2014} = 1.2 * FCTSU_{A,2014} - SU_{A,2014} + SU_{j,2014}$$

		Published Threshold	Published Housing Share	Alternative Threshold	Alternative Housing Share
Owners with Mortgages		$25,844		$25,840	
	shelter		34.1%		34.1%
	utilities		16.6%		11.0%
	housing total		*50.7%*		*45.2%*
Renters		$25,460		$25,534	
	shelter		36.4%		36.3%
	utilities		13.6%		8.2%
	housing total		*50.0%*		*44.5%*
Owners without Mortgages		$21,380		$21,070	
	shelter		18.3%		18.5%
	utilities		22.2%		14.2%
	housing total		*40.5%*		*32.8%*

2014 2 Adults with 2 Children SPM Thresholds with and without Quality-Adjusted Normalized "Prices" Applied to S_j+U_j

$$SPM'_{j,2014} = 1.2 * FCTSU'_{A,2014} - SU'_{A,2014} + SU'_{j,2014}$$



Impact on Housing Shares of Adjusting S+U at CU Level

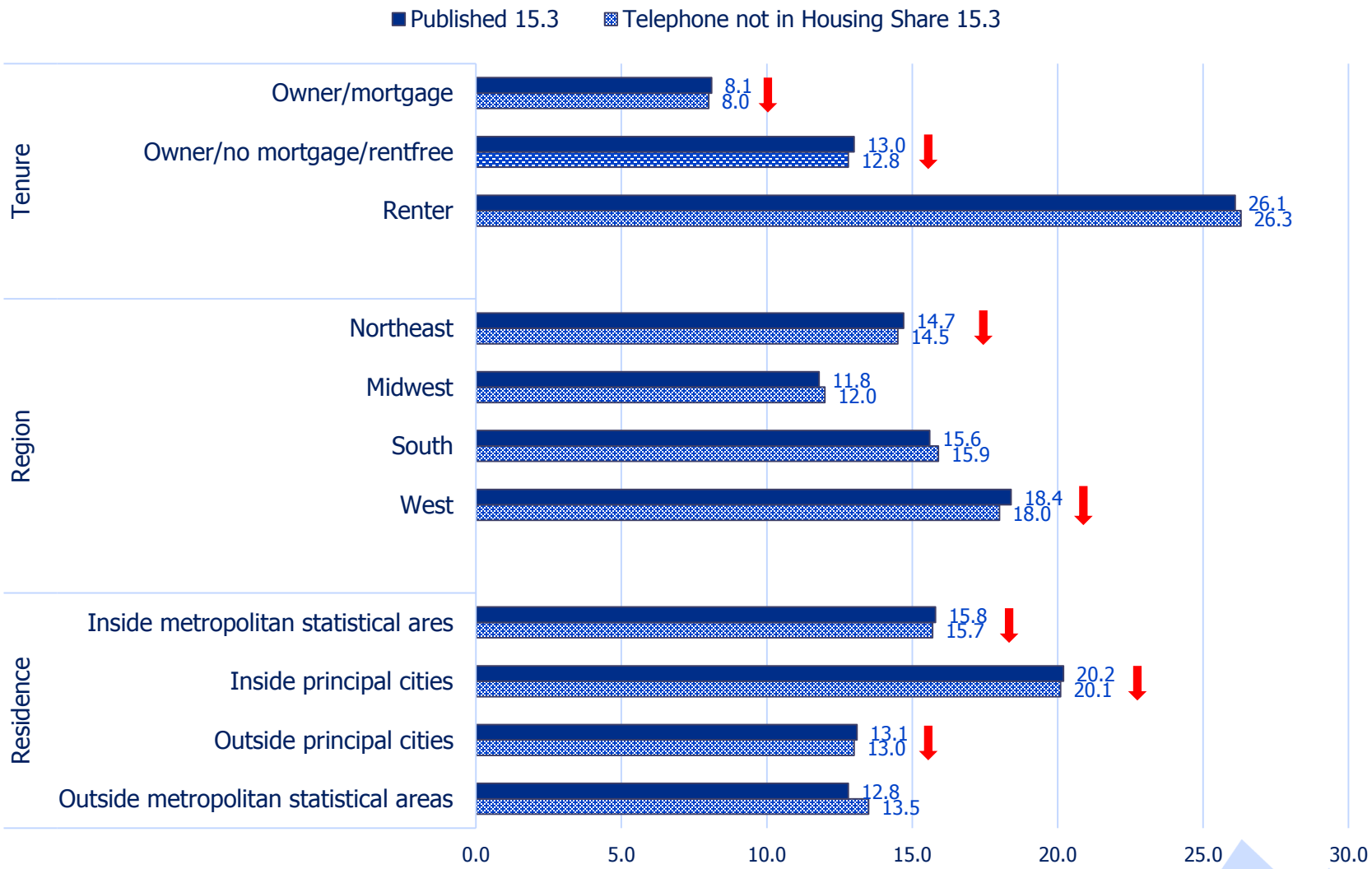
- Important for Census Bureau geographic (MRI) adjustment for sub-national thresholds

2014 SPM 2A+2C Thresholds Housing Expenditure Shares for 2014 2A+2C: Published and When Shelter and Utilities Price-Adjusted at CU Level

		Published	for Thresholds with S+U Adjusted at CU Level	
			Telephone in Housing Share	Telephone not in Housing Share
Owners with Mortgages				
	shelter	34.1%	34.1%	34.1%
	utilities	16.6%	16.6%	11.1%
	housing total	*50.7%*	*50.6%*	*45.1%*
Renters				
	shelter	36.4%	35.5%	35.5%
	utilities	13.6%	13.9%	8.3%
	housing total	*50.0%*	*49.5%*	*43.8%*
Owners without mortgages				
	shelter	18.3%	17.9%	17.9%
	utilities	22.2%	23.0%	16.4%
	housing total	*40.4%*	*40.9%*	*34.3%*

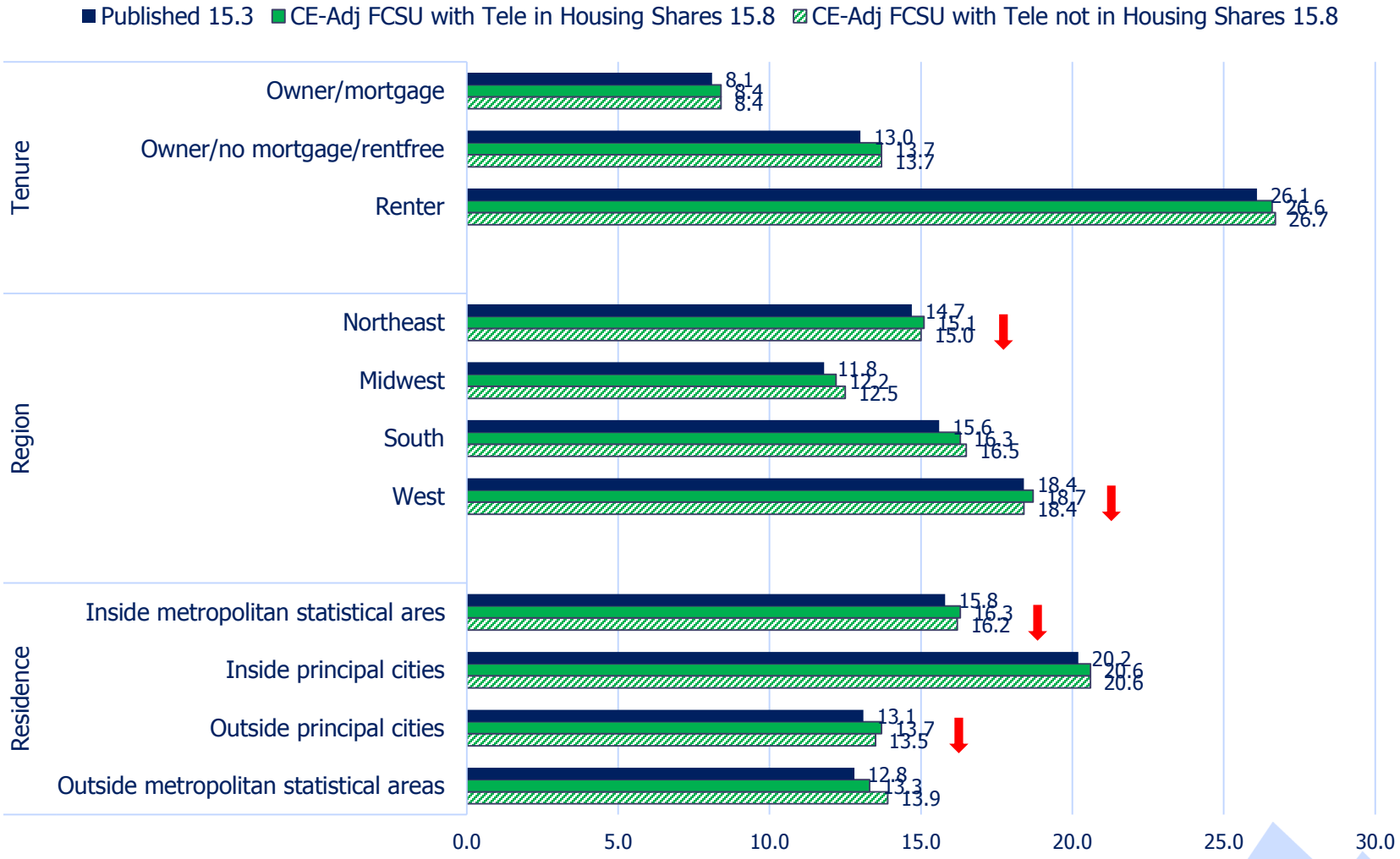
Poverty Rates

Percentage of SPM Poor Based on Published SPM Thresholds vs. Thresholds with Telephone not in Housing Share (no CE_adj): 2014



Special thanks to Trudi Renwick for producing these poverty rates (12_1_17)

Percentage of SPM Poor Based on Published SPM Thresholds vs. Thresholds with S+U Adjusted at CU Level Before Thresholds Calculated: 2014



Summary

- ***Question:*** Do spatial differences in shelter and utility costs are already embedded in the 2A+2C SPM thresholds matter?
- ***Answer:*** Results from this study suggests that the answer is "yes"
- ***Question, if "yes":*** How to account for these differences across areas and across housing tenure before producing thresholds?
- ***Answer:*** Proposal presented in this study

- Recommendations
  - Remove telephone expenditures out of housing share for Census Bureau adjustment to derive geographic SPM thresholds
  - Develop methods to account for spatial differences in shelter and utilities before estimating SPM thresholds

- Thoughts for the future regarding prices
  - Develop out-of-pocket or payments based indexes for across time and across area adjustments that match concept underlying the SPM, particularly issue for owners
  - For across time indexes, see experimental Household Costs Indices produced by UK Office for National Statistics (2017) with justification that out-of-pocket expenditures or payments "better reflect price changes as understood and experienced by the household" *[New Zealand and Australia]*

Contact Information

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Geographic Price Adjustment Applied to "National" Thresholds

- At ***2A+2C Threshold Level***
  - Adjust *S+U* share α_j of j thresholds for differences in prices across areas

$$SPM_{sgj,2014} = [(\alpha_j * MRI_{sg}) + (1 - \alpha_j)] * SPM_{j,2014}$$

where

α_j = *housing (S+U) share of j 2A+2C SPM threshold*

s = *state*

g = *specific metro area, other metro, or non-metro area*

j = *owner with mortgage, owners without mortgage, renter*

MRI = *Median rent index based on American Community Survey data (ACS) based on median rents plus utilities for 2-bedroom apartments with complete kitchens and full bath*

  - *Example:* Renter Threshold for San Jose-Sunnyvale-Santa Clara, CA: $\alpha_R = 0.5$ *and* $MRI = 1.81$

$$SPM_{R,SJ,2014} = [(0.5 * 1.81) + (1 - 0.5)] * SPM_{j,2014}$$

Inspiration and Guidance

- Bishop, Lee, and Zeager (2017): noted potential problem
- Renwick (2011 and other): Median Rent Index for "constant quality" rental unit based on American Community Survey
- Martin, Aten, and Figueroa (MAF, 2011): production of quality-adjusted normalized rent prices using CPI Housing Sample and ACS (2005-2009) –first stage for RPPs
- Renwick (2014): should there be a separate index for each of the three thresholds
- Garner and Verbrugge (2009): owner out-of-pocket expenditures and rents (rental equivalence) move differently
- UK Office for National Statistics (2017): out-of-pocket expenditures or payments "better reflect price changes as understood and experienced by the household" (Household Cost Index) *[New Zealand and Australia]*

- Topic to examine
- Quality-adjusted "prices" relative to national average prices
- Log linear regression model with area dummies and housing unit characteristics
- Produce separate "prices" for owners with and without mortgages and renters
- Use out-of-pocket expenditures for renters and owners

Shelter and Utilities

- Shelter for primary residence
  - For renters
    - Rents
    - Maintenance and repairs
    - Tenants insurance
  - For owners without mortgages
    - Property taxes
    - Home insurance
    - Maintenance and repairs
  - For owners with mortgages
    - Same as for owners without mortgages plus
    - Mortgage interest
    - Principal repayments
- Utilities for primary residence
  - Energy: natural gas, electricity, fuel oil, and other fuels
  - Water and other public services
  - *Telephone (do not include in utilities when producing CE-quality adjusted normalized prices)*

Correlations of CE Quality-Adjusted Normalized "Prices": All CUs versus CUs with 2 Children

		All Consumer Units		
		Renter S+U	Owner with Mortgage S+U	Owner without Mortgage S+U
Consumer Units with 2 Children	Renter S+U	0.960		
	Owner with Mortgage S+U		0.869	
	Owner without Mortgage S+U			0.976

Due to sample size concerns, use quality-adjusted normalized prices based on All CUs for thresholds

Correlations of CE Quality-Adjusted Normalized "Prices" with CPI and ACS Normalized Rents

	MAF (2011) Quality-Adjusted Normalized Rent Prices	
CE Quality-Adjusted Normalized "Prices" (2010-2014)	**CPI Housing Survey (2005-2009)**	**ACS (2005-2009)**
Renter S+U	0.951	0.931
Owner with Mortgage S+U	0.913	0.861
Owner without Mortgage S+U	0.633	0.546