Estimating the Distribution of Consumption-based Taxes with the Consumer Expenditure Survey

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Disclaimer

Analysis and conclusions presented here are my own and should not be interpreted as those of the Congressional Budget Office.

Uses of the CE

- Primary Use: Distribution of consumption-based taxes
  - Excise taxes
  - Cap and Trade
  - Value-Added Tax?
- Estimated distributional effect of these taxes depends critically on relationship between consumption and income observed in the CE

Average Excise Tax Rate By Income Quintile

Percent of Income

Lowest

Middle

Highest
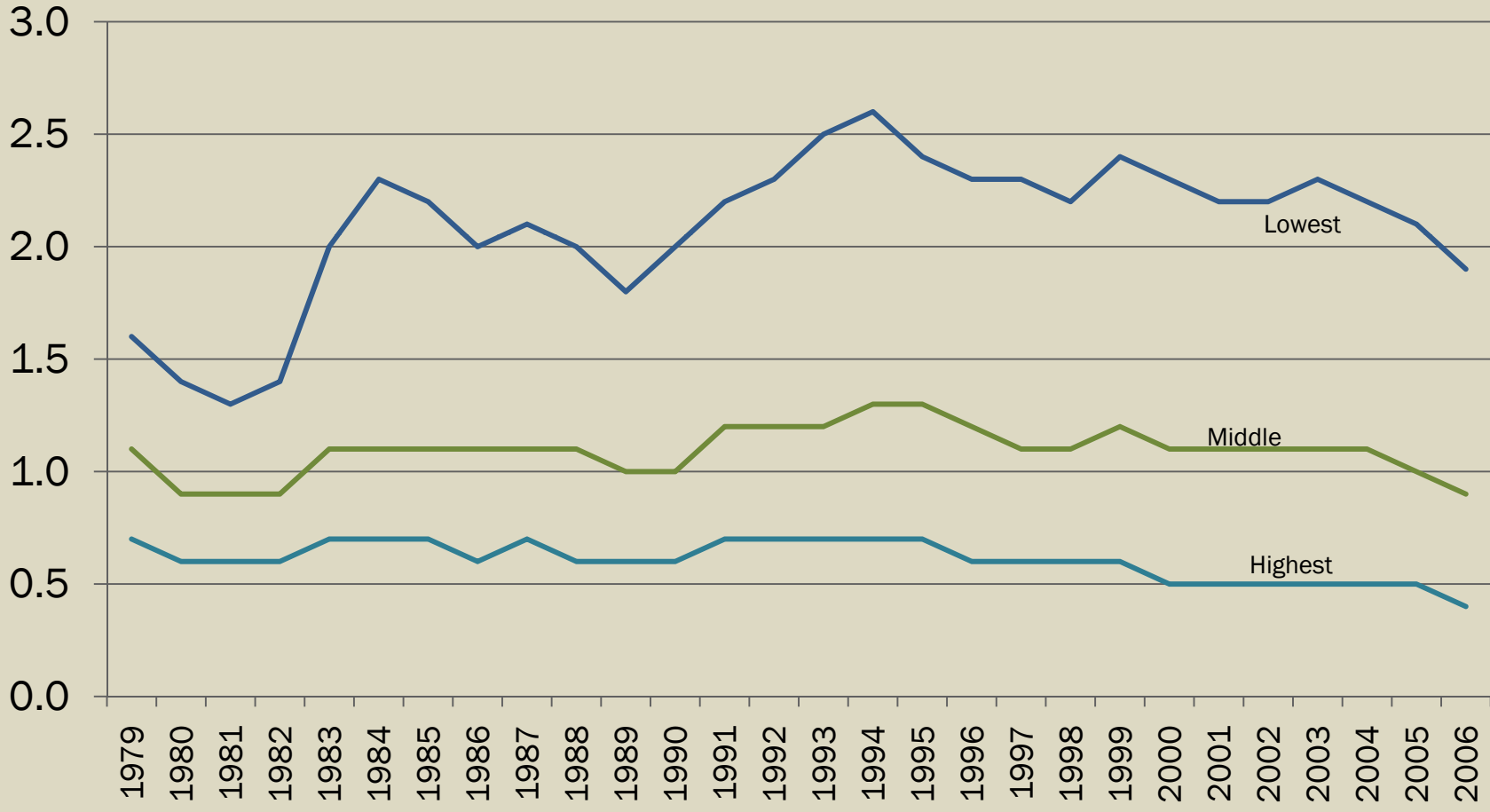
Average Gain or Loss in Households' Purchasing Power from the Greenhouse-Gas Cap-and-Trade Program in H.R. 2454: 2020 Policy Measured at 2010 Levels of Income

	Loss From Compliance Costs	Gain From Allowance Allocations and Other Transfers	Net Gain or Loss in Household Purchasing Power
Average Dollar Gain or Loss per Household			
Lowest Quintile	-430	555	125
Second Quintile	-560	410	-150
Middle Quintile	-685	375	-310
Fourth Quintile	-825	455	-375
Highest Quintile	-1,400	1,235	-165
Unallocated	-120	130	10
All Households	-900	740	-160
Gain or Loss as a Percentage of After-Tax Income			
Lowest Quintile	-2.5	3.2	0.7
Second Quintile	-1.5	1.1	-0.4
Middle Quintile	-1.3	0.7	-0.6
Fourth Quintile	-1.1	0.6	-0.5
Highest Quintile	-0.7	0.6	-0.1
Unallocated	-0.2	0.2	0.0
All Households	-1.2	1.0	-0.2

Approach To Cap and Trade Estimates

- Estimate price effect of the cap and trade program on final goods

- Impute expenditures by category from the CE to CBO's base distributional database (which is based on income tax records supplemented with data from the CPS)

- Apply price effect to spending to estimate the effect across income groups

Input-Output Model: Price Change Results

Food	0.5%
Clothing	0.2%
Nondurables	0.4%
Electricity	8.8%
Natural Gas	11.4%
Gasoline	4.2%
All Expenditures	0.7%

Assumes Total allowance revenues of about 0.7% of GDP

CE and NIPA aggregates

- CE aggregates generally below NIPA aggregates
- Applying price increases from NIPA based I/O model to spending in the CE does not yield the same revenue
- Differential across expenditure categories
- Adjusting for these has distributional implications

Imputing Consumption: Preparing the CE

- We convert quarterly cross-sections from the Interview Survey to annual panel files
  - Reweight complete and incomplete interviews
- Adjustments for diary spending
- Adjustments for renters with no reported utility spending
- Pool multiple panels
- Two Methods to impute from adjusted CE:
  - Hot deck imputation for most of sample
  - Regression imputation for high income households

Imputing Consumption:
Statistical Match SOI/CPS & CE

- Hot deck routine with both rigid and flexible matching criteria
  - Fixed: Region
  - Flexible: Age (+/- 1 year increments)
  -                  Income (+/- 2% increments)
  -                  Family Type (+/- 1 child only)
- For each record in base data file, match to a CE record within the same cell
- Carry over ratio of consumption to income, expenditure shares of different items
- Applied to:
  - Single households <$150,000 income
  - Married households <$300,000 income

Consumption to Income ratios, 2004

BLS Published Income and Consumption by Income Class, 2004

|	Population	Average Income	Average Consumption	Consumption/ Income
< $5,000	4.553	$2,626	$17,029	6.49
< $10,000	7.218	$7,856	$14,596	1.86
< $15,000	8.950	$12,554	$19,444	1.55
< $20,000	8.177	$17,427	$23,023	1.32
< $30,000	14.172	$24,892	$27,741	1.11
< $40,000	13.125	$35,107	$33,273	0.95
< $50,000	11.374	$45,052	$38,204	0.85
< $70,000	18.069	$59,920	$47,750	0.80
> $70,000	30.644	$118,332	$76,954	0.65
Total	116.282	$54,680	$43,395	0.79

NOTE:
BLS consumption concept does NOT equal CBO consumption concept

Consumption and income data are constructed based on
both survey and diary data.

Source: BLS, Consumer Expenditure Survey, 2004 Table 2. Income
before taxes: Average annual expenditures and characteristics.

Consumption-to-Income Ratios by Pre-tax-Income Quintiles, CEX 1994 - 2004

Quintile 1

Quintile 2

Quintile 3

Quintile 4
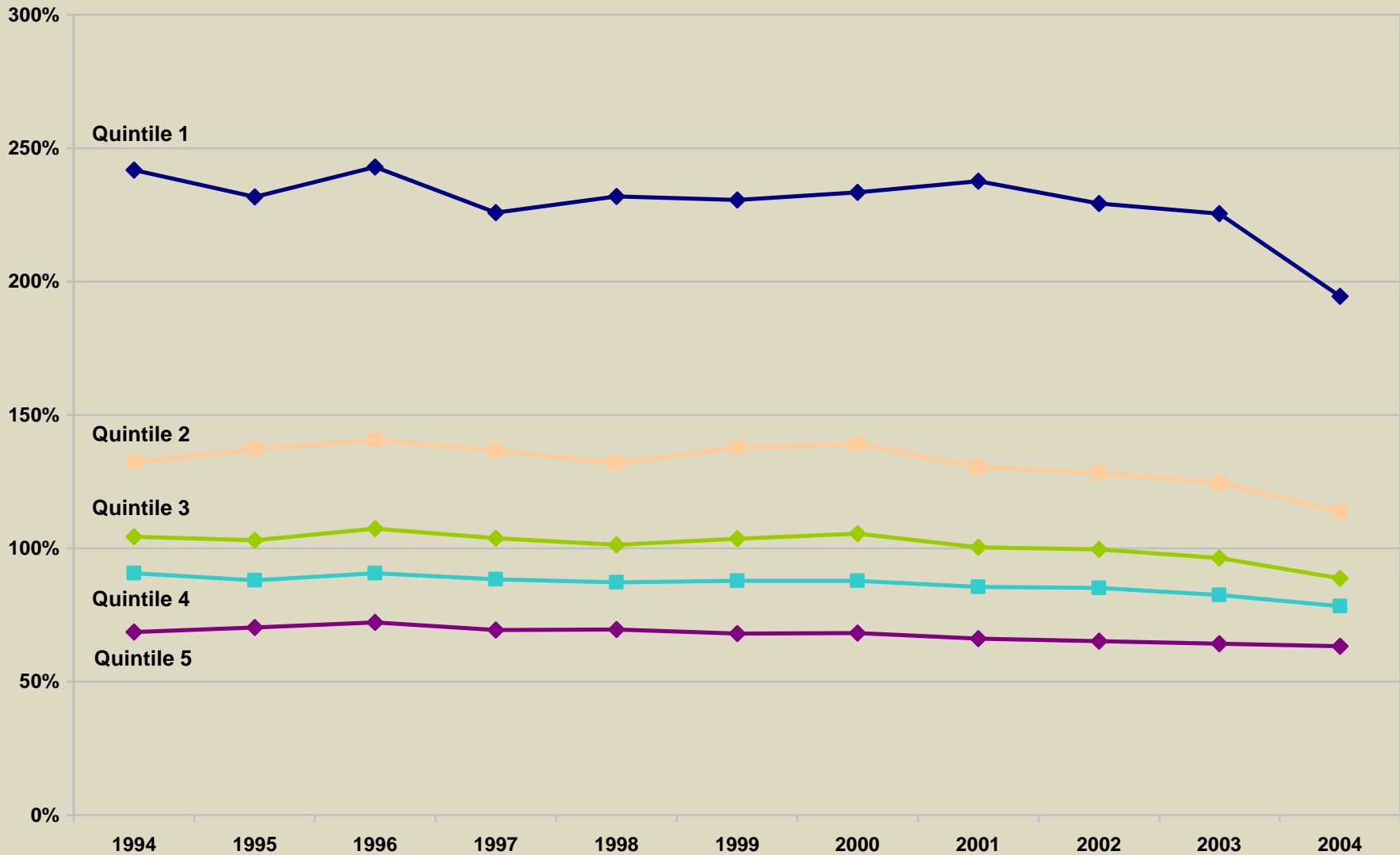
Quintile 5

Source: BLS, Consumer Expenditure Survey, Table 1. Quintiles of income before taxes: Average annual expenditures and characteristics, multiple years

Potential Adjustments That Reduce C-I ratios at the Bottom

Adjustments Made:
- Drop very low-income records
- Use income averaged between 1st and last interview
- Estimate income taxes based on reported income, use ratio of consumption to after-tax income
- Adjustments to consumption definition

Explored But Not Done:
- Limit to prime-age individuals
- Cap consumption-income ratios unless observed dis-saving can explain

- Even with these adjustments, C-I ratios are quite high for bottom of the distribution
- Any adjustments to hit PCE totals exacerbate this problem
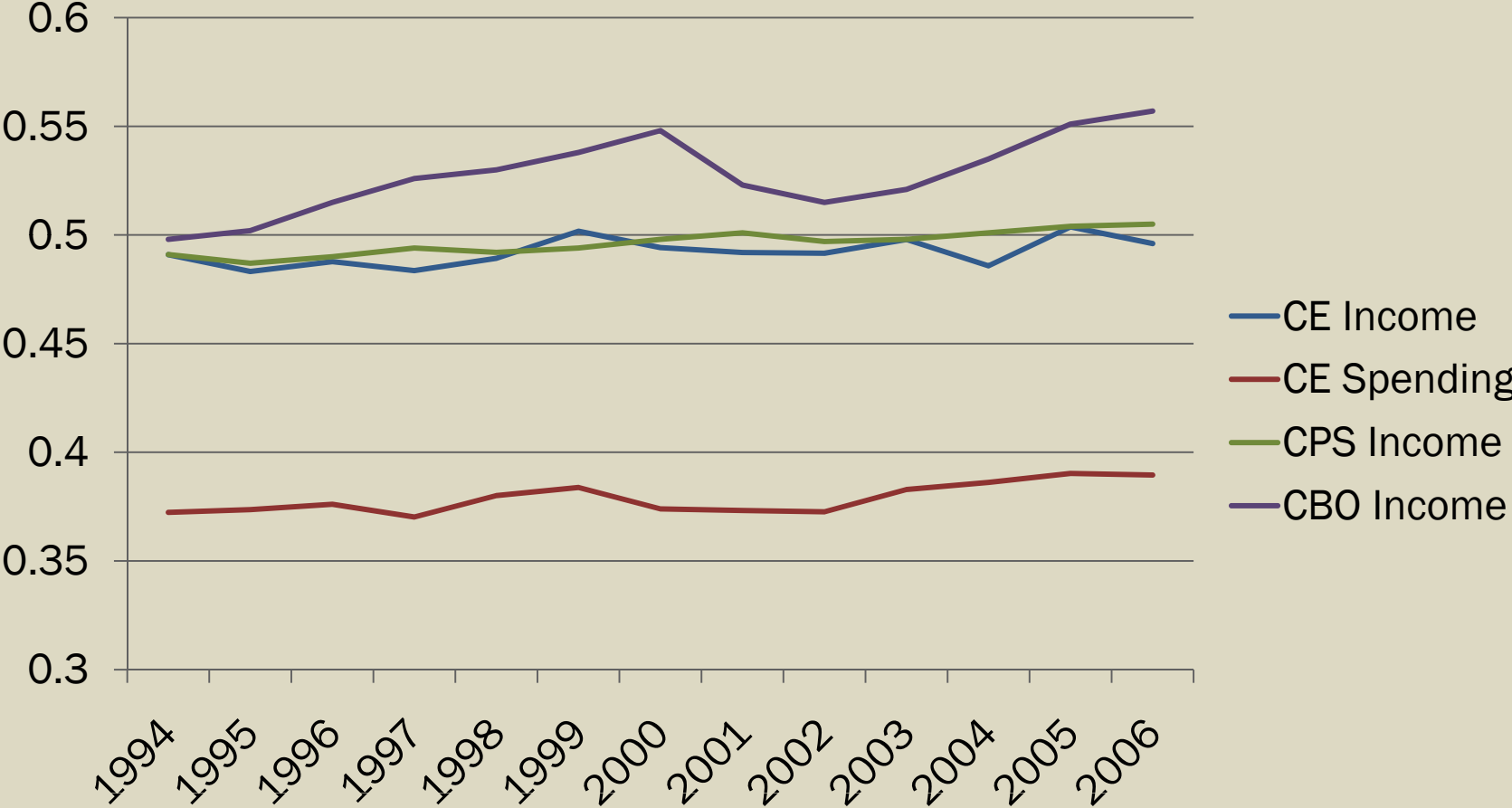
High Income Regressions

- Both income and expenditure amounts are top coded in CE
- Impute expenditure amounts based on regression models for high-income households
- Need to extend analysis significantly beyond the income range covered in the CE
- Separate models for electricity, gasoline, fuel oil, natural gas, and total expenditures
- Use regression results up to 1M in income, after that hold C-I ratio constant

Comparison of High Income Units

	CE	SOI
Units above 100,000		
Number of Units (M)	18.9	16.1
Average Income	$164,000	$254,000
Share of Income	43.2	51.2
Units above 150,000		
Number of Units (M)	7.3	7.1
Average Income	$236,000	$425,000
Share of Income	23.8	37.7

Source: BLS Table 2301. Higher income before taxes: Average annual expenditures and characteristics, Consumer Expenditure Survey, 2006 and IRS Statistics of Income, Individual Income Tax Returns 2006 Table 1.2
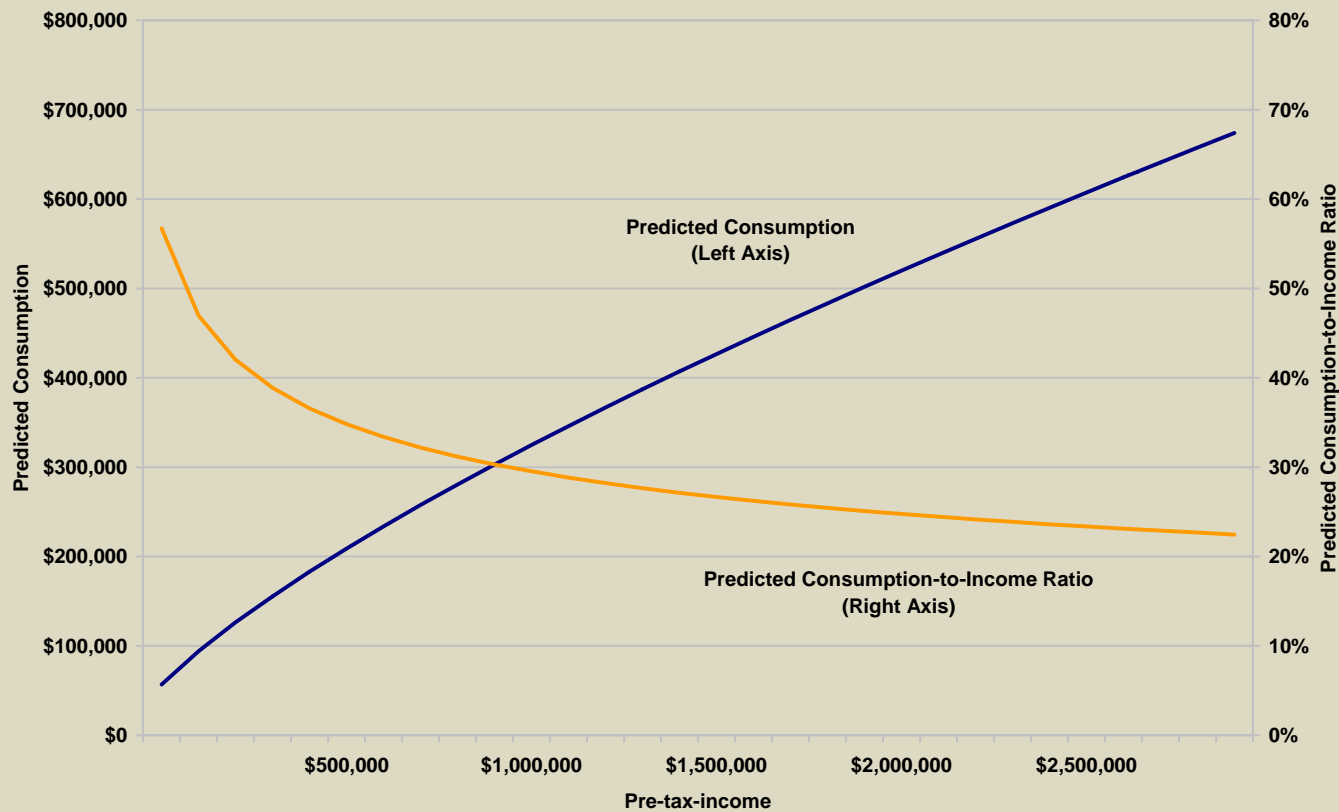
Top Quintile Income and Consumption Shares

Legend:
- CE Income
- CE Spending
- CPS Income
- CBO Income

High Income Regressions

ln(Consumption) by ln(Pre-tax-income), CEX 2004
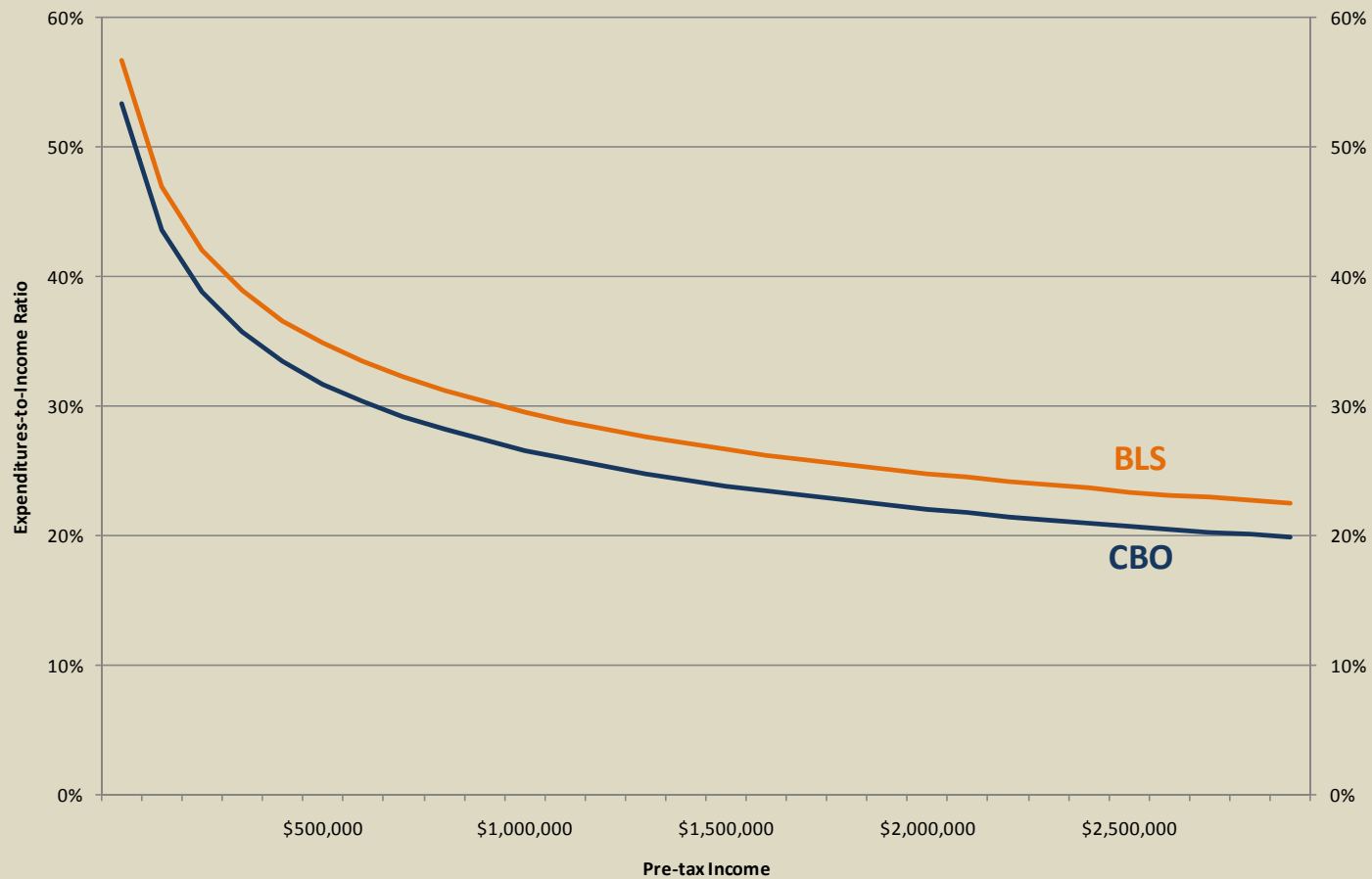
High Income Regressions Projections

Ln(Consumption) = Ln(Pre-tax-Income)

High Income Regressions
Effect of Top-coding

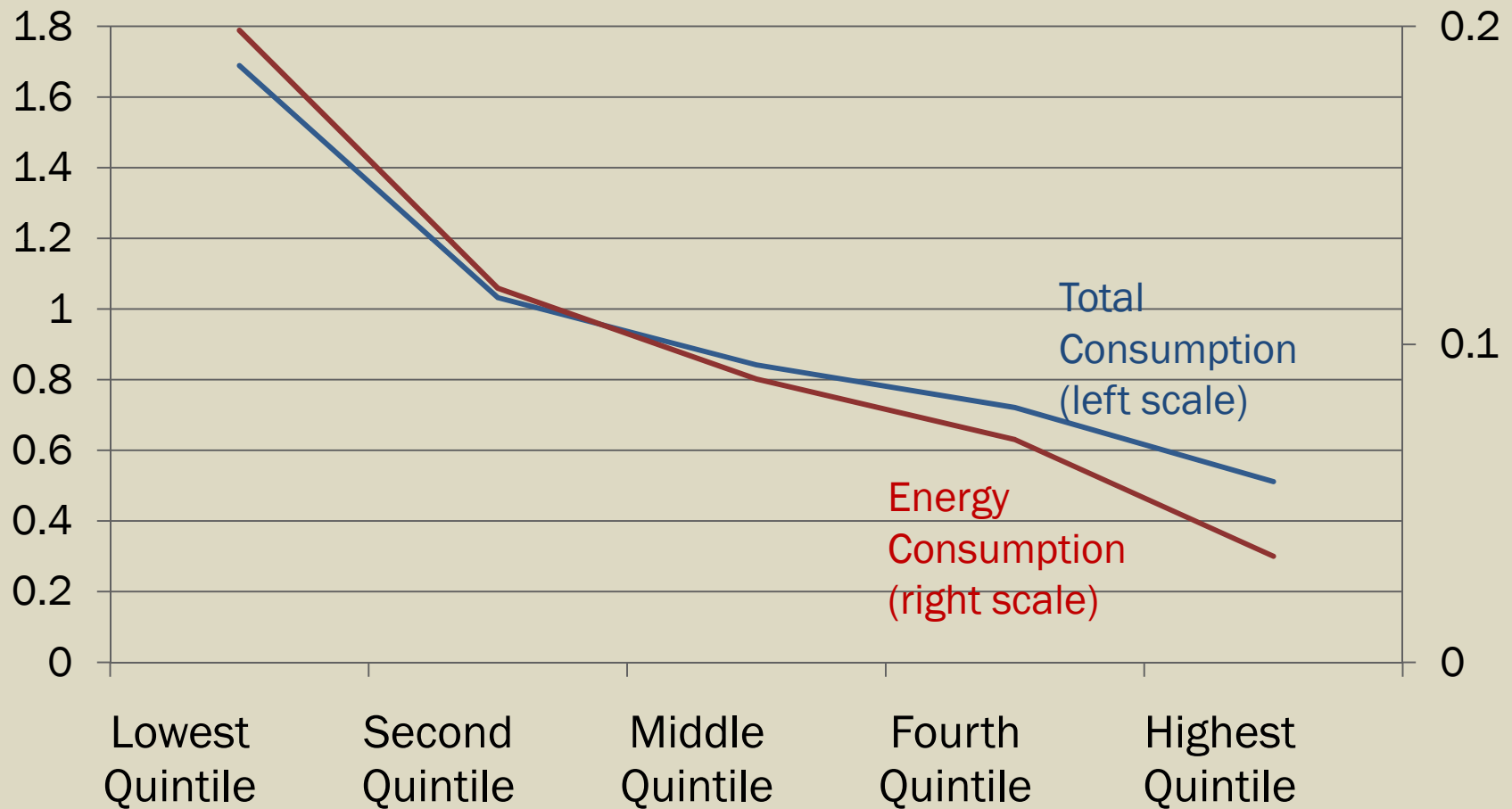**ln(Expenditures) = ln(Pre-tax Income)**
BLS vs. CBO estimates

High Income Regressions
Effect of Top-coding

ln(Gasoline Expenditures) = ln(Pre-tax Income)
BLS vs. CBO estimates

Evaluation

- Data from CE is very valuable. Especially access to the micro data. Only source for:
  - Detailed consumption
  - Variation of consumption by age, geographic region,

- But…
  - Observed consumption-income pattern is difficult to explain
  - Differential reporting error across income groups
  - Raises questions about the expenditure shares derived from the CE

Suggested Improvements

Major

- Top-down reconciliation of income and consumption as part of the interview process
  - Perhaps something like to the diary, where focus is total spending/saving
- High-Income oversample

Minor

  - Pool all interviews for a CU, create panel weights
  - Impute from diary to interview, so one complete file
  - Continue research into reconciling differences with PCE
    - Provide cross-walk (or adjustment factors) between NIPA PCE and UCC codes
  - Study income misreporting with a one-time match to administrative records