

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

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# Disclaimer

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

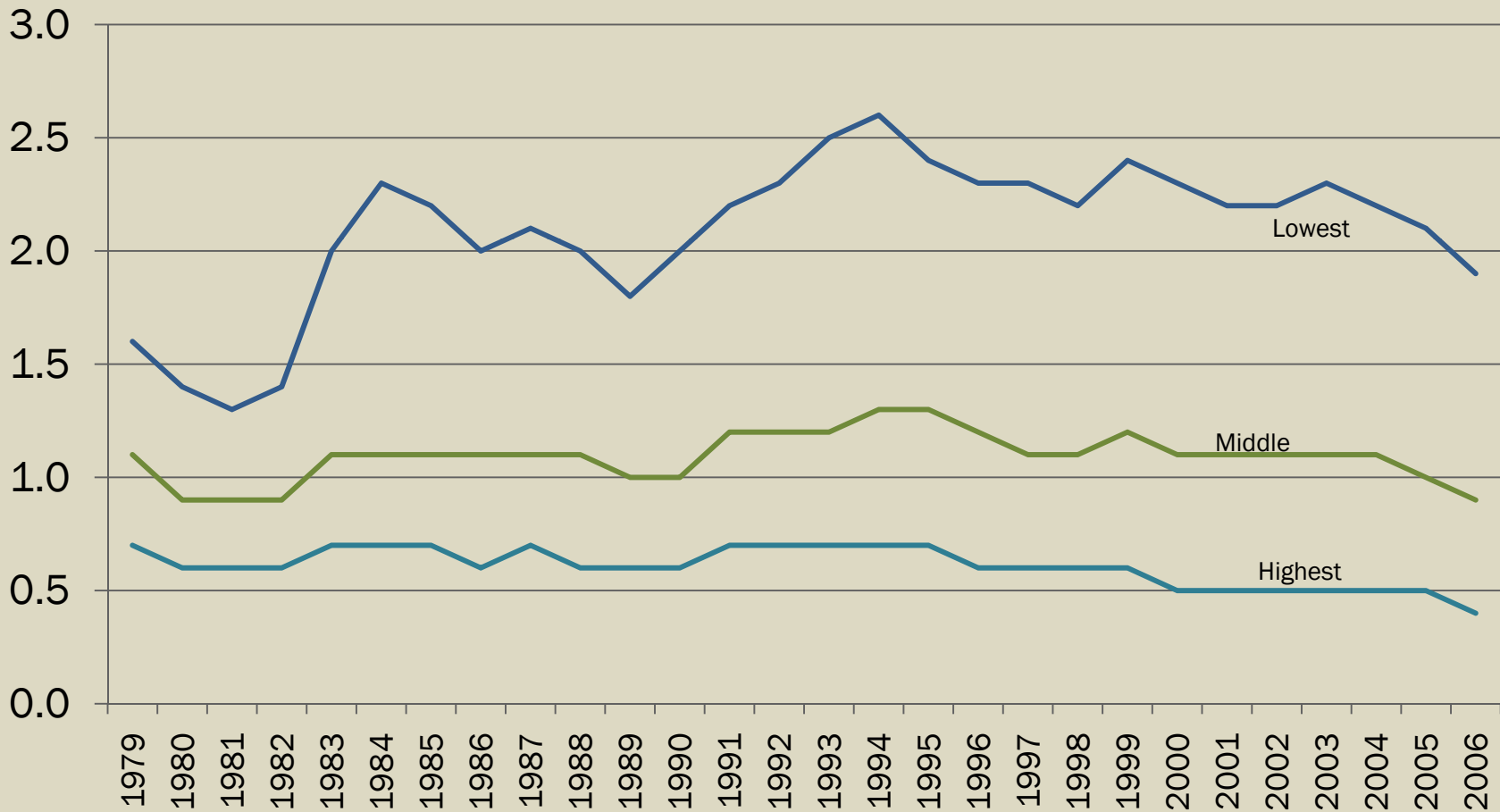
# Uses of the CE

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- 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



## 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
<b>Average Dollar Gain or Loss per Household</b>			
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
<b>Gain or Loss as a Percentage of After-Tax Income</b>			
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

Source: Congressional Budget Office, "The Economic Effects of Legislation to Reduce Greenhouse Gas Emissions", September 2009, Table2

# Approach To Cap and Trade Estimates

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- 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

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

Assumes Total allowance revenues of about 0.7% of GDP

# CE and NIPA aggregates

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- 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

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- 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

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- 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

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**BLS Published Income and Consumption by Income Class, 2004**

	<b>Population</b>	<b>Average Income</b>	<b>Average Consumption/ Consumption</b>	<b>Income</b>
< \$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
<b>Total</b>	<b>116.282</b>	<b>\$54,680</b>	<b>\$43,395</b>	<b>0.79</b>

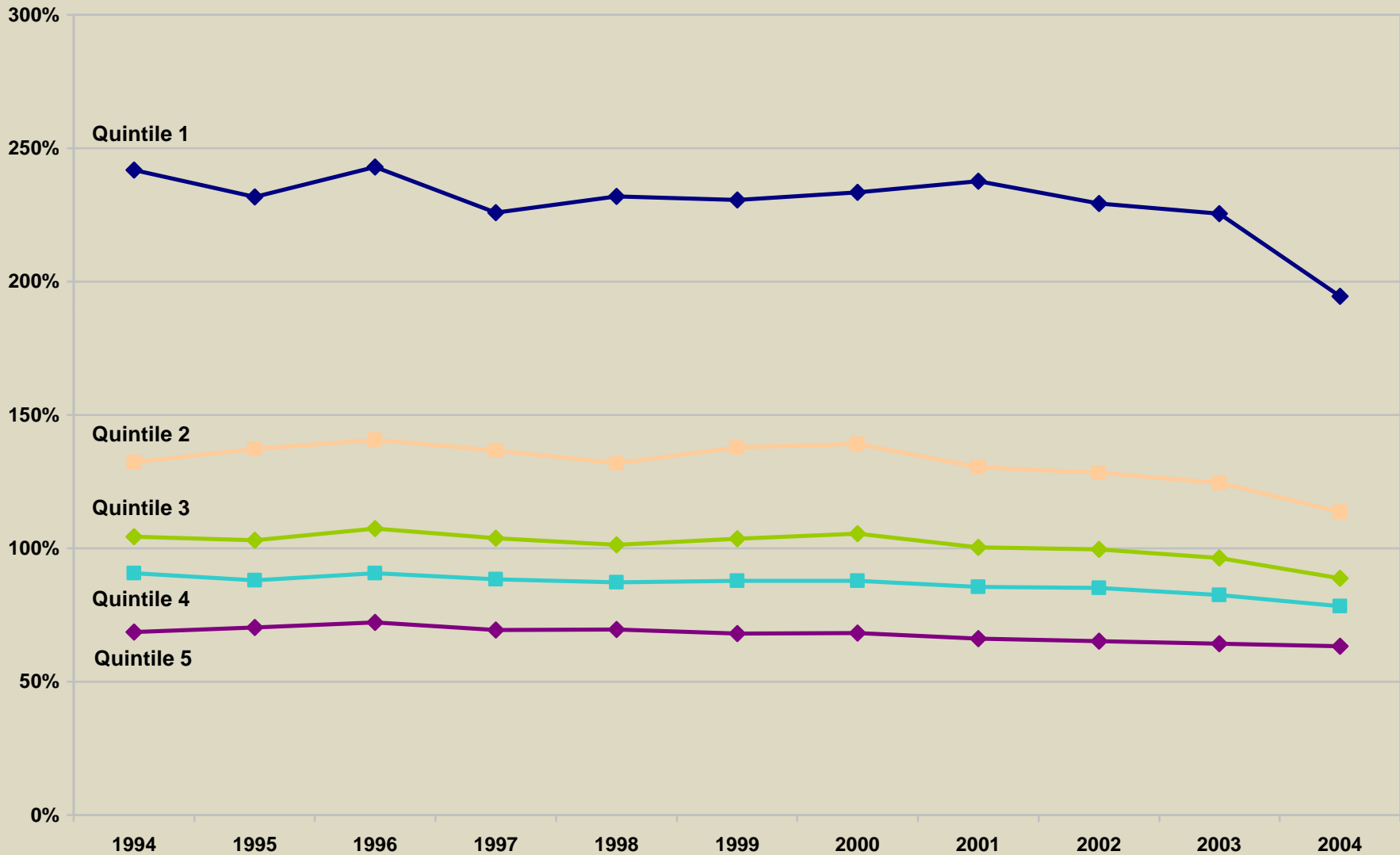
**NOTE:**

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



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

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## Adjustments Made:

- Drop very low-income records
- Use income averaged between 1<sup>st</sup> 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

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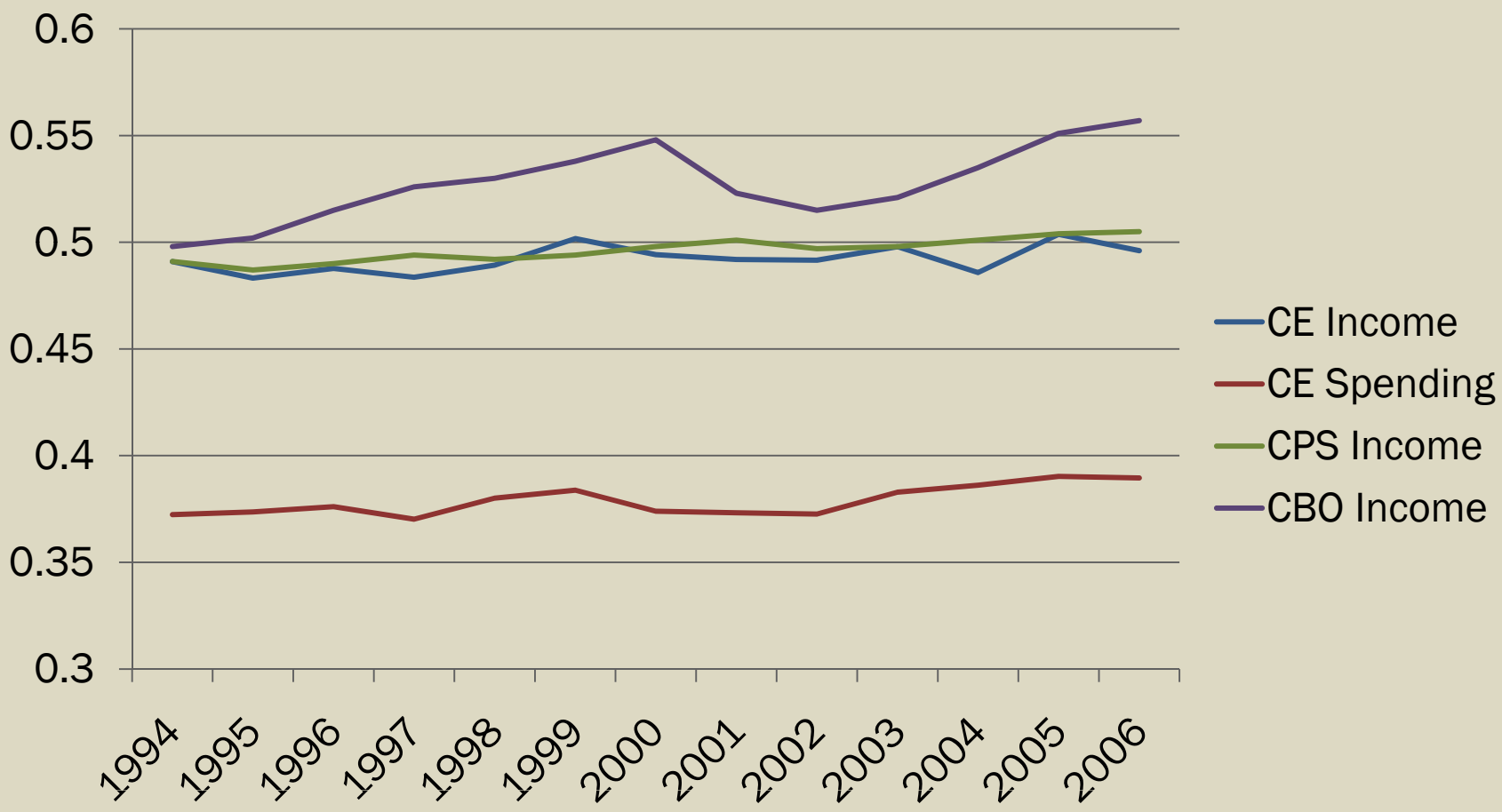
- Both income and expenditure amounts are top coded in CE
- Impute expenditure amounts based on regression models for high-income households
- Need to extend analysis significantly beyond the income range covered in the CE
- Separate models for electricity, gasoline, fuel oil, natural gas, and total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

# Comparison of High Income Units

	CE	SOI
<b>Units above 100,000</b>		
Number of Units (M)	18.9	16.1
Average Income	\$164,000	\$254,000
Share of Income	43.2	51.2
<b>Units above 150,000</b>		
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





# High Income Regressions

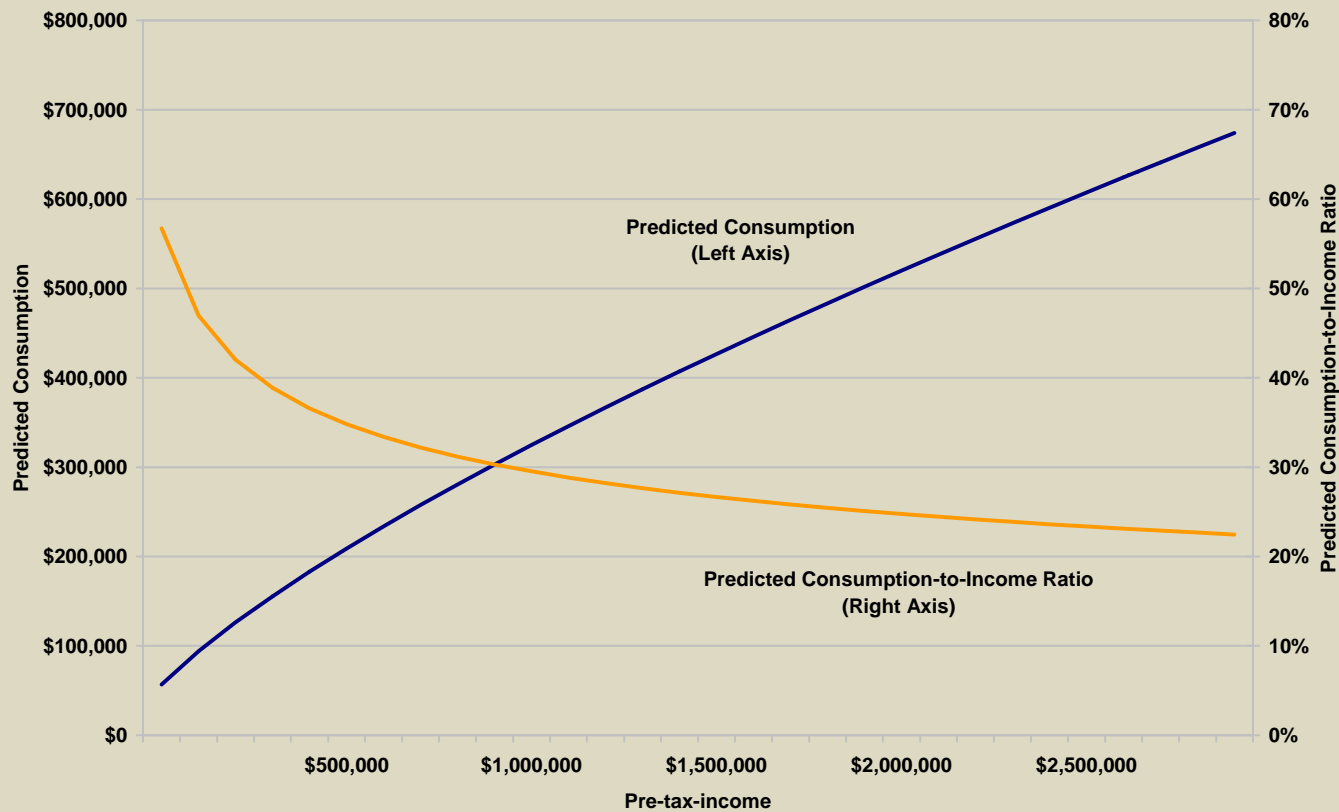
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In(Consumption) by In(Pre-tax-income), CEX 2004



# High Income Regressions Projections

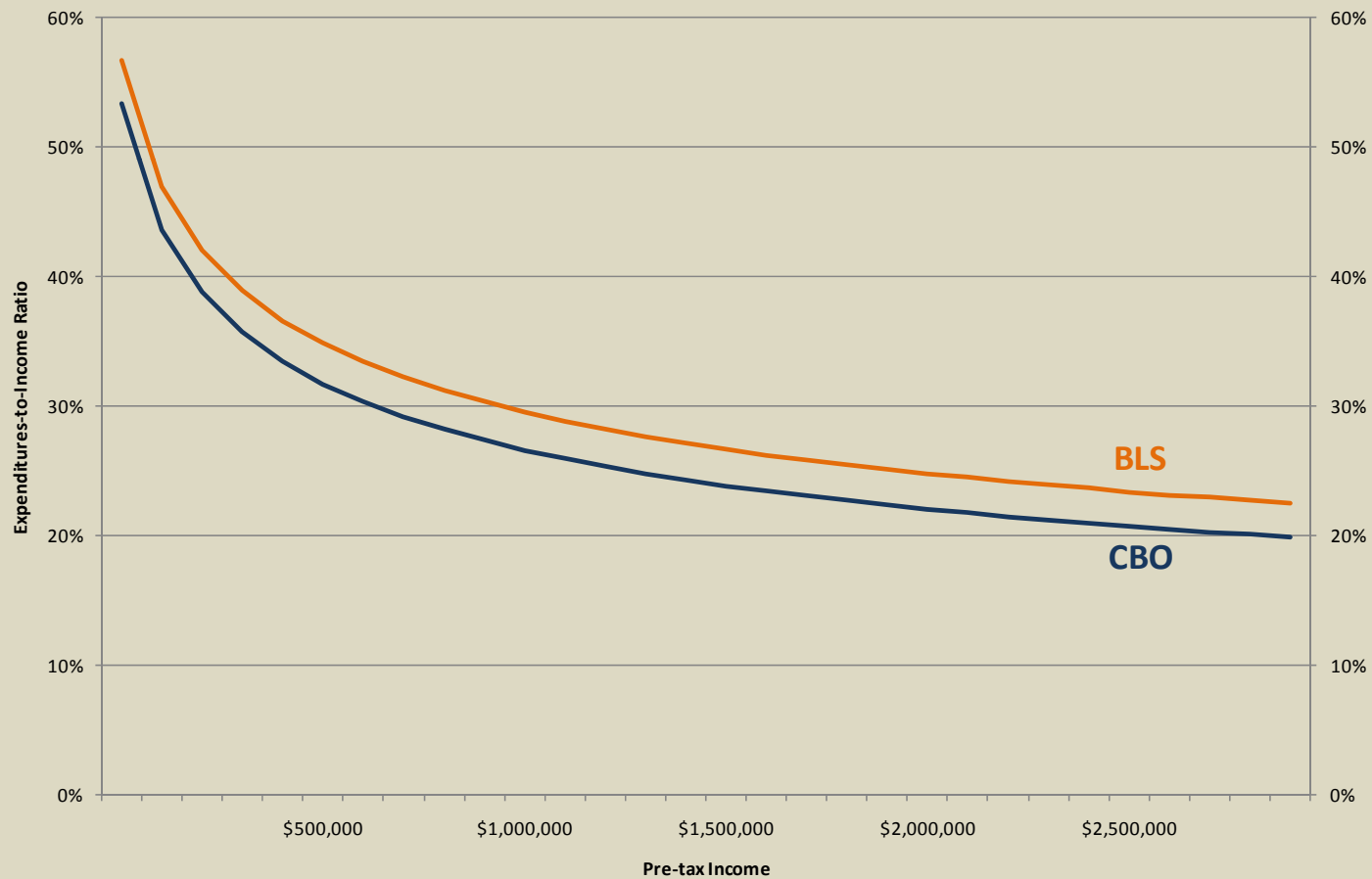
$$\text{Ln}(\text{Consumption}) = \text{Ln}(\text{Pre-tax-Income})$$



# High Income Regressions

## Effect of Top-coding

$\ln(\text{Expenditures}) = \ln(\text{Pre-tax Income})$   
BLS vs. CBO estimates



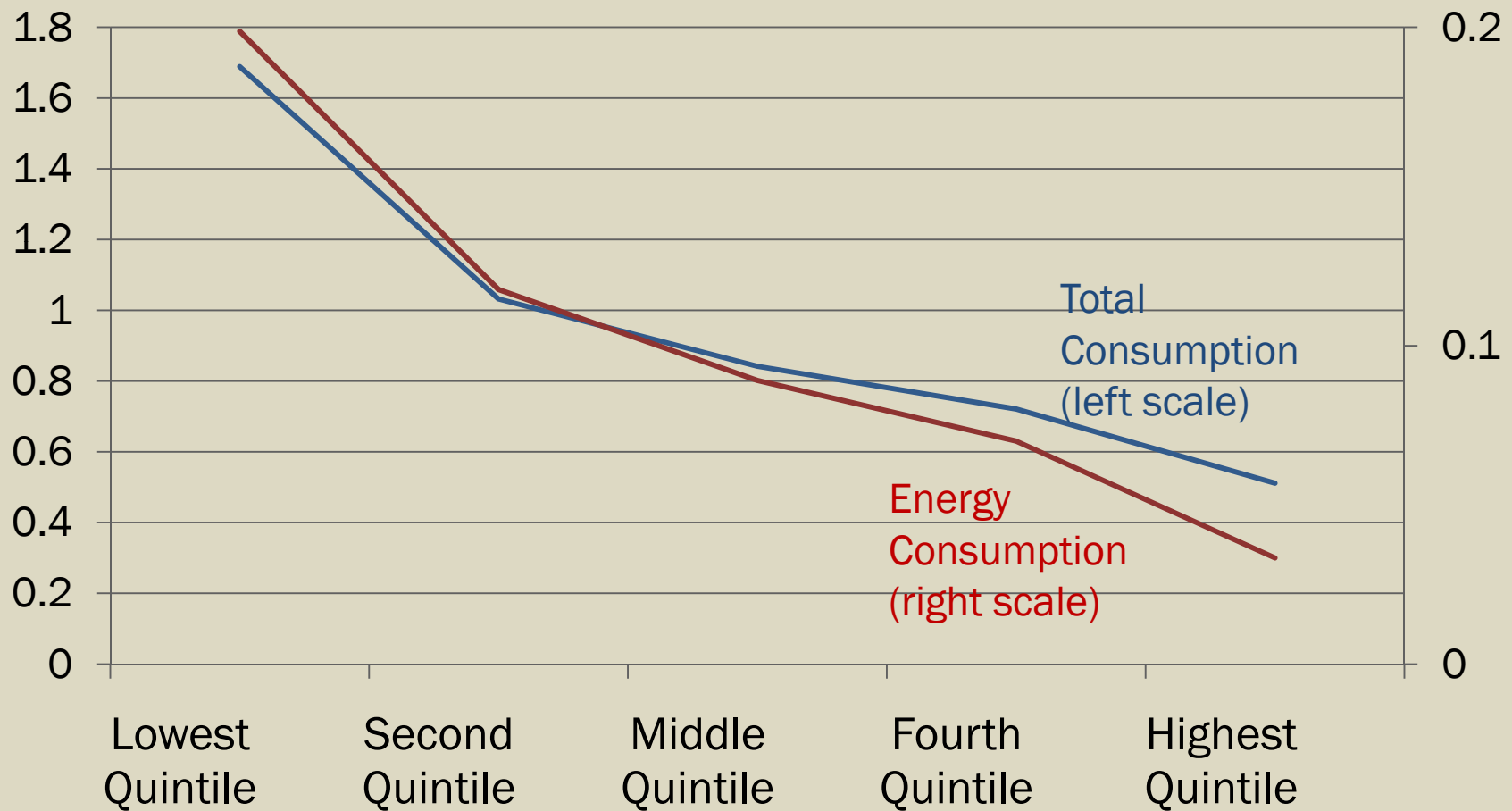
# High Income Regressions

## Effect of Top-coding

$\ln(\text{Gasoline Expenditures}) = \ln(\text{Pre-tax Income})$   
BLS vs. CBO estimates



# Final Consumption-Income Ratio



# Evaluation

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- 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

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## 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