

# **A Journey into the PCE Jungle with CE Colored Glasses**

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**Workshop on Consumption  
Bureau of Labor Statistics  
Washington, D.C.**

**December 12, 2005**



# Outline

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- ◆ Introduction
- ◆ Data Comparison Issues
- ◆ Historical Methodology & Results
- ◆ Revised Methodology & Results
- ◆ Detailed Example - Recreation

# Comparing CE Expenditure Estimates with Data from Other Sources

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- ◆ Department of Energy
  - Residential Energy Consumption Survey
  - Residential Transportation Energy Consumption Survey
- ◆ Health Care Financing Administration
  - National Health Expenditures
- ◆ Health Care Quality and Research Agency
  - Medical Expenditure Panel Survey (Household)
- ◆ Bureau of Economic Analysis (BEA)
  - Personal Consumption Expenditures (PCE)
- ◆ Progressive Grocer/Supermarket Business

## Since the Start of the Ongoing CE...

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*“What was expected from these comparisons was a sense of degree and direction of possible survey errors, rather than an exact measure of bias, because the specific estimates from other sources are not necessarily the ‘true’ values”*

(Gieseeman 1987, p. 9)

# PCE: Primary Source of Independent Data for Comparison Over Time

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- ◆ Used for source selection for integrated published data (Diary or Interview)
- ◆ Publish comparisons in biennial publications
- ◆ Monitor consistency of results
- ◆ Help identify areas where CE data collection and methods might be improved by understanding the differences

# CE and PCE Compared

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- ◆ Historical methodology (Gieseman 1987; Branch 1994; CE bulletins and reports from 1990-1999)
  - Type by expenditure (food, apparel, housing, etc.)
  - Trends over time in ratios
    - » 1984-2002
- ◆ Revised methodology (April 2000 to present)
  - Type by product (durables, non-durables, services)
  - CE and PCE aggregates and ratios
    - » 1992, 1997, 2002
  - Concerns and issues
  - Detailed example: Recreation (PCE-defined service)

# Major Findings from Revision

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- After adjustments for comparability, CE/PCE ratio
  - » 0.86 for 1992 (vs. 0.67 unadjusted)
  - » 0.85 for 1997 (vs. 0.65 unadjusted)
  - » 0.81 for 2000 (vs. 0.60 unadjusted)
- Owner-occupied dwellings and new autos CE expenditure aggregates greater than PCE
- For most other items, CE aggregates lower than PCE and ratios decreasing over time
- Explanations
  - » some can be explained
  - » others need more work to understand

# Making Comparisons: Issues to Consider

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- ◆ Populations
- ◆ Expenditures (publication vs. “comparable”)
  - Underlying conceptual framework (scope)
  - Definition
- ◆ Sources of data
  - Censuses
  - Surveys
  - Administrative records
  - Trade association publications
- ◆ Periodicity
  - Collection, reference, production



# Populations

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## ◆ CE: *consumer units and persons*

- Civilian non-institutional population and some institutional
- Continental U.S., Alaska, and Hawaii
- Urban and Rural

Numbers of persons 3.4% less than represented by PCE

## ◆ PCE: *persons resident*

- Individuals
  - » Persons resident in U.S. and those who physically located in U.S. and have resided, or expect to reside in U.S. for 1 year or more
  - » Employees of U.S. businesses abroad for 1 year or less
  - » U.S. government civilian and military personnel stationed abroad regardless of time
- Nonprofit institutions serving individuals

# Definition of Expenditure: CE (Publication) & PCE

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- ◆ CE - What consumers spend: transaction costs including excise and sales taxes of goods and services acquired during reference period
  - Primarily out-of-pocket expenditures (OOP) reported by consumers plus value of in-kind food and rent as pay, and food stamps
- ◆ PCE - Value of goods and services purchased by the personal sector (excludes intra-sector transactions) including excise and sales taxes
  - Spent by individuals
  - Operating expenses of nonprofit institutions serving individuals
  - Value of food, fuel, clothing, rent of dwellings, and financial services received in kind by individuals; and net purchases of used goods

# Scope: CE (Publication) & PCE

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- ◆ In scope for CE, out of scope for PCE
  - Transactions between households (includes person to person sales such as for used vehicles, apparel, etc.)
  - Life and personal insurance, and pensions
- ◆ In scope for PCE, out of scope for CE publication
  - Rental value of owner occupied dwellings and owned appliances
  - Value of home production for own consumption on farms
  - Standard clothing issued to military
  - Services furnished without payment by financial intermediaries except life insurance carriers

# Scope/Item Definition

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- ◆ Partly Out Of Scope For CE / Partly Defined Quite Differently
  - Medical Care Expenditures
  - Religious and Welfare
  
- ◆ Defined Quite Differently
  - Education Expenditures
  - Life and Personal Insurance and Pension Plans
  - Owner-Occupied Housing Expenditures

# Data Sources and Periodicity

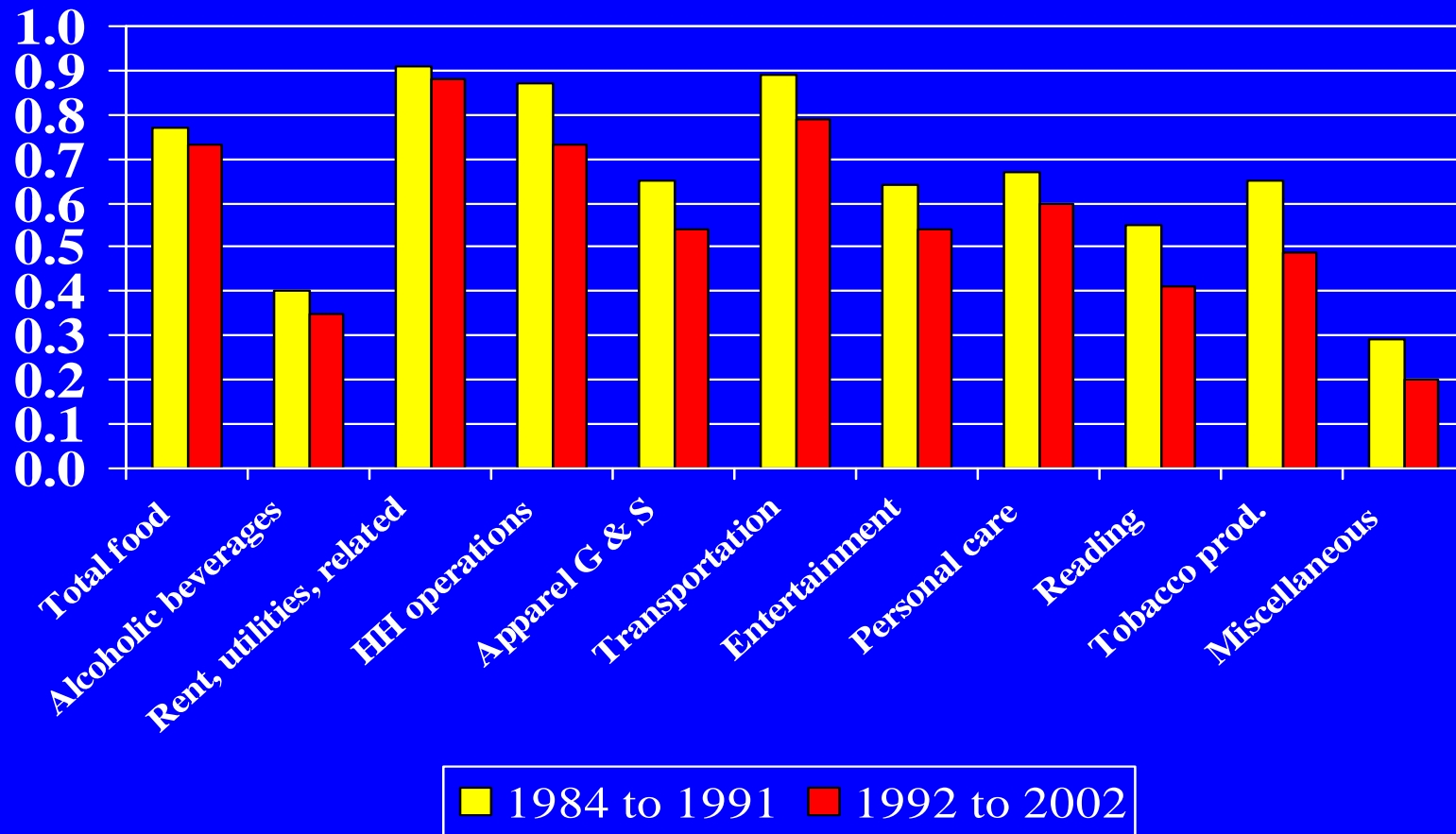
- ◆ CE: direct
  - Household Surveys
    - » Interview
    - » Diary
  - Periodicity
    - » Annual
    - » Quarterly
    - » Monthly
    - » Weekly
  - Sampling and non-sampling errors
  - Imputation/allocation
- ◆ PCE: indirect (commodity flow; mostly residual)
  - Sources
    - » Government census/survey reports
    - » Government administrative and regulatory agency reports
    - » Reports from private organizations
    - » CE (motor vehicle leasing and rental, taxis, nursery schools, child care)
  - Periodicity
    - » 5-year Benchmark (detailed)
    - » Annual
    - » Quarterly
    - » Monthly
  - Interpolation/extrapolation
  - Expert judgment
  - Revisions

# Historical Methodology: CE to PCE Published Ratios

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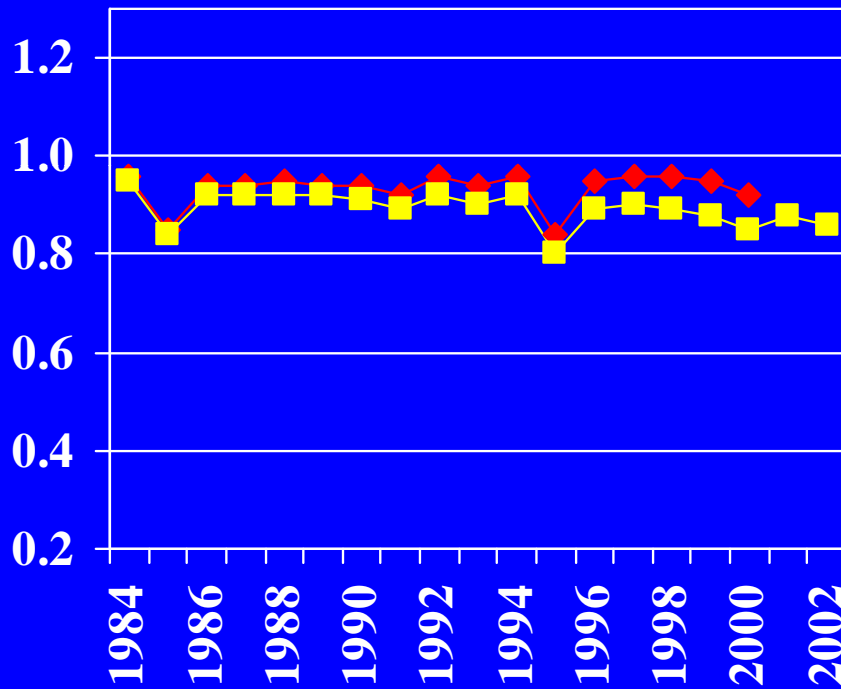
- ◆ Classification scheme:
  - *Type by expenditure*
  - *CE into PCE*
- ◆ Benchmark: *1997 PCE*
- ◆ Categories: *selected*
- ◆ Years: *1984 to 2002*

# CE to PCE Ratios: Averages Over Time

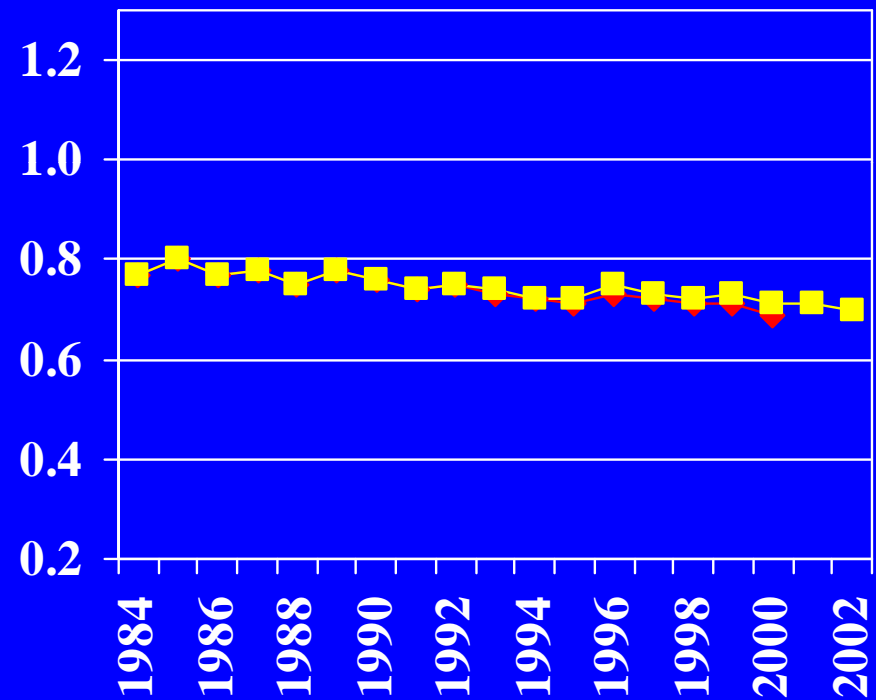


# Stable, Higher Ratios

## Rent, Utilities, and Public Services



## Food



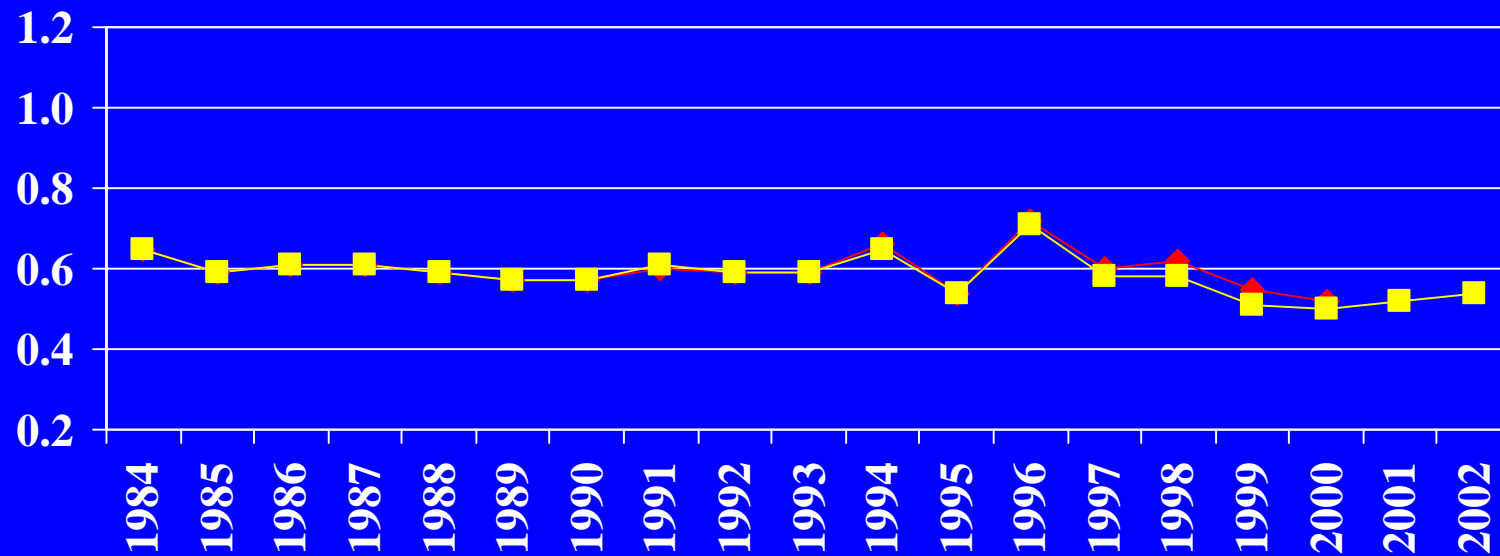
Historical

- 1997 benchmark
- ◆ 1992 benchmark



# Stable/Decreasing, Mid Ratio

Public Transportation

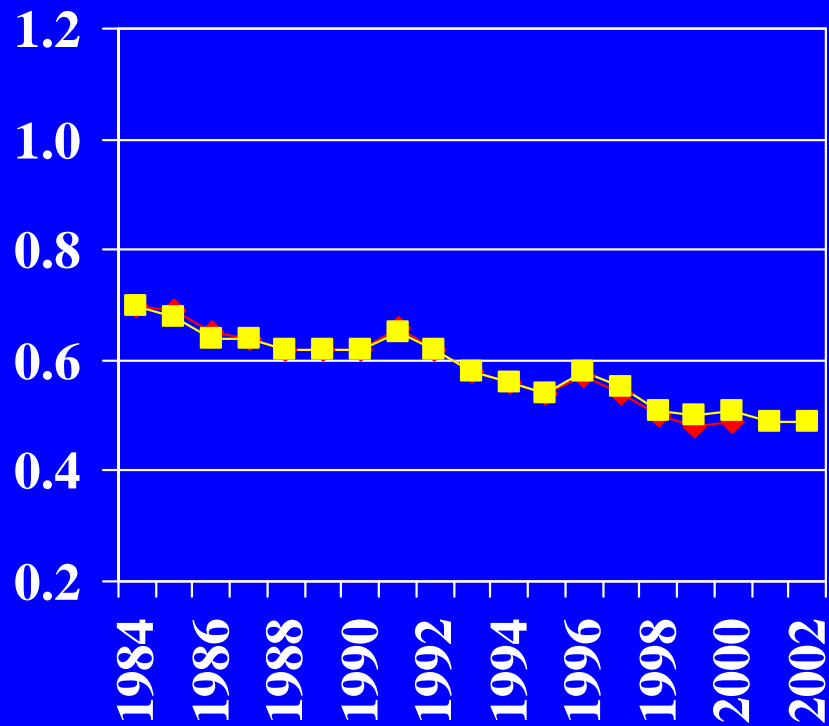


Historical

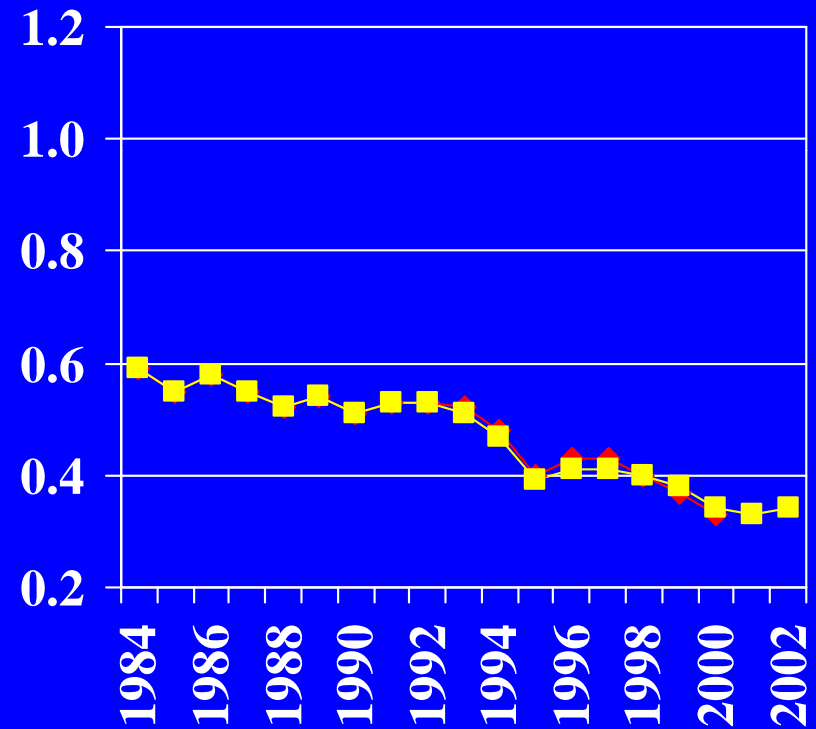
- 1997 benchmark
- ◆ 1992 benchmark

# Decreasing, Lower Ratios

## Apparel and Services



## Reading



Historical



1997 benchmark



1992 benchmark

# Others Have Been Watching and Using...

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- ◆ Economic Growth and Economic Trends
  - Slesnick (1992, 1998)
  - Triplett (1997)
  - Nalewaik (2000)
  - Fernandez-Villaverde and Krueger (2004)
  - Parker and Preston (2005)
- ◆ Consumption based measure of poverty
  - GAO (1996) report on Slesnick (1993)
- ◆ CE in the production of the CPI
  - Fixler and Jaditz (2002)
  - Johnson and Greenlees (2003)
  - Lebow and Rudd (2003)
  - National Research Council (2002)

# Calls for Further Examination with Caution...

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- ◆ Slesnick (1992)

- *remaining differences “is a mystery that can only be resolved by future investigation.”*
- *“...suggest caution is in order before one assigns full blame ... to underreporting in the CEX.”* [due to magnitude of PCE revisions]

- ◆ Triplett (1997)

- *“...individual components of PCE and CE have been studied too little to permit conclusions about which is better ...”*

- ◆ GAO report (1996) referring to 1994 BEA study

- *“...more than half [of the differences in the aggregate expenditures] was traceable to coverage and definitional differences, with the remainder due to statistical differences.”*

# Call For Further Examination

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## ◆ National Research Council (2002)

- *“On the basis of available evidence, it is unclear whether the PCE or CEX weights are superior...It is an open question as to how accurately expenditure categories can be mapped from the PCE to CEX. We are not in a position to advocate one set of weights over the other, but the question certainly warrants further investigation”*

But then go on to say...

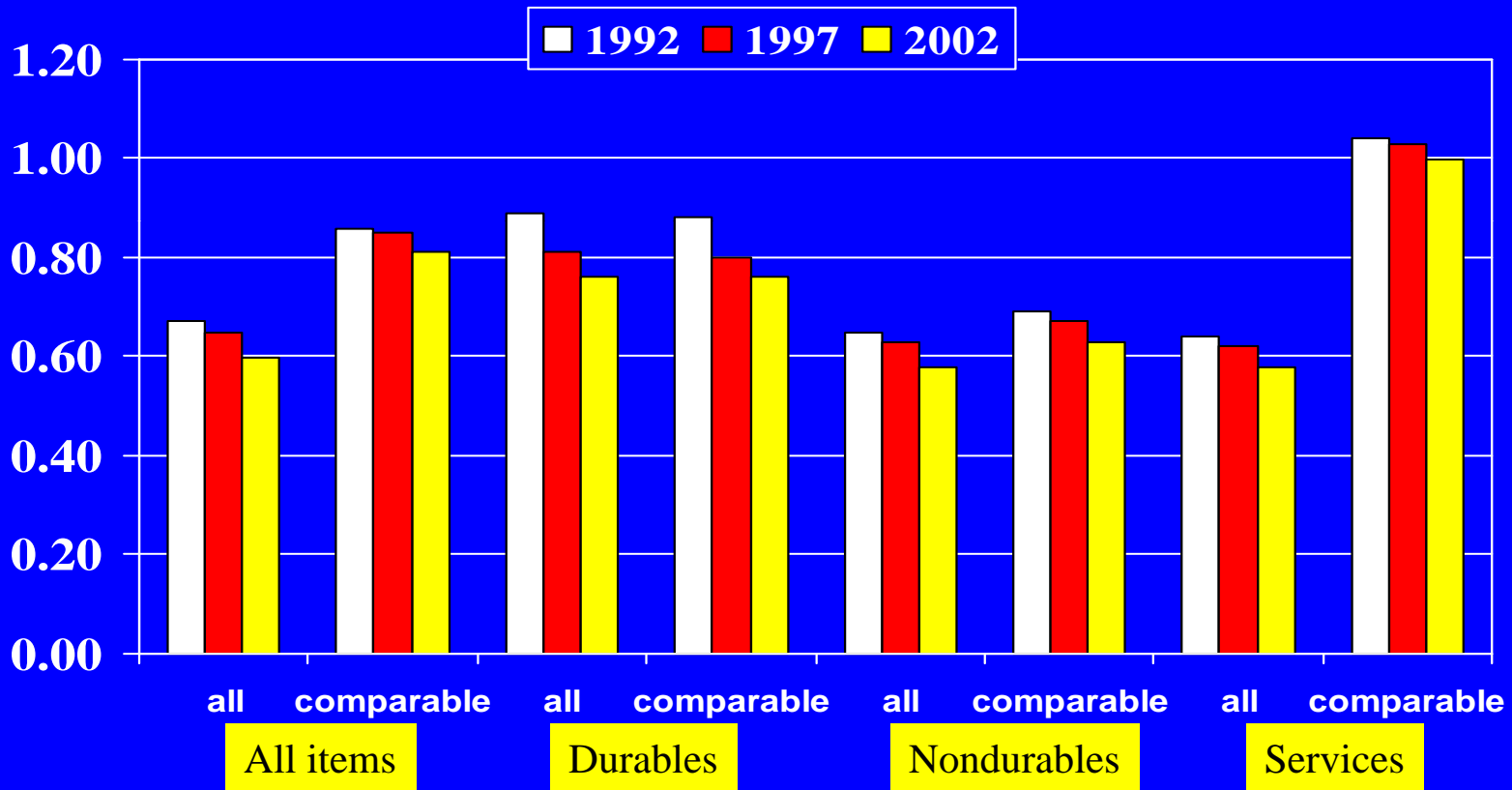
- *“The panel concluded that it is likely that the CEX estimates of consumer expenditure shares are biased, perhaps seriously.”*

# Revised Methodology

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- ◆ Classification:
  - Type by product (durables, non-durables, services)
  - CE into PCE
  - PCE Bridge to 1997 Input-Output Table
- ◆ Benchmark: 1997
- ◆ Categories
  - All
  - Redefined “comparable”
    - » e.g., drop used vehicles; include owner-occupied dwellings
- ◆ Years: 1992, 1997, 2002

# CE Integrated/Personal Consumption Expenditures Ratios: Comparables



Revised

# CE to PCE Aggregate Expenditures

	1992 (billions)	1997 (billions)	2002 (billions)
Total CE	\$2,856	\$3,590	\$4,457
Total PCE	\$4,235	\$5,545	\$7,376
<b>% Total</b>	<b>67%</b>	<b>65%</b>	<b>60%</b>
Total CE Comparable	\$2,085	\$2,564	\$3,126
Total PCE Comparable	\$2,422	\$3,028	\$3,842
<b>% Comparable</b>	<b>86%</b>	<b>85%</b>	<b>81%</b>
<i>CE Comparable as % of CE Total</i>	<i>73%</i>	<i>71%</i>	<i>70%</i>
<i>PCE Comparable as % of PCE Total</i>	<i>57%</i>	<i>55%</i>	<i>52%</i>

Revised, 1997 Benchmark



# Issues to Consider: CE vs. PCE

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- ◆ Populations differ
- ◆ Expenditures: concept / scope, definition
- ◆ Collection / Sources of data
- ◆ Sources of error
  - CE
    - » Measurement errors associated with surveys
    - » Processing imputation / allocation
  - PCE
    - » Expert judgment
    - » Interpolation / extrapolation
    - » Measurement errors associated with surveys (non-benchmark)
- ◆ PCE revisions

# Analytical Example

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1997 Expenditures for Recreation  
in the CE and PCE

# Rationale for Year and Expenditure Category

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## ◆ Why 1997?

- Data represent latest benchmark year at time of study
- Benchmark data are available at finer level of item detail

## ◆ Why recreation?

- CE expenditures for services, in general, are only 3/5 of PCE services based on new methodology
- The difference between aggregate CE and PCE recreation estimates is relatively large
- As opposed to other service categories exhibiting large differences, there are no a priori explanations for the results

## Expenditures for recreation, total and by major item category, 1997 CE and PCE

<b>Item category</b>	<b><i>CE</i></b>	<b><i>PCE</i></b>	<b><i>% Ratio CE/PCE</i></b>
Total recreation	\$107,583	\$215,067	50.0%
Motion picture & legitimate theaters, opera, and entertainments of non- profit institutions (excl. athletic)	13,582	15,781	86.1%
Spectator sports	5,013	10,108	49.6%
Radio & TV repair	775	2,850	27.2%
Clubs & fraternal organizations	7,931	16,285	48.7%
Commercial participant amusements	10,896	59,423	18.3%
Parimutuel net receipts & lotteries	5,616	18,265	30.7%
Pets, vets, & other pet services	11,688	12,837	91.0%
Cable TV	27,697	30,131	91.9%

## Expenditures for recreation, total and by major item category, 1997 CE and PCE (cont.)

<b>Item category</b>	<b><i>CE</i></b>	<b><i>PCE</i></b>	<b><i>% Ratio CE/PCE</i></b>
Film developing & photo studios	5,570	12,602	44.2%
Sporting & recreational camps	2,254	1,414	159.4%
Video cassette rental	4,255	8,193	51.9%
Internet service providers	2,181	3,575	61.0%
Commercial amusements, not elsewhere classified	10,125	23,311	43.4%

# Derivation of CE Estimates

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- ◆ Interview survey is the source for about 86 percent of aggregate recreation expenditures, while the Diary survey accounts for the remaining 14 percent
- ◆ Individual expenditure reports originate in three ways.
  - Directly reported by respondent
  - Allocation of expenditures where respondent reports expenditure for a combination of items
  - Imputation of expenditures where respondent acknowledges purchase, but does not provide value

# Derivation of PCE Estimates

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- ◆ Process uses data created for preparation of input-output accounts for U. S.
- ◆ The benchmark purchasers' value of goods and services is calculated to determine allocable output.
- ◆ Total purchasers' value is allocated among intermediate and end users.

## Amount of value added to total recreation estimate by factor, 1997 PCE

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<b>Factor</b>	<b>Value added</b> <i>(millions of dollars)</i>	
Total	\$215,067	
Basic value		\$208,064
Wholesale margin		30
Transportation cost		76
Wholesale taxes		6,153
Retail margin		677
Retail taxes		68



# Aggregation and allocation of receipts for recreation, 1997 I/O Accounts *(millions of dollars)*

Aggregation of receipts	Basic value	Whole. margin	Trans. cost	Comm & whole. taxes	Retail margin	Retail taxes	Purchasers' value
Payroll establishments	\$310,593						
Nonemployer establishments	19,922						
Tax-exempt establishments	82						
	\$330,597						
Adjustments:							
Secondary production	14,783						
Nonemployer misreporting	1,664						
Filer misreporting	1,505						
Nonfiler misreporting	3,337						
Capital consumption allow.	507						
	21,796						
<b>Allocable receipts</b>	<b>\$352,393</b>	<b>\$112</b>	<b>\$294</b>	<b>\$7,565</b>	<b>\$752</b>	<b>\$74</b>	<b>\$361,190</b>
<b>Imports</b>	2,332						
Adjustments:							
Census re-exports	-41						
NIPA territorial adj. to imports	1						
	2,292						
<b>Allocable import receipts</b>	<b>2,292</b>						<b>2,292</b>
<b>Total allocable receipts</b>	<b>354,685</b>	<b>112</b>	<b>294</b>	<b>7,565</b>	<b>752</b>	<b>74</b>	<b>363,482</b>

# Aggregation and allocation of receipts for recreation, 1997 I/O Accounts – cont. (millions of dollars)

<b>Allocation of Production</b>	Basic value	Whole. margin	Trans. cost	Comm & whole. taxes	Retail margin	Retail taxes	Purchasers' value
Exports of goods	1,400	30	78	0			1,508
Intermediate production	19,186	46	119	74	6	0	19,431
Travel & conference services	7,124	0	0	9			7,133
Real estate services	6,505	0	0	38			6,544
Legal, accounting, & insurance services	5	0	0	0			6
Communication & utility services	4,054	0	0	59			4,113
Rental & leasing of equipment	11,748	0	0	261			12,009
Repairs & maintenance costs	9,870	0	0	53			9,924
Government purchases & sales – Federal, state, local, foreign	-1,828	0	0	-284			-2,112
Net purchases & sales of foreigners	2,099	0	0	0			2,099
Change in inventories	44	1	1	0			45
Unspecified costs	41,497	5	13	565			42,080
Unallocated output	5,783	0	0	259			6,042

# Aggregation and allocation of receipts for recreation, 1997 I/O Accounts – cont. *(millions of dollars)*

<b>Allocation of Production</b>	Basic value	Whole. margin	Trans. cost	Comm & whole. taxes	Retail margin	Retail taxes	Purchasers' value
PCE Sporting Equipment	602	0	0	5	0	0	607
PCE Sports Supplies, Incl. Ammo	48	1	3	0	41	4	97
PCE Fish & Seafood	78	0	5	0	28	2	113
PCE Food in Purchased Meals	452	0	0	33	0	0	486
PCE Alcohol in Purchased Meals	98	0	0	0	0	0	98
PCE Other Meats	129	0	0	0	0	0	129
PCE Toys, Dolls, & Games	16	0	0	0	0	0	16
PCE Electrical Repair	1,708	0	0	22	0	0	1,730
PCE Laundry & Garment Repair	230	0	0	12	0	0	242
PCE Beauty Shops & Health Clubs	6,557	0	0	169	0	0	6,726
PCE Commercial & Vocational Schools	1,742	0	0	1	0	0	1,743
PCE Elementary & Secondary Schools	832	0	0	0	0	0	832
PCE Miscellaneous Personal Services	15	0	0	0	0	0	15
PCE Bus	663	0	0	0	0	0	663
PCE Mass Transit Systems	7,686	0	0	0	0	0	7,686

# Aggregation and allocation of receipts for recreation, 1997 I/O Accounts – cont. (millions of dollars)

Allocation of Production	Basic value	Whole. margin	Trans. cost	Comm & whole. taxes	Retail margin	Retail taxes	Purchasers' value
PCE Other Purchased Intercity Transportation	6,242	0	0	37	0	0	6,278
PCE Other Motor Vehicle Services	98	0	0	2	0	0	100
PCE Hotels & Motels	418	0	0	15	0	0	433
PCE Postage	16	0	0	0	0	0	16
PCE Household Operations Services, Not Elsewhere Classified (NEC)	4,105	0	0	74	0	0	4,179
PCE Professional Association Expenses	4,417	0	0	0	0	0	4,417
PCE Social Welfare	2,980	0	0	8	0	0	2,988
<b><i>PCE Recreation</i></b>	<b><i>208,064</i></b>	<b><i>30</i></b>	<b><i>76</i></b>	<b><i>6,153</i></b>	<b><i>677</i></b>	<b><i>68</i></b>	<b><i>215,067</i></b>
	<b>354, 685</b>	<b>112</b>	<b>294</b>	<b>7,565</b>	<b>752</b>	<b>74</b>	<b>363,482</b>

# Evaluation of CE and PCE Estimates

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- ◆ Standard errors and confidence intervals
- ◆ Expert judgment
- ◆ Classification of items
- ◆ Collection issues

# Standard error and 95% confidence interval for total recreation expenditures, 1997 CE

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<b>Item</b>	<b>Value</b> <i>(millions of dollars)</i>
<b>Total recreation</b>	<b>\$107,583</b>
<b>Standard error</b>	<b>\$2,430</b>
<b>95% confidence intervals</b>	
<b>Upper limit</b>	<b>\$112,346</b>
<b>Lower limit</b>	<b>\$102,820</b>

# Quality identifier in PCE

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- ◆ Since PCE is compiled from numerous sources, calculating standard errors and confidence intervals is not feasible.
- ◆ The basic value for each transaction contributing to PCE is assigned a quality ID of 1, 2, or 3, in decreasing order of quality or level of confidence.

# Quality identifier in PCE – cont.

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- ◆ Quality ID of 1 – basic value based on survey, census, or other reliable published source
- ◆ Quality ID of 2 – basic value based on source data, but further estimates made by BEA
- ◆ Quality ID of 3 – basic value not based on survey data or other reliable source
- ◆ 83 percent of basic value for recreation derived from Quality ID 2 transactions
- ◆ Remaining 17 percent derived from Quality ID 3 transactions



# Expert Judgment in CE

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- ◆ Data adjustment in CE
  - Allocation procedures
  - Imputation procedures
  
- ◆ “Analyst judgment” in PCE
  - Tradition & experience – ‘S’s, ‘R’s & ‘IED998’s
  - Explicit

# Impact of data adjustment procedures on recreation estimates, 1997 CE *(millions of dollars)*

Item	Total	Allocated	% Allocated	Imputed	% Imputed	Other*	% Other*
Total recreation	\$107,583	\$3,447	3.2%	\$2,663	2.5%	\$2,945	2.7%
Movies, theater, etc.	13,582	259	1.9%	608	4.4%	711	5.2%
Spectator sports	5,013	86	1.7%	299	6.0%	237	4.7%
Radio & TV repair	775	67	8.6%	15	1.9%	1	0.1%
Clubs & frat. orgs.	7,931	0	0.0%	323	4.1%	<1	<0.1%
Comm. participant amusements	10,896	1,285	11.8%	582	5.3%	1,355	12.4%
Parimut. & lotteries	5,616	347	6.2%	0	0.0%	0	0.0%
Pets & vets	11,688	109	0.9%	32	0.3%	9	0.1%

\* Other includes manual adjustment, combined imputation and allocation, and special Section 18 processing (Trips and Vacations).

# Impact of data adjustment procedures on recreation estimates, 1997 CE – cont. *(millions of dollars)*

Item	Total	Allocated	% Allocated	Imputed	% Imputed	Other*	% Other*
Cable TV	\$27,697	189	0.7%	\$223	0.8%	\$13	<0.1%
Film developing & photo studios	5,570	403	7.2%	228	4.1%	<1	<0.1%
Sport. & rec. camps	2,254	404	17.9%	0	0.0%	0	0.0%
Video cassette rental	4,255	0	0.0%	186	4.4%	1	<0.1%
Internet service providers	2,181	0	0.0%	17	0.8%	0	0.0%
Commercial amusements, NEC	10,125	298	2.9%	150	1.5%	617	6.1%

\* Other includes manual adjustment, combined imputation and allocation, and special Section 18 processing (Trips and Vacations).

# Expert Judgment in PCE

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- ◆ Tradition & experience
  - ‘S’ – Domestic supply
  - ‘IED998’ – Converted 1992 commodity flow records
  - ‘R’ - Residual
- ◆ Explicit
  - “Based on analyst judgment”

# Classification of Items

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- ◆ CE - UCC for parimutuel receipts include miscellaneous fees, such as pet, fishing, & hunting licenses that can't be separated
- ◆ CE - UCC for sporting and recreational camp fees includes sports camps, such as football and baseball.
  - PCE assigns sports instruction camps to commercial amusements, NEC.

# Collection Issues: Spectator Sports

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## ◆ Items in PCE

- Pro & semi-pro baseball admission receipts
- Pro & semi-pro football admission receipts
- Other pro & semi-pro sports clubs admissions
- Other receipts from sports teams & clubs
- Admission receipts for horse racetracks
- Admission receipts for dog racetracks
- Admission receipts for auto racetracks
- Racing (excl. track oper., radio, TV, & ads)
- Exhibition bowling
- Travel arrangement & reservation services

# Collection Issues: Spectator Sports – cont.

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- ◆ Items in PCE – cont.
  - Promoters of performing arts, sports, and similar events
  - College sports
  - Sales & services of higher educational est. incidental to education activities
  - Government sales of elementary & secondary education services

# Collection Issues: Spectator Sports – cont.

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## ◆ UCC's in CE

- 620221 – Admission to sporting events
- 620222 – Admission to sporting events, out-of-town trips

## ◆ Questions for UCC 620221

- “Since the 1<sup>st</sup> of (*month, 3 months ago*), have you (or any members of your CU) purchased any of the following for your own use?”
  - Season tickets to sporting events
- “Have you (or any members of your CU) paid any single admissions to spectator sporting events such as football, baseball, hockey, or soccer?”



# Collection Issues: Spectator Sports – cont.

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## ◆ Questions for UCC 620222

- For trips paid for at least in part by the CU and not a package deal:  
“Did you (or any members of your CU) spend anything on this trip for entertainment or admissions (not counting what the package deal covered)? *Hand respondent information booklet, page 40.*
- The info booklet gives the following cues:
  - » Movies                      Theaters                      Concerts
  - » Museums                      Tours                      Sports events
  - » Other entertainment event
- 25 percent of the amount is allocated to UCC 620222 for longer trips, 11 percent if the trip is reported as a local overnight stay.

# Collection Issues: Spectator Sports – cont.

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- For reimbursed trips, trips for non-CU members and package deals:  
“Did [the trip] expenses include anything for - ?
    - Food and beverages
    - Lodging
    - Transportation
    - Anything else
  - A portion of “Anything else” is allocated to entertainment and admissions depending on what other items were included on the trip.
  - 25 percent of the entertainment and admissions portion is then allocated to UCC 620222.
- ◆ Thus, the CE instrument and methodology do not elicit the same detail on spectator sports expenses as the PCE source data provides. The questions are also asked towards the end of the interview at which point fatigue may be a factor.

# Summary of Evaluation

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- ◆ Differential between 1997 CE and PCE estimates - \$107 billion
  - If true CE estimate at upper end of confidence interval - \$5 billion
  - Though we have no estimates of effects, it is unlikely that adjusting other BLS allocation/imputation procedures or reapplying BEA expert judgment in allocation decisions on total purchasers' value would have an appreciable impact on expenditure differential.
- ◆ Remaining differential - approx. \$100 billion
- ◆ A potential methodological reason for the difference is questionnaire design in the CE.

# Summary

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- ◆ Revised methodology for comparisons
- ◆ Product replaces expenditures in classifications
- ◆ Explanation of differences in estimates between CE and PCE
- ◆ Results
  - Overall
  - Detailed recreation