

# RENTS HAVE BEEN RISING, NOT FALLING, IN THE POSTWAR PERIOD

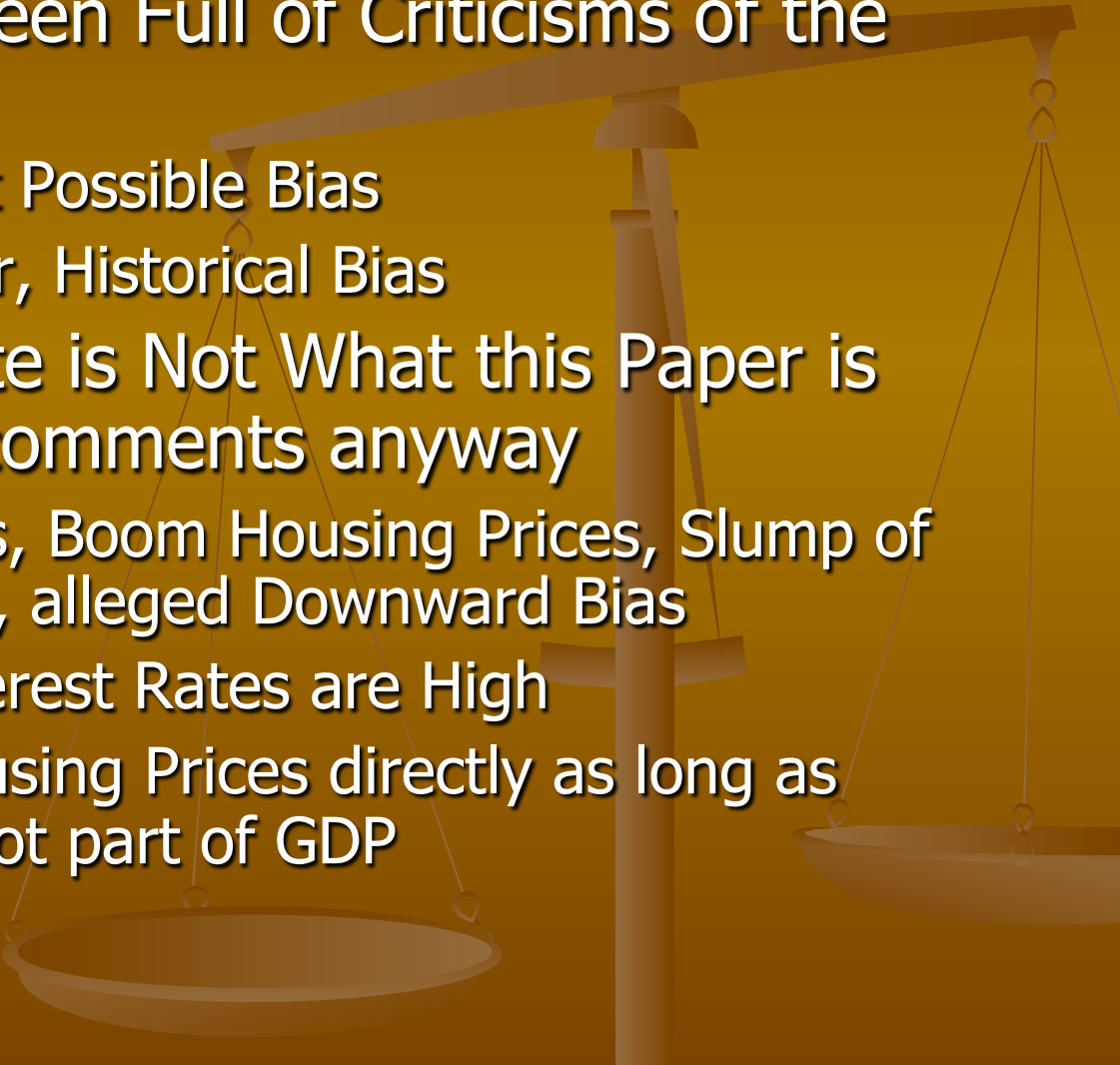
Theodore M. Crone and Leonard I. Nakamura  
Federal Reserve Bank of Philadelphia, and  
Richard Voith, Econsult Corporation

Discussed by RJG, NBER, July 18, 2006

# What Has Happened in the Past 1152 Days?

- Intense Policy and Journalistic Interest in Alleged Flaws in CPI/BEA Treatment of Owner-Occupied Housing
- Partly Inspired by CNV's 2003 Version, I'm Now Involved with a Paper on the Topic, hereafter GvG
- Fortunately, this is a Blessed Marriage, for two Different Research Approaches come up with the same Answer on the History of CPI Bias back to 1940 (!)
- This Topic is the *BIG BANANA* of CPI Bias Research, nothing else compares
  - And nothing compares to Leonard Nakamura and the CNV Trio as the leading producers of research on this topic

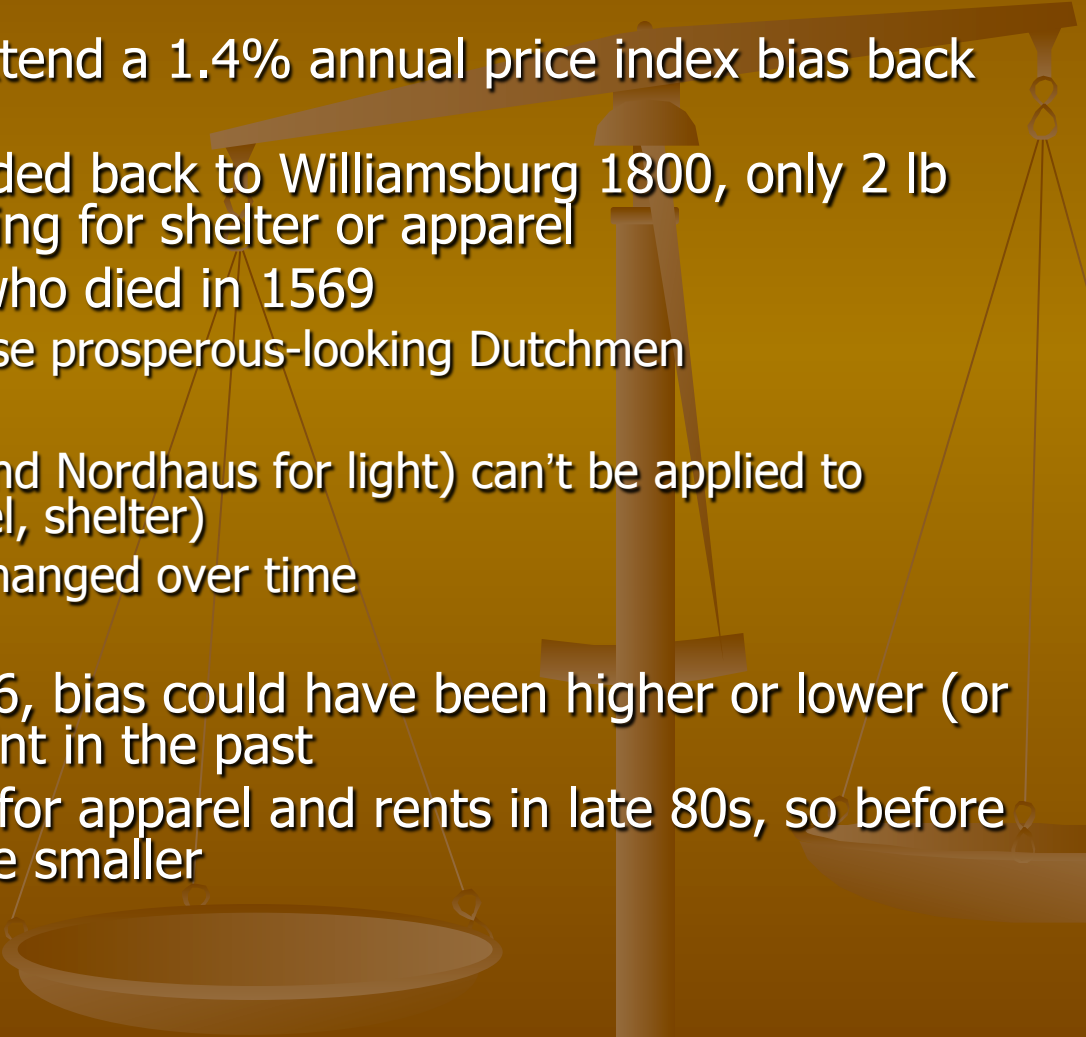
# Broader Context for Interest in this Line of Research

- The Media Have Been Full of Criticisms of the CPI for Housing
    - First Issue, Recent Possible Bias
    - Focus of this paper, Historical Bias
  - The Current Debate is Not What this Paper is About, but a few comments anyway
    - Low Interest Rates, Boom Housing Prices, Slump of Rent Inflation rate, alleged Downward Bias
    - Reverse when Interest Rates are High
    - Can't Measure Housing Prices directly as long as capital gains are not part of GDP
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# Identifying the Acronyms

- CNV = Crone, Nakamura, and Voith
  - Two important papers presented at conferences in 2002, early 2003, including Bosworth-Triplett workshop in May, 2003
    - One paper, this one, on nonresponse bias
    - The other was on AHS rental shelter hedonics
  - I learned what was possible from them
- GvG = Gordon and vanGoethem, forthcoming CRIW on 100 years of CPI rental shelter bias
  - Given at Bethesda Zvi conference Sept 2003
- Bottom line is to Ratify Triplett 1971 paper, the bias can go either way

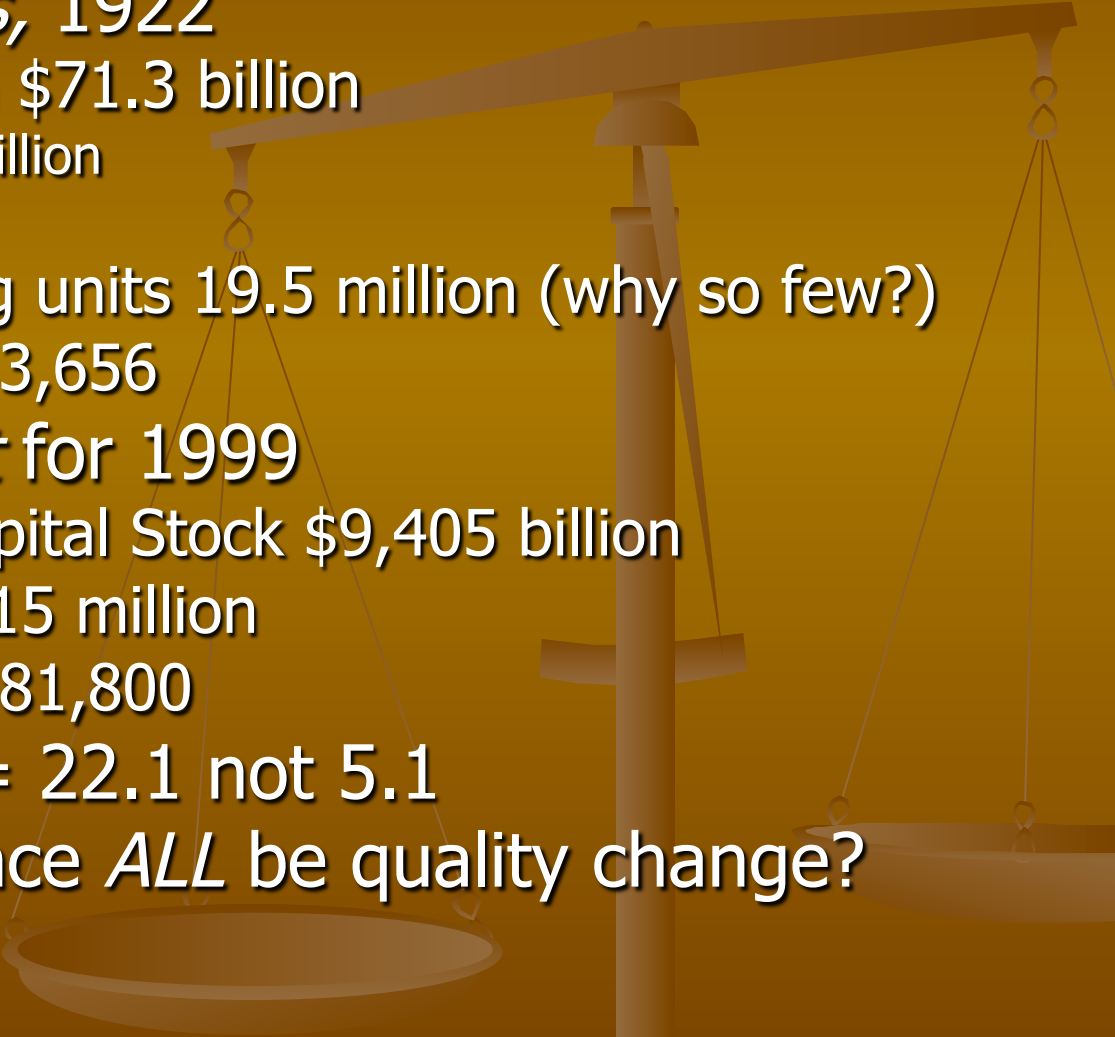
# Bias differs across products, and it may change over time

- Hulten-Bruegel paradox
  - Nordhaus' suggestion, extend a 1.4% annual price index bias back two centuries
  - Hulten's response, extended back to Williamsburg 1800, only 2 lb of potatoes per day, nothing for shelter or apparel
  - Extend back to Bruegel, who died in 1569
    - 1/4 lb of potatoes vs. those prosperous-looking Dutchmen
  - Resolution?
    - Bias in durable goods (and Nordhaus for light) can't be applied to necessities (food, apparel, shelter)
    - *OR*, bias in necessities changed over time
  - *Boskin Report*: only 95-96, bias could have been higher or lower (or opposite sign?) at any point in the past
  - BLS fixed downward bias for apparel and rents in late 80s, so before 1985 upward bias must be smaller
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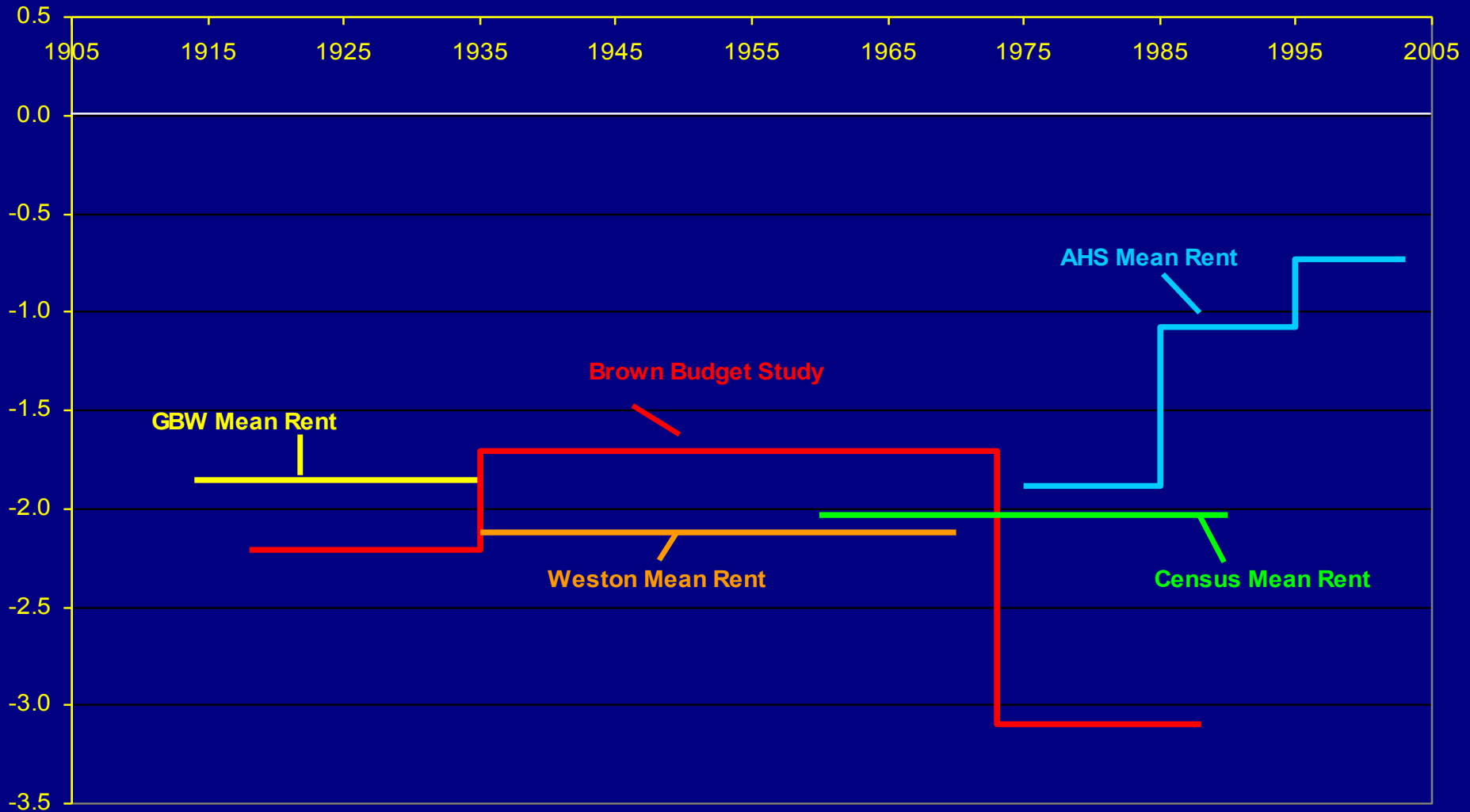
# *Prima Facie* Case that the CPI for Shelter is Biased Downwards, just Browse the *Historical Statistics*

- How I got into this topic long before the GvG paper
- Change over long historical periods
  - CPI for Shelter 1999/1925 = 5.1
- Median Price of Existing Houses
  - *Historical Statistics*, Washington DC, 1925, \$7,809
  - *Statistical Abstract*, Washington DC, 1999, \$176,000
  - Ratio = 22.5, not 5.1
- OK, rent vs. ownership price including land
  - But CPI for shelter is used to proxy for home ownership price
  - Tenants pay for the land, not just the structure

# Another Example

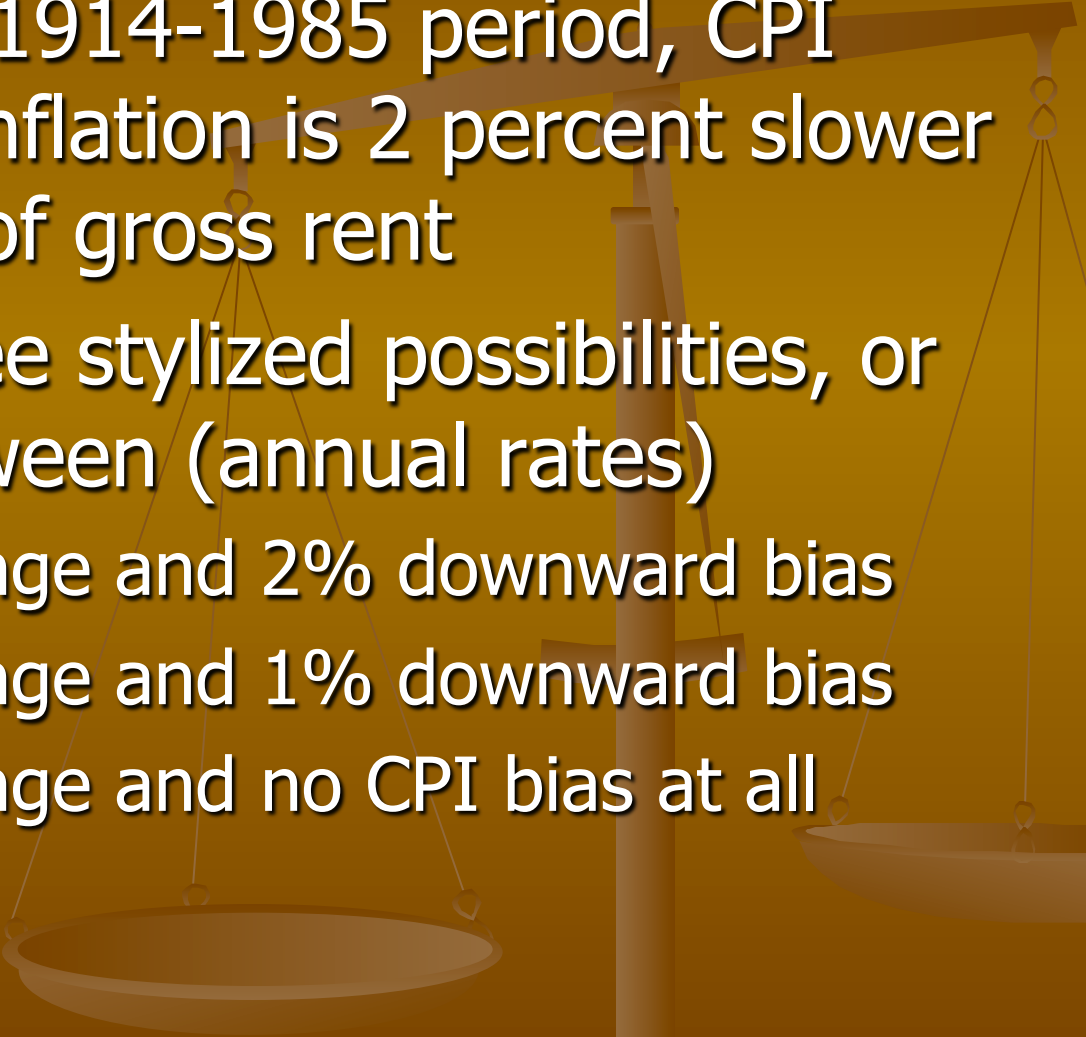
- *Historical Statistics, 1922*
    - Residential Wealth \$71.3 billion
      - Structures \$51.1 billion
      - Land \$20.2 billion
    - Number of housing units 19.5 million (why so few?)
    - Value per Unit = \$3,656
  - *Statistical Abstract for 1999*
    - Net Residential Capital Stock \$9,405 billion
    - Number of units 115 million
    - Value per Unit = \$81,800
  - Ratio 1999/1925 = 22.1 not 5.1
  - Could that difference *ALL* be quality change?
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# Common Starting Place, Difference CPI vs. Gross Rents



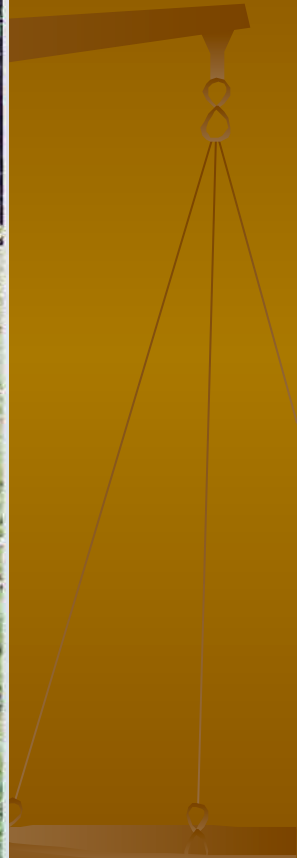


# To Interpret CNV's Basic Result, You must know in advance

- Over the entire 1914-1985 period, CPI rental housing inflation is 2 percent slower than the AAGR of gross rent
  - So we have three stylized possibilities, or anything in between (annual rates)
    - 0% quality change and 2% downward bias
    - 1% quality change and 1% downward bias
    - 2% quality change and no CPI bias at all
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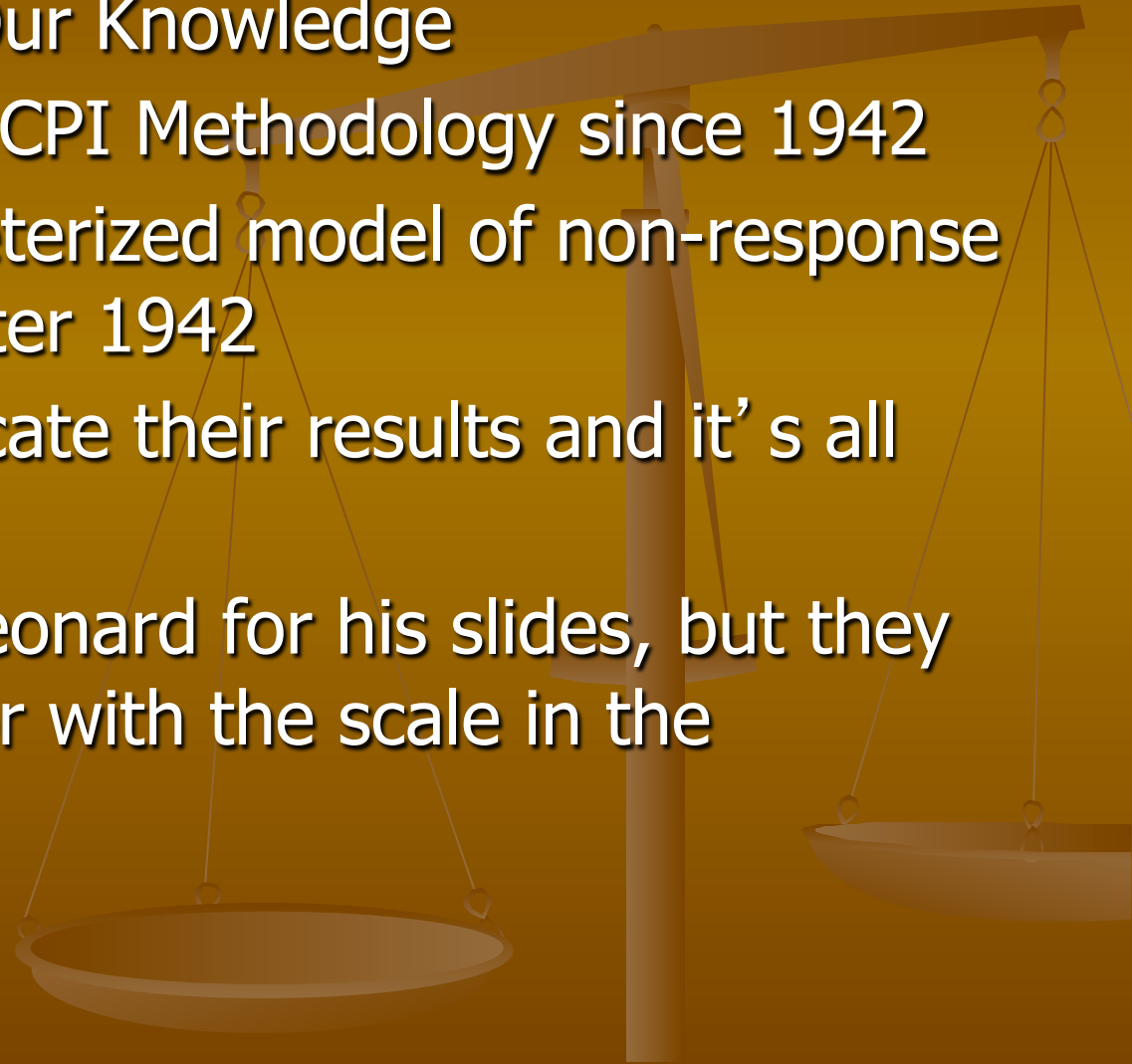
# This Research is Superb by Explaining *WHY* CPI was biased

- CNV in 2003 had already identified tenant non-response bias as a key ingredient in downward CPI bias for rental shelter, roughly 1940-85
  - BLS (Randolph, 1988) had already identified aging bias
- BLS fixed aging bias based on Randolph's work and in several stages has fixed the tenant non-response bias
- As a landlord, let me tell you about tenant non-response bias
  - Annual lease, rent held fixed for a minimum of 12 months
  - I don't tend to raise rents for a given tenant, only between tenants (tenant duration = 2 years)



# CNV Paper

- Real Addition to Our Knowledge
- Terrific History of CPI Methodology since 1942
- Ingenious parameterized model of non-response bias by decade after 1942
- I've tried to replicate their results and it's all 100% convincing
- Many thanks to Leonard for his slides, but they look better in color with the scale in the background



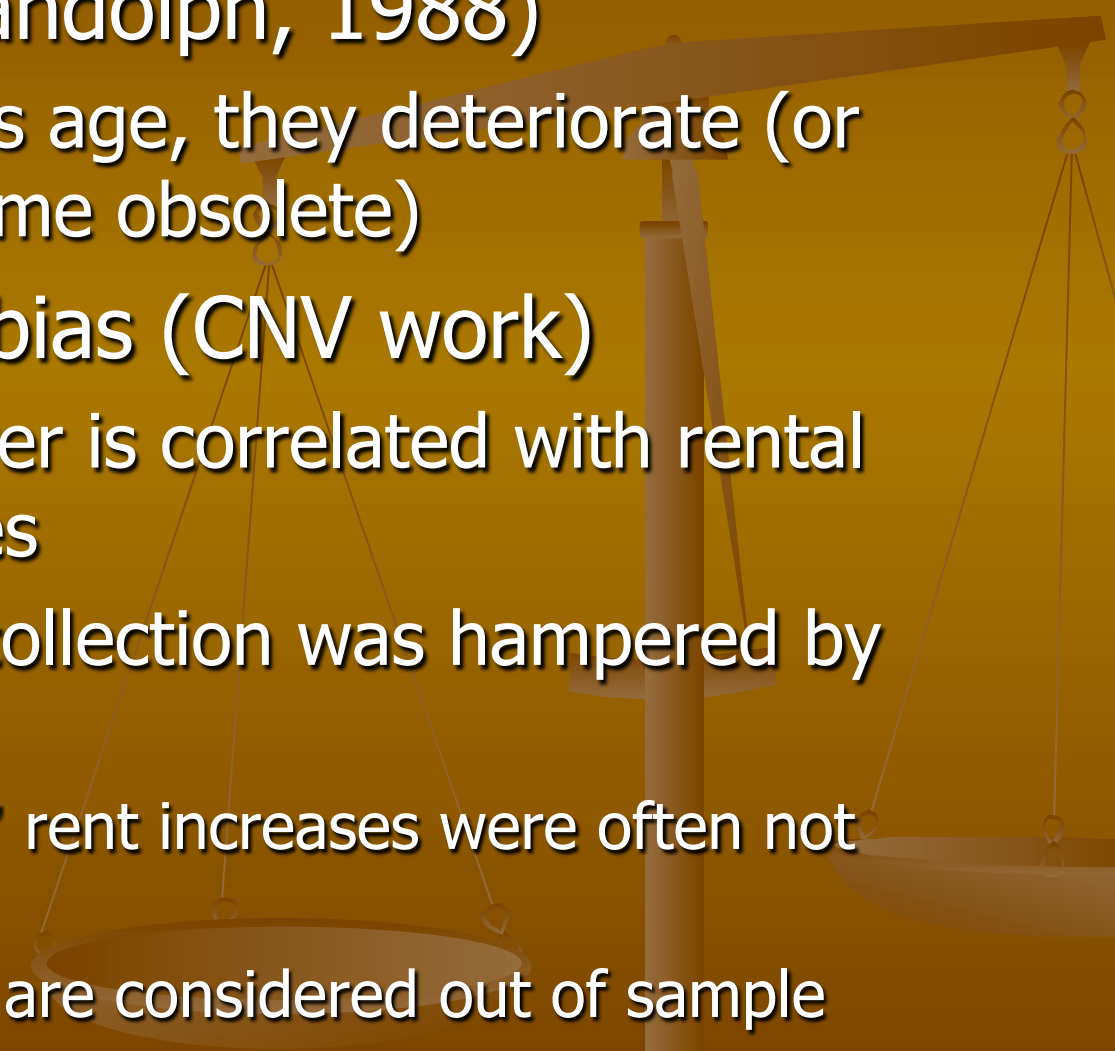
# Did tenant rent inflation continue at the same rate after 1985—or did it slow down?

Comparison between survey data and BLS rent data		
Annual growth rates, percent	Census of Housing or American Housing Survey, median rent	CPI, tenant rents
1940 to 1985	5.8%	3.4 %
1985 to 2001	3.5 %	3.4 %

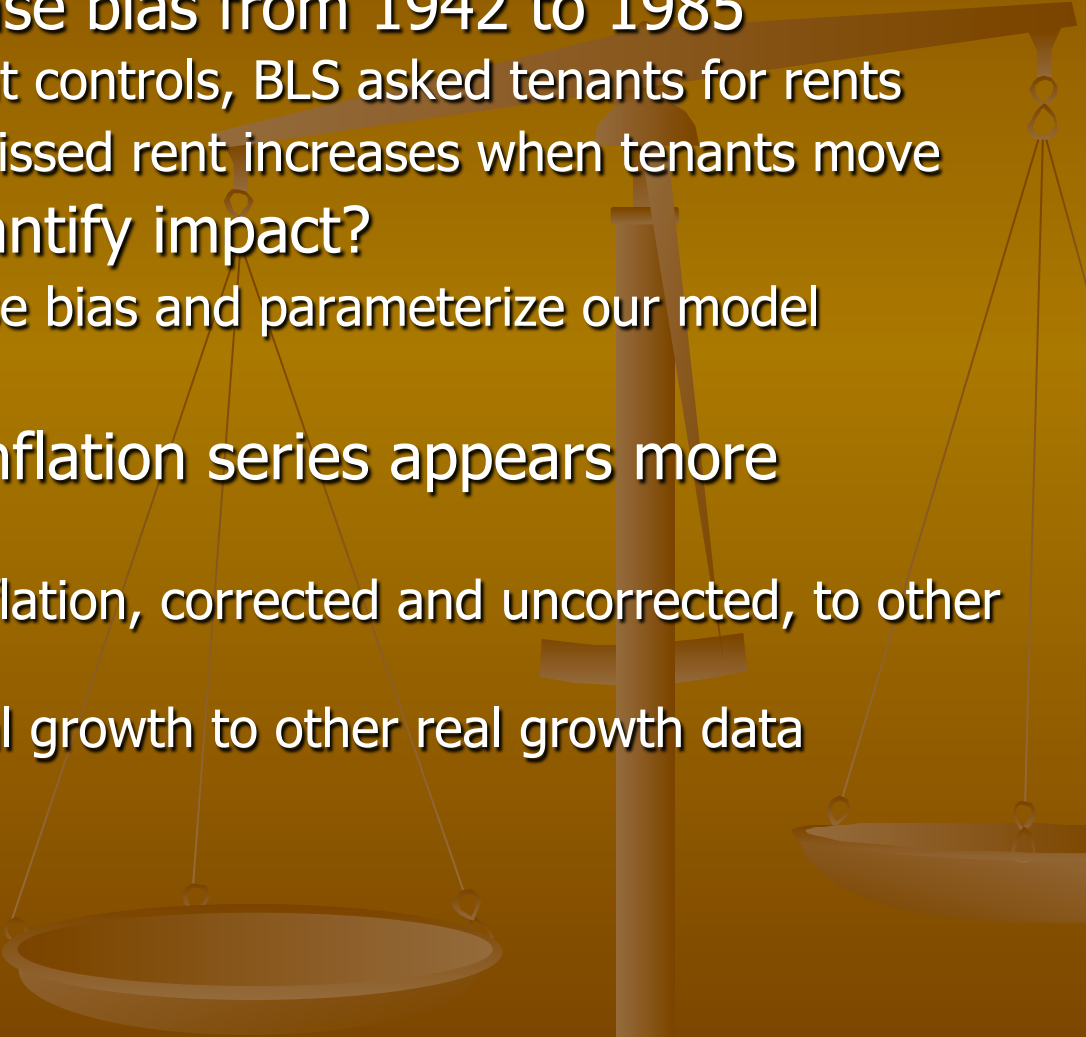
**Actual rents paid decelerated by 2 percent!**

**CPI rental inflation was unchanged**

# Point of Departure: Two Problems with CPI for Rent

- Aging bias (Randolph, 1988)
    - As rental units age, they deteriorate (or possibly become obsolete)
  - Nonresponse bias (CNV work)
    - Rental turnover is correlated with rental price increases
    - Rental price collection was hampered by turnover
      - New tenants' rent increases were often not recorded
      - Vacant units are considered out of sample
- 

# Focus of the CNV paper:

- Estimating nonresponse bias from 1942 to 1985
    - With World War II rent controls, BLS asked tenants for rents
    - But as a result, BLS missed rent increases when tenants move
  - Question: can we quantify impact?
    - We model nonresponse bias and parameterize our model
    - We find a large bias
  - The adjusted rental inflation series appears more reasonable
    - We compare rental inflation, corrected and uncorrected, to other inflation series;
    - Also implied real rental growth to other real growth data
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# Measuring inflation



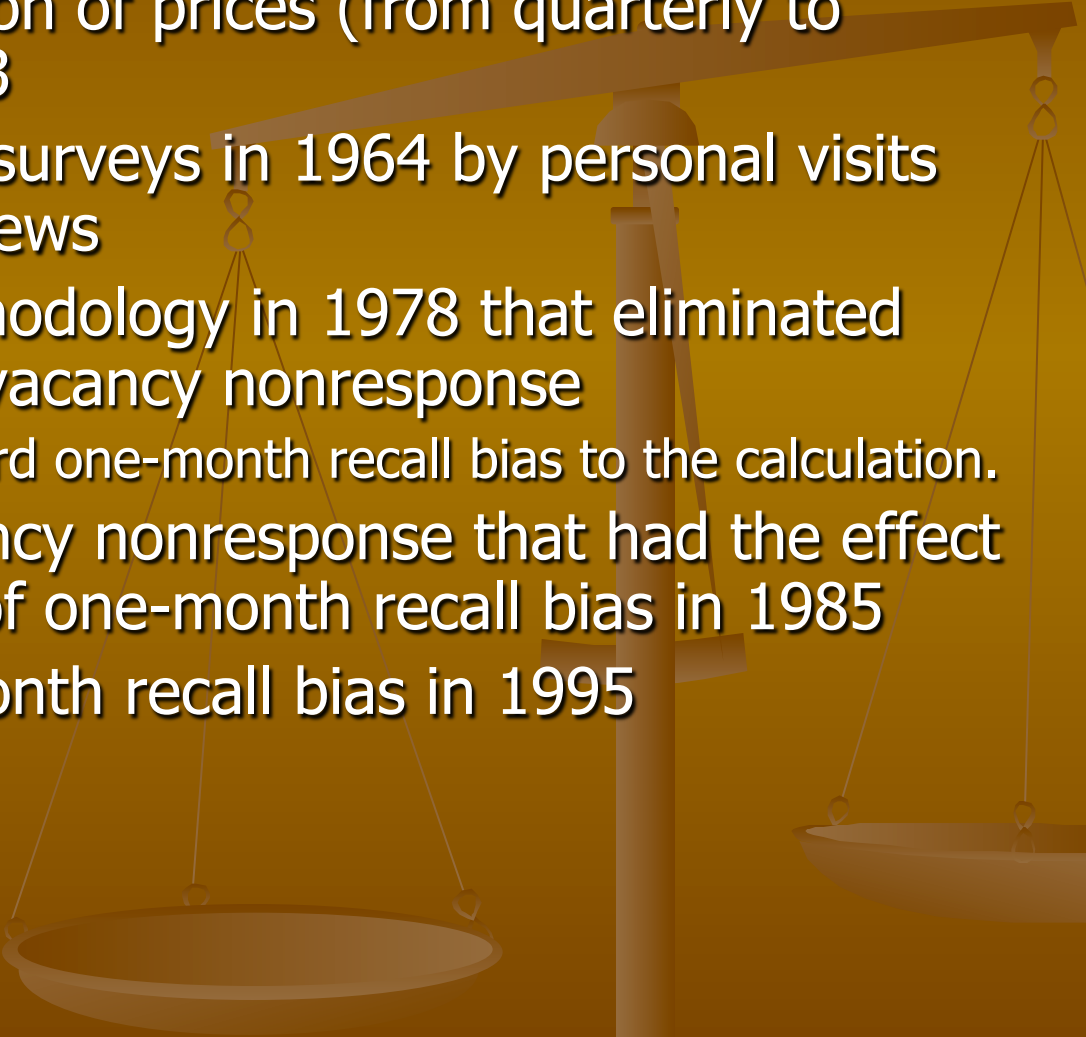
- Most of CPI is based on posted prices:
  - BLS inspectors go into department store or supermarket or airline reservation system
    - See how the posted price compares to the same item priced in previous month
- Rents are based on transactions price:
  - Go to tenant (or landlord, rental manager) and ask what price is currently being paid at same unit compared to six months ago
  - Vacancy is considered a missing observation



# Problem with asking *tenant*

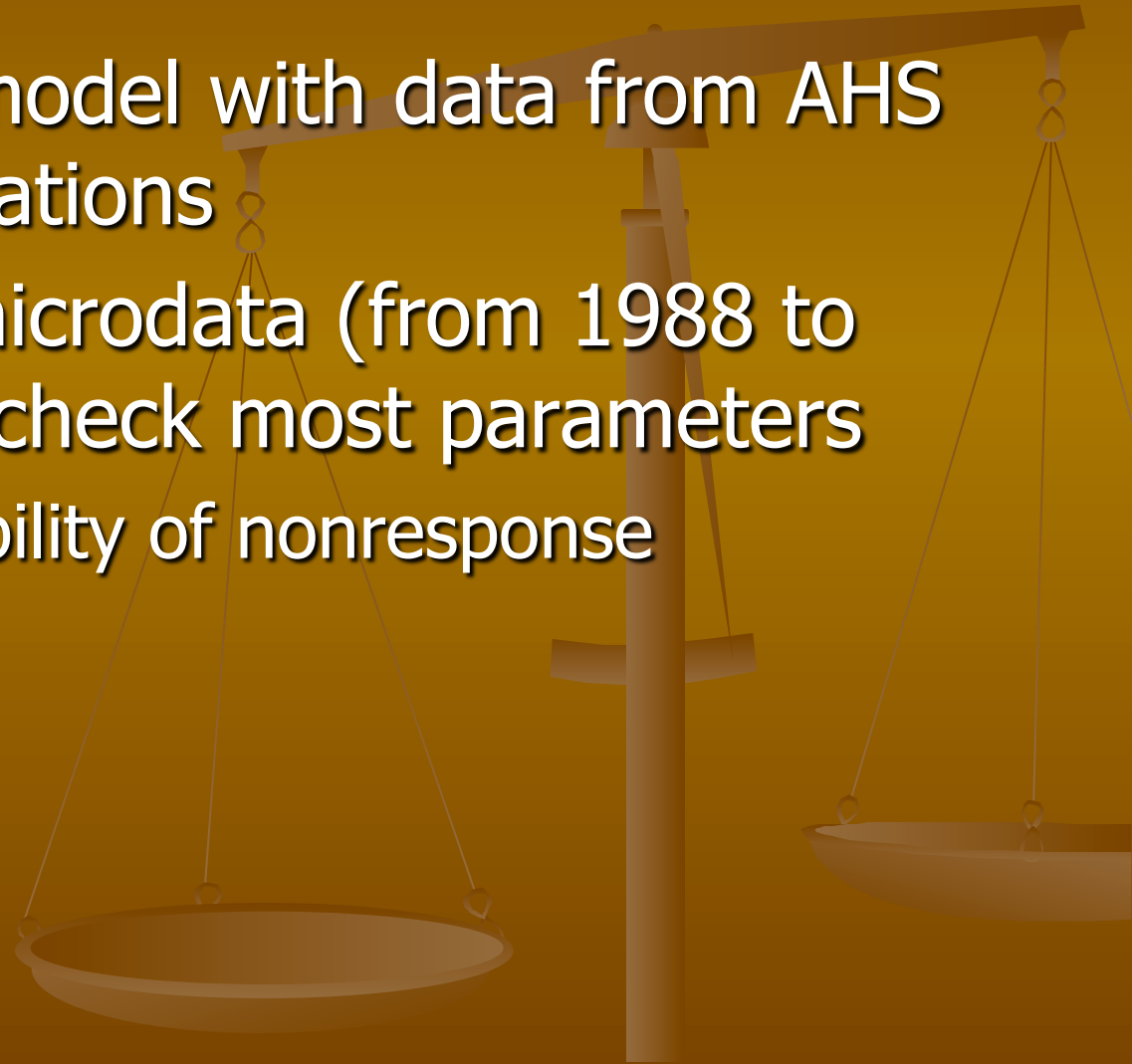
- Rents are generally increased annually
- If tenants are asked rents semiannually, half the time tenant reports zero increase
  - in practice, these zeros were overweighted because:
    - When the rent went up, it was often missed due to turnover (34 % annual rate) either the apartment became *vacant* or
      - a new relationship must be established with the new tenant or else the rental increase is not recorded
    - When tenants left, rent went up more than for tenants who stayed (Genosove)

# From 1953 to 1995, the BLS corrected nonresponse in five steps

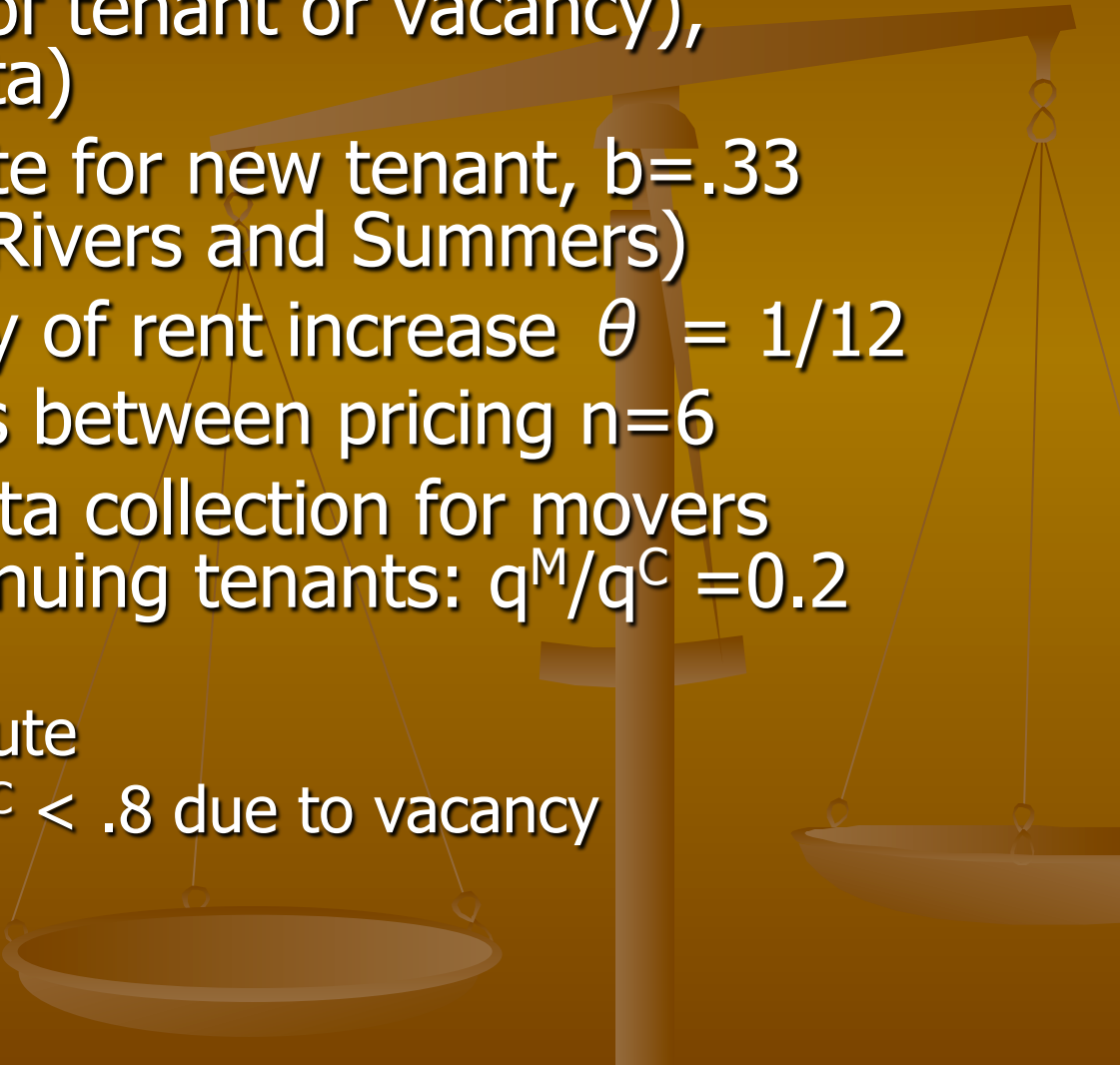
- Less frequent collection of prices (from quarterly to semiannually) in 1953
  - Replacement of mail surveys in 1964 by personal visits and telephone interviews
  - Major change in methodology in 1978 that eliminated nonresponse except vacancy nonresponse
    - Introduced a downward one-month recall bias to the calculation.
  - Imputations for vacancy nonresponse that had the effect of eliminating much of one-month recall bias in 1985
  - Elimination of one-month recall bias in 1995
- 

# Quantifying size of bias

- Parameterize model with data from AHS and BLS publications
- Detailed BLS microdata (from 1988 to 1992) used to check most parameters
  - but not probability of nonresponse



# Here are the key parameters in the model

- Turnover(change of tenant or vacancy),  $\rho = .344$  (AHS data)
  - Higher inflation rate for new tenant,  $b=.33$  (From BLS study, Rivers and Summers)
  - Monthly probability of rent increase  $\theta = 1/12$
  - Number of months between pricing  $n=6$
  - Relative rate of data collection for movers compared to continuing tenants:  $q^M/q^C = 0.2$  before 1978
    - this is hard to impute
    - but we know  $q^M/q^C < .8$  due to vacancy
- 

# Formula for rental inflation to correct for nonresponse, 1942-77

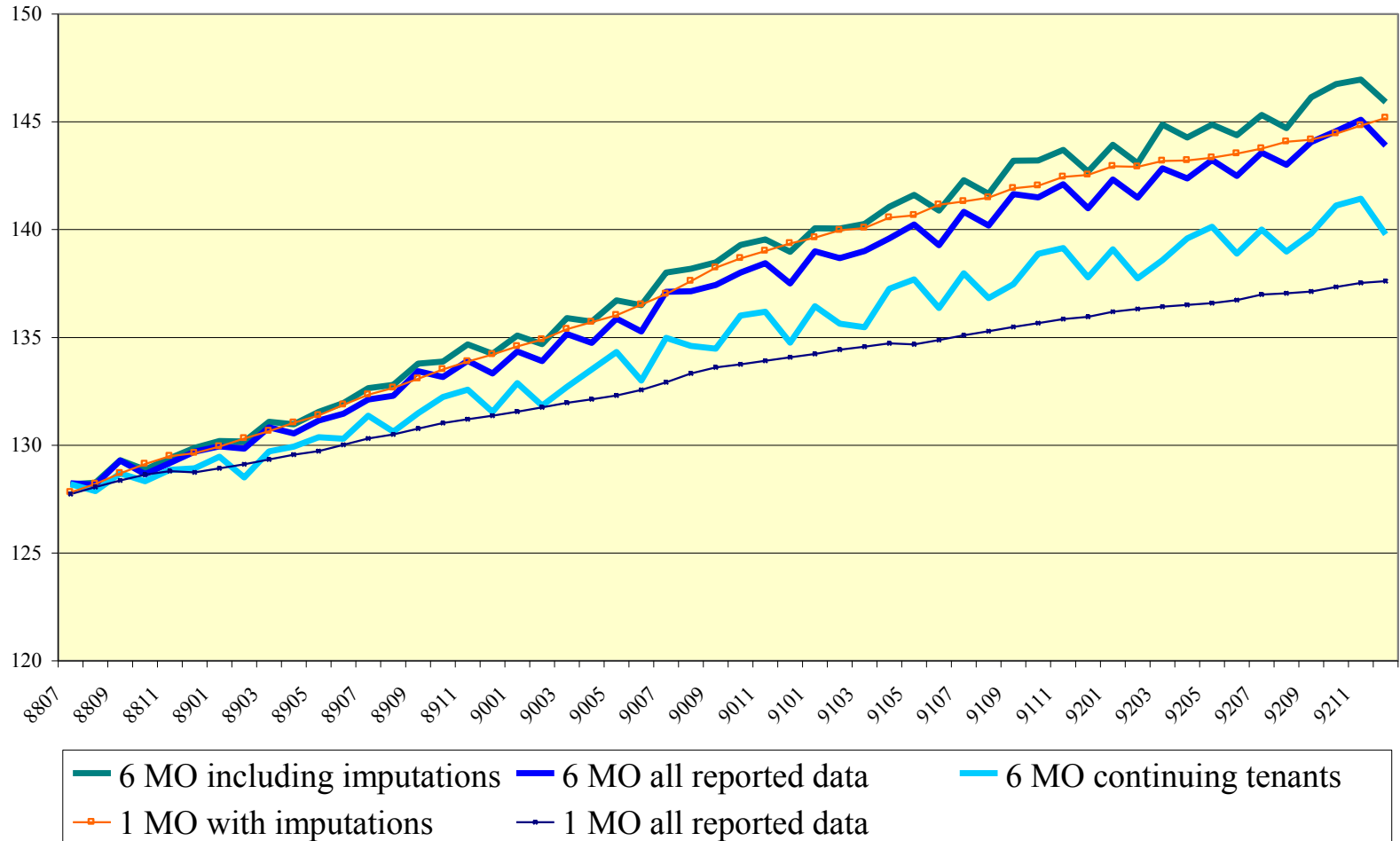
- true rate of rent inflation  $\pi_t$
- = true rent inflation for continuing tenants times adjustment for higher inflation at turnover units
- = factors accounting for rate of nonresponse times measured inflation

$$\pi_t = (1 + \rho b)\pi_{Ct} = \frac{(1 + \rho b)(1 - n\theta\rho(1 - \frac{q_M}{q_C}))}{1 - \rho(1 - \frac{q_M}{q_C}(1 + b))} \pi_t^m$$

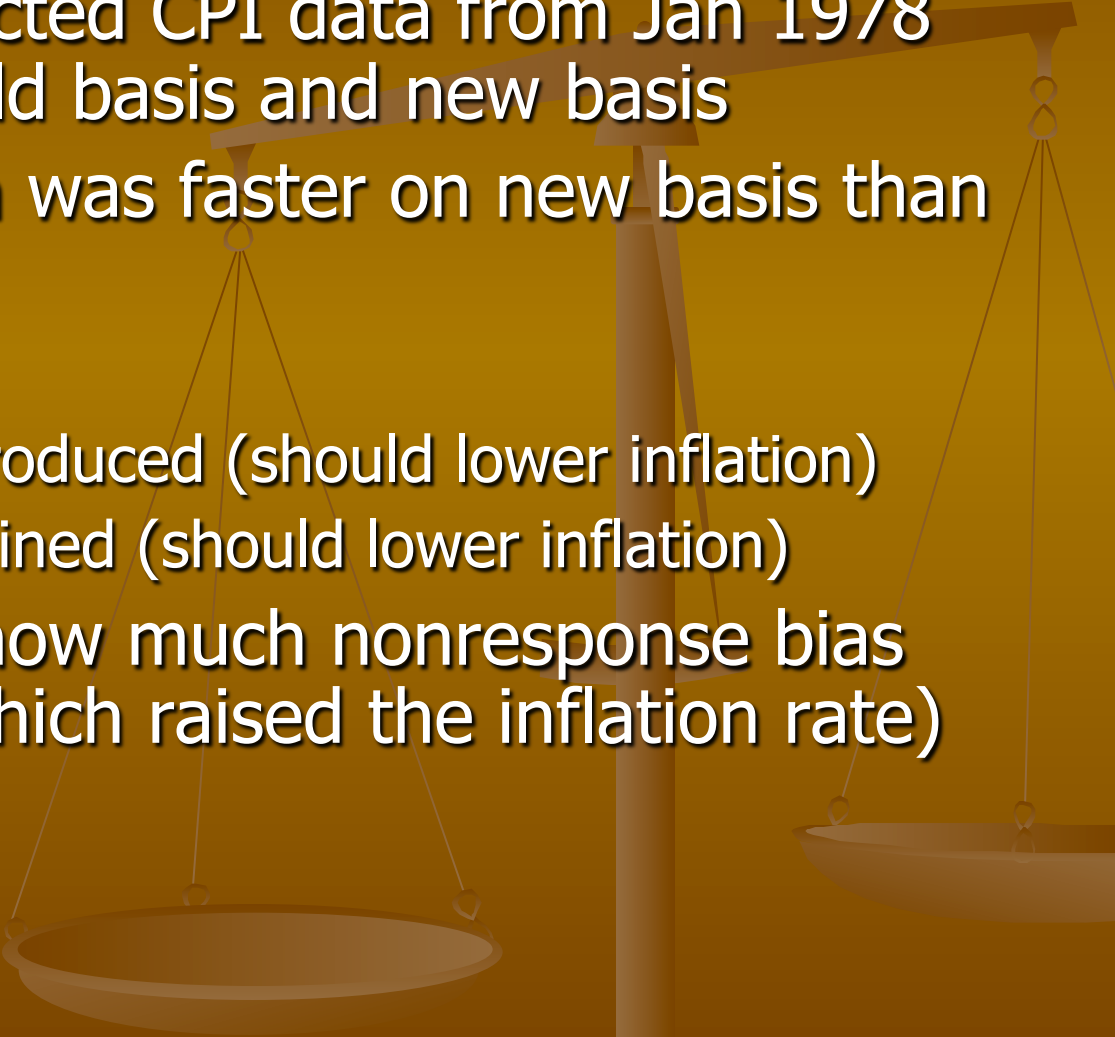
# Check parameters with BLS microdata

- Data: microdata BLS CPI for rents, 1988 to 1992
- We can check: vacancy bias, actual measured rents, recall bias
- But not rate of nonresponse for units where tenants move
- Key fact on following graph: AAGR for continuing tenants was 1.9, correcting for movers and vacancies raised it to 3.0

Figure 1. BLS Rent Microdata, 1988-1992



# Inferring rate of nonresponse before 1978 change in procedures

- In 1978, BLS collected CPI data from Jan 1978 to June 1978 on old basis and new basis
  - CPI rental inflation was faster on new basis than old basis
  - But:
    - recall bias was introduced (should lower inflation)
    - vacancy bias remained (should lower inflation)
  - We can back out how much nonresponse bias was eliminated (which raised the inflation rate)
- 



# Key Page Showing Calculations, Table 4 on p. 35

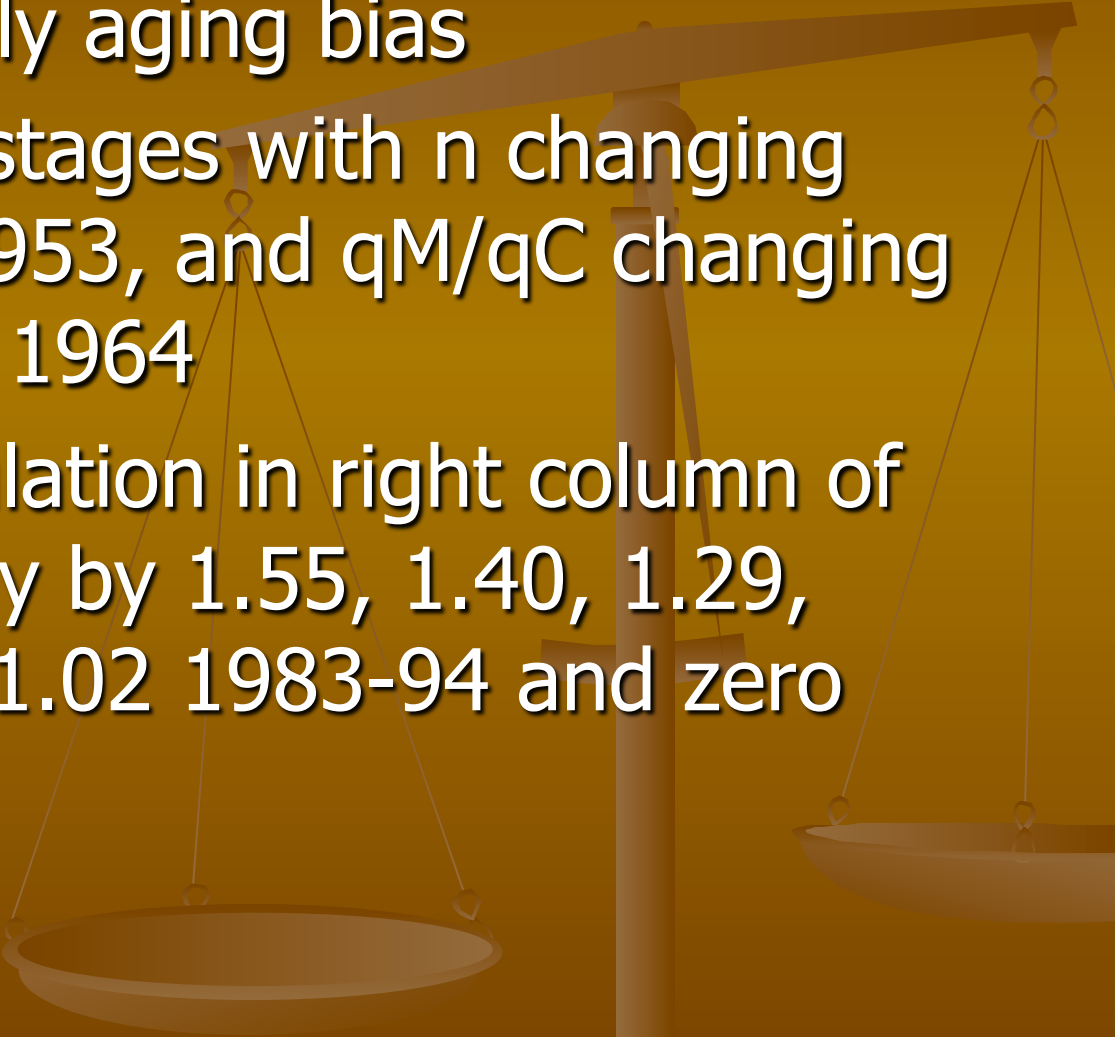
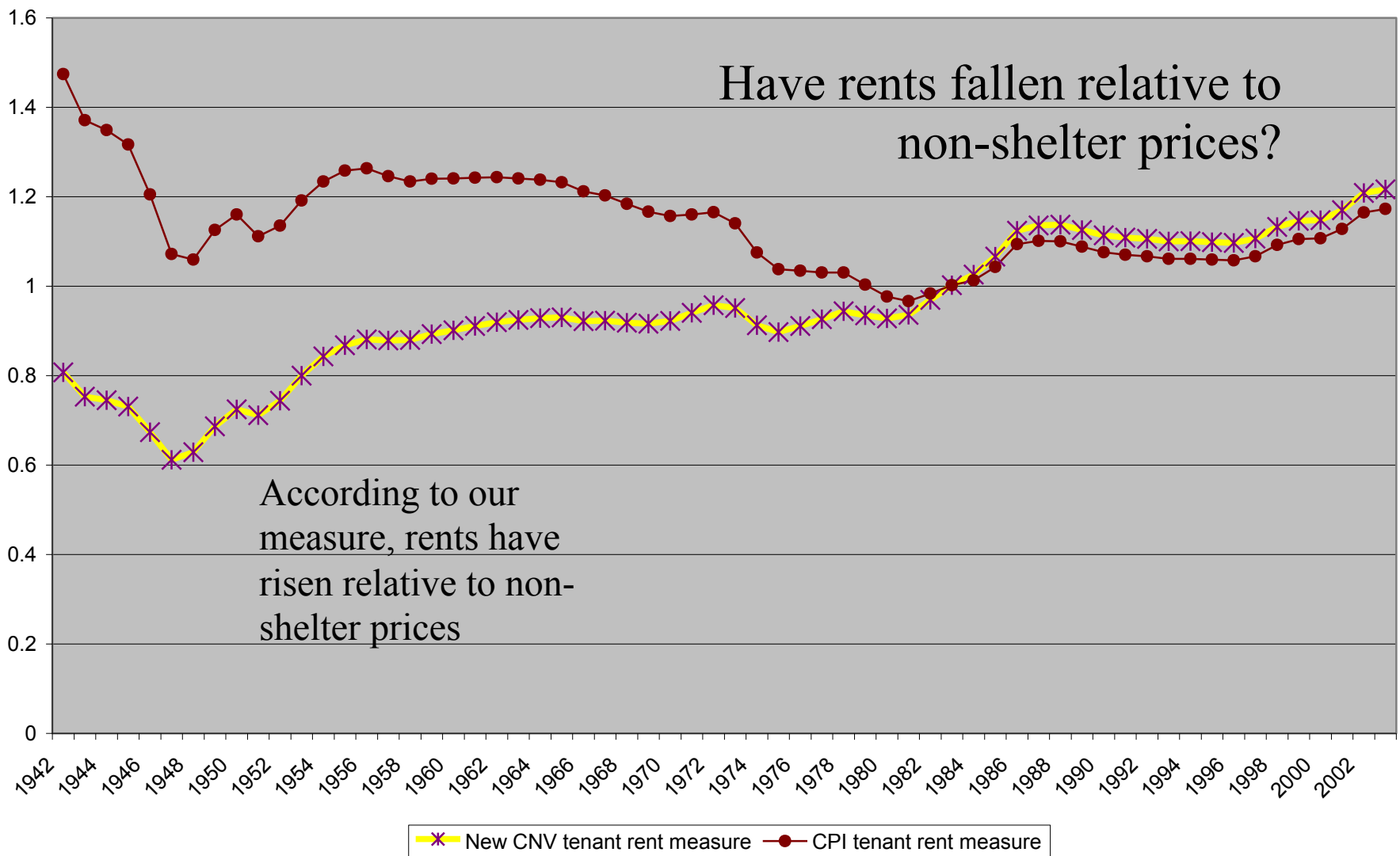
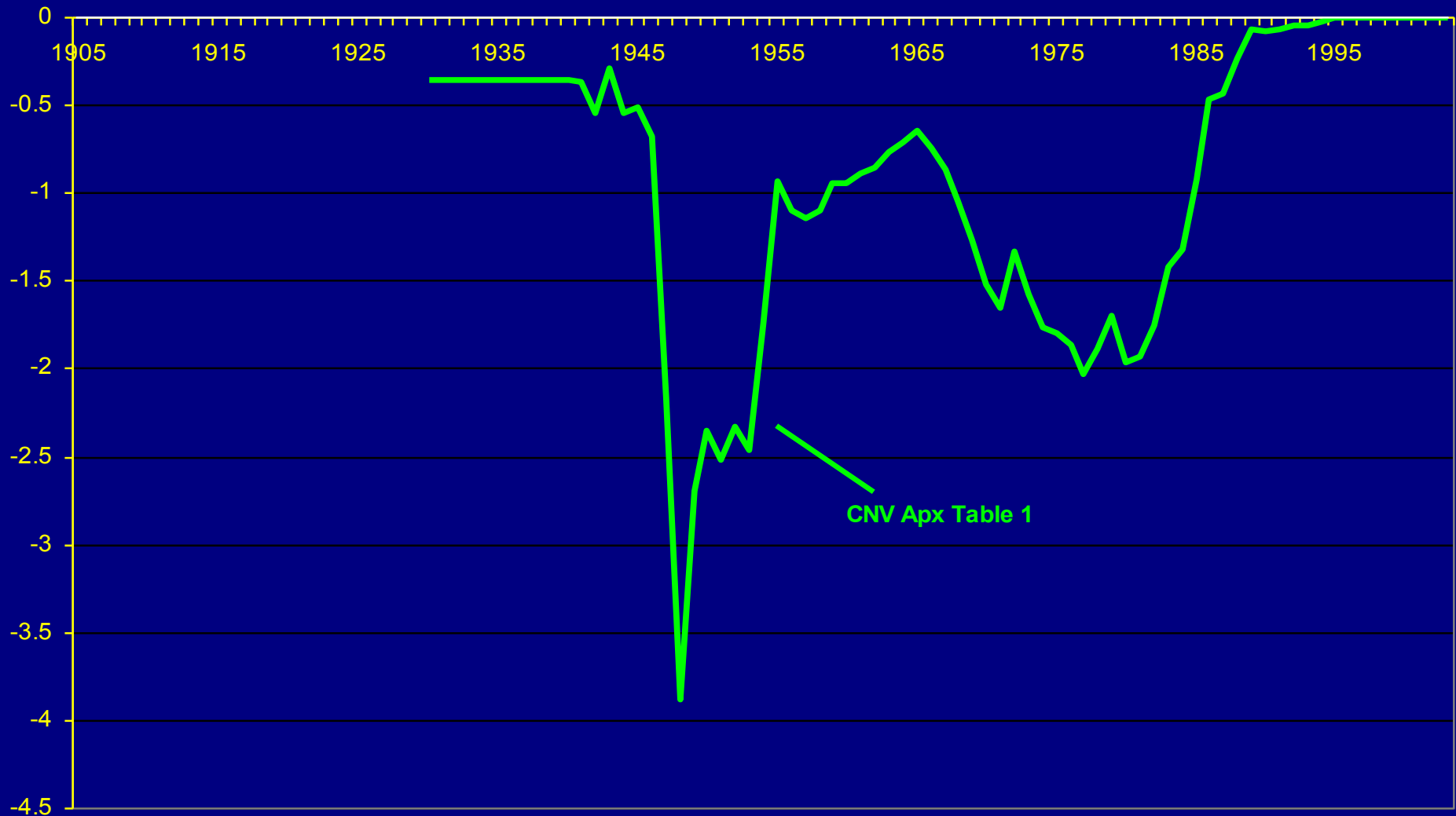
- Before 1942, only aging bias
  - 1942-77, three stages with  $n$  changing from 3 to 6 in 1953, and  $q_M/q_C$  changing from 0 to 0.2 in 1964
  - Note basic calculation in right column of Table 4. Multiply by 1.55, 1.40, 1.29, 1.19, then only 1.02 1983-94 and zero 1994-present
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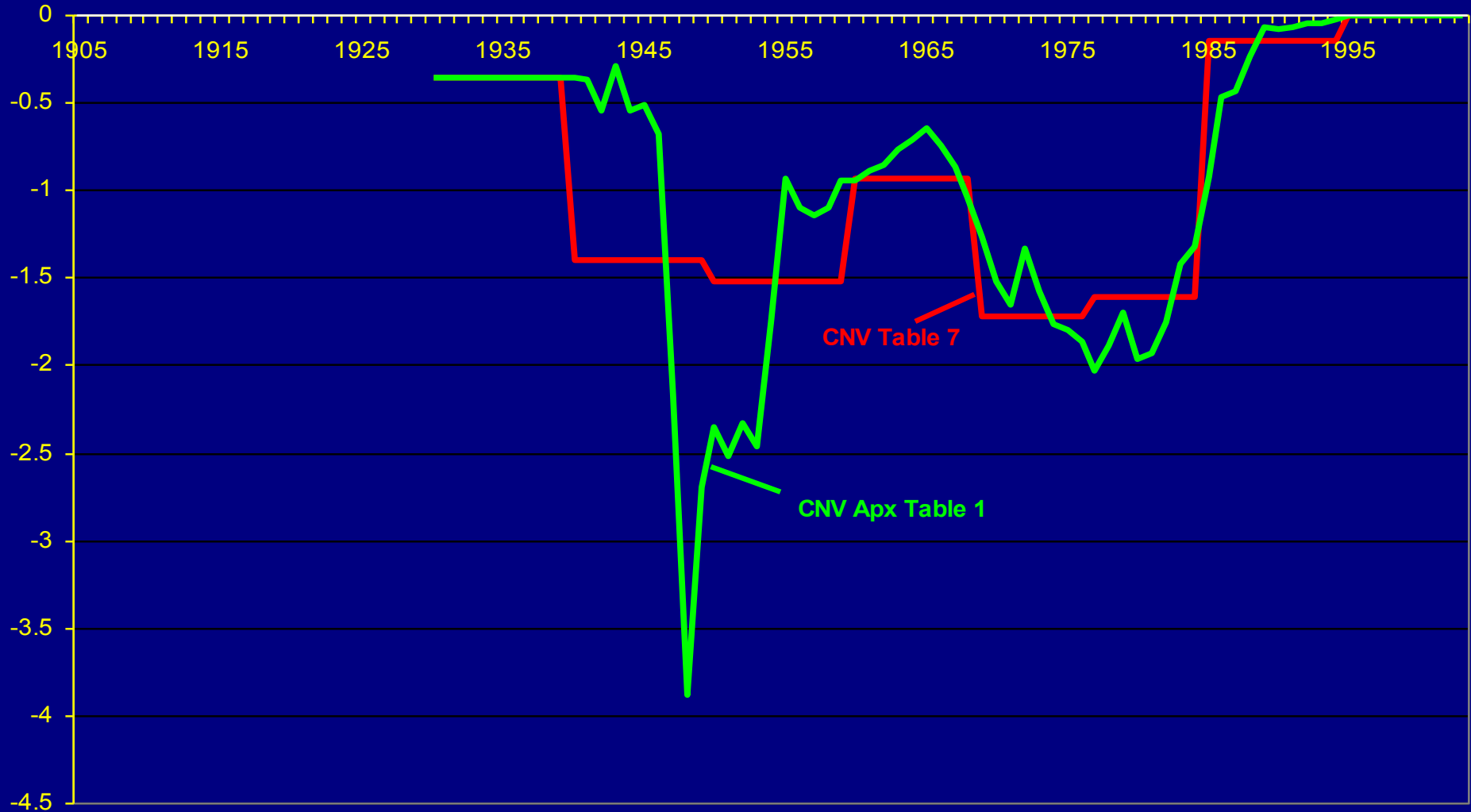
Figure 1. CNV and official CPI measures of rent ratio to CPI all items excluding shelter



# Growth Rates from CNV Apx Table 1 (pp. 28-29), Why So Wild?



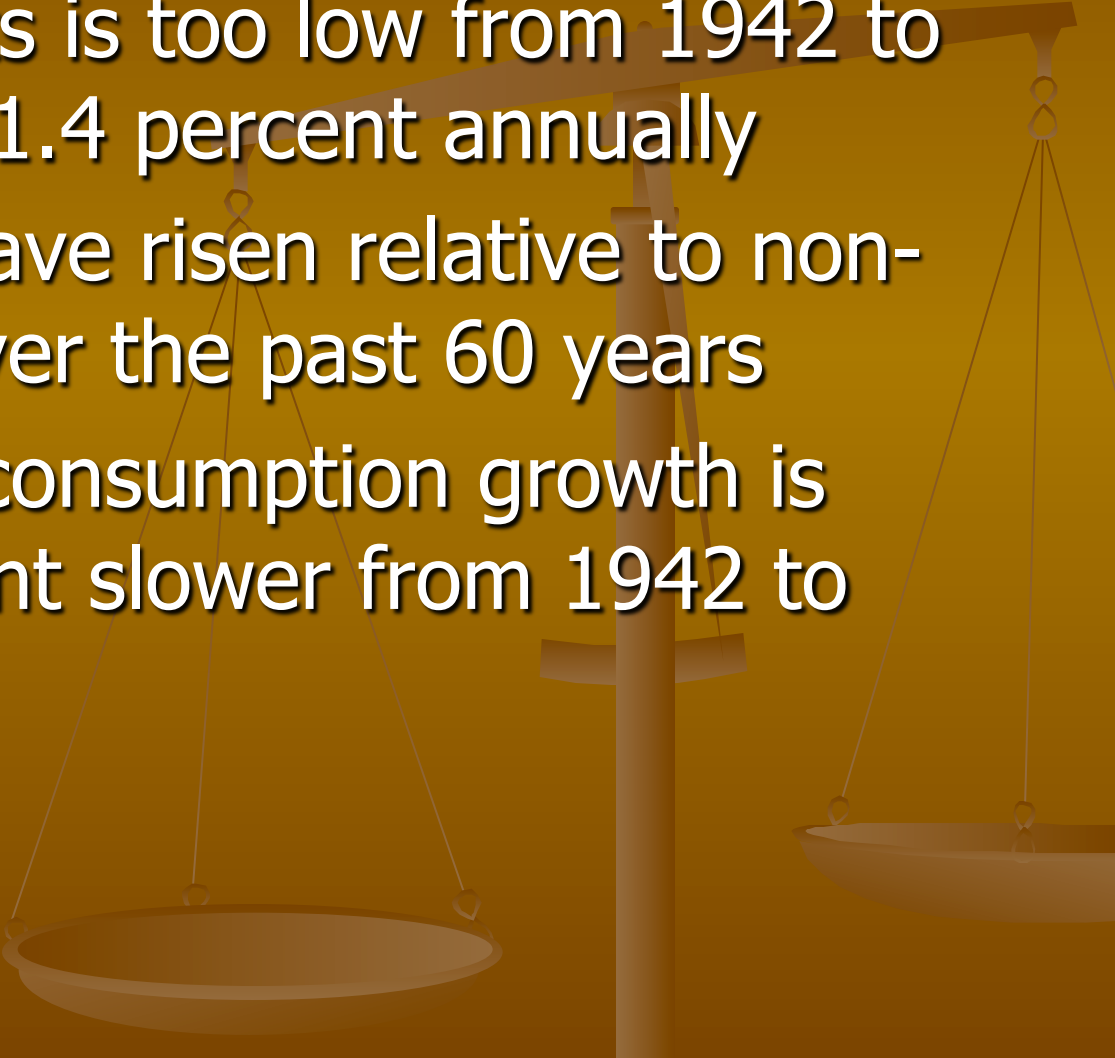
# Let's Calm it Down by Taking the Decadal Averages from Table 7



## Compare deceleration to other residential price indexes

Table 9. Comparison of alternative rent price indexes with other price indexes, log percent annualized inflation rates.				
		1940 to 1985	1985 to 2001	Difference
Official rent estimates	CPI-W, not seasonally adjusted, tenant rents, BLS	3.43	3.37	-0.06
New CNV rent estimate	Adjusted CPI-W rents, new estimates	4.84	3.46	-1.38
Median rents	Median gross rents, Census and AHS,	5.78	3.45	-2.33
Residential structures	Residential fixed investment chain price index, BEA	5.06	3.15	-1.91

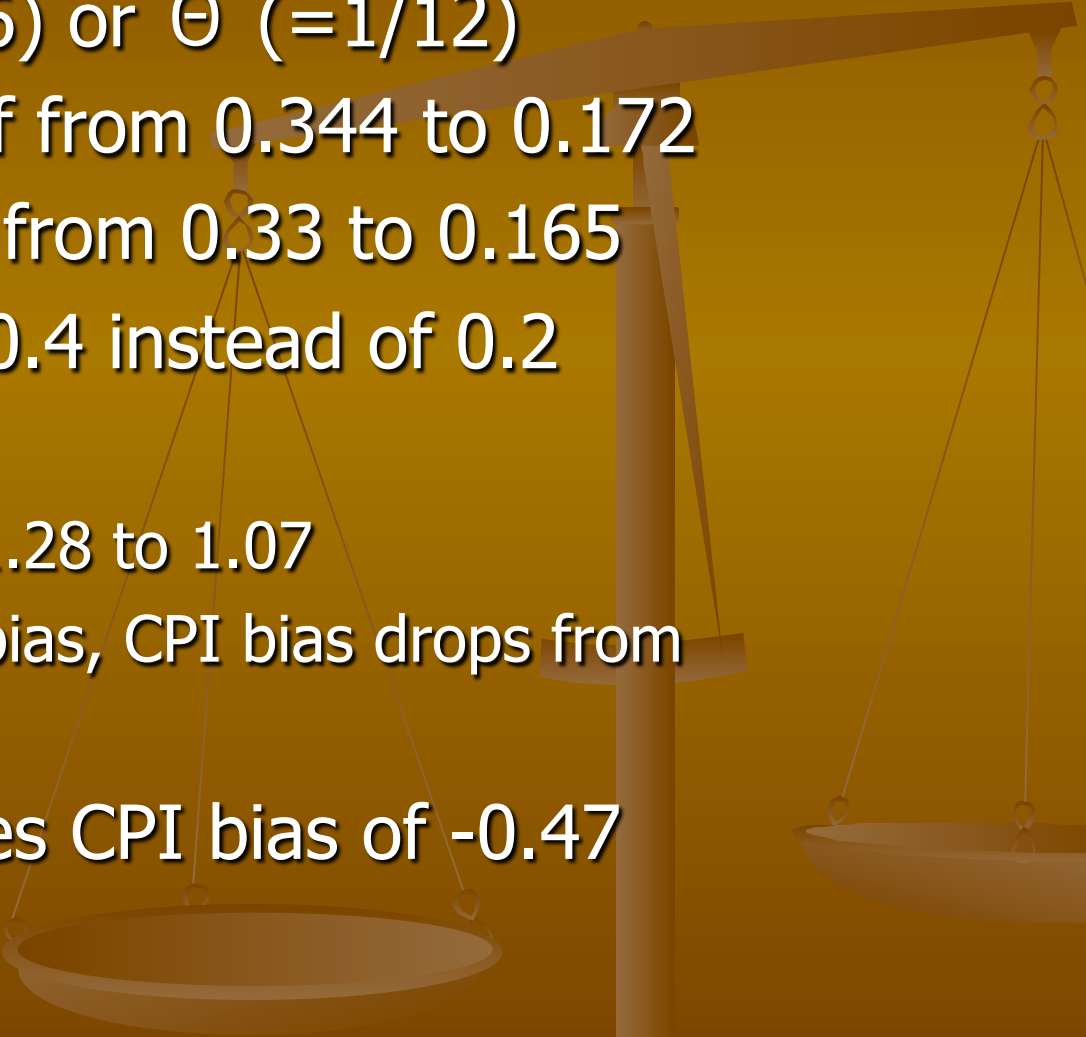
# Conclusion

- BLS CPI for rents is too low from 1942 to 1985, by about 1.4 percent annually
  - Relative rents have risen relative to non-shelter prices over the past 60 years
  - Aggregate real consumption growth is about 0.2 percent slower from 1942 to 1985
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# Comments: How Robust is the Technique of Parameterization?

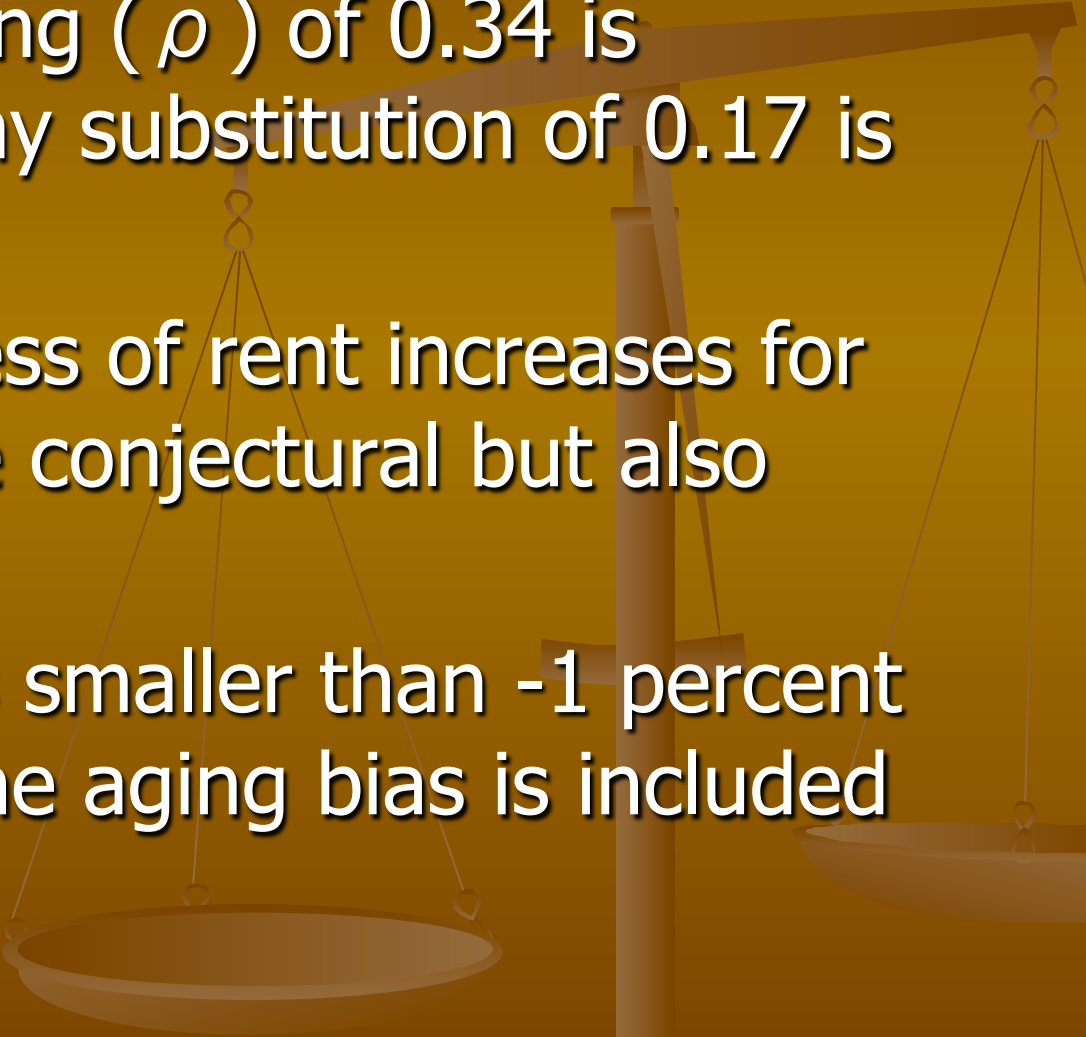
- Let's work through their base result for 1963-77 (method 4 Table 4 p. 35)
- Formula comes out that true inflation is 1.28 times measured CPI inflation:
  - $1.28 * 3.43 = 4.76$
  - Bias is  $3.43 - 4.76$  or  $-1.33$
- Of this  $-1.33$ ,  $-0.36$  is aging bias and  $-0.97$  is the authors' new calculations

# Now Adjust Three Parameters

- Can't adjust  $n$  ( $=6$ ) or  $\Theta$  ( $=1/12$ )
  - Let's cut  $\rho$  in half from 0.344 to 0.172
  - Let's cut  $b$  in half from 0.33 to 0.165
  - Assume  $q_M/q_C$  is 0.4 instead of 0.2
  - Result?
    - Ratio drops from 1.28 to 1.07
    - Aside from aging bias, CPI bias drops from -0.97 to -0.25
  - $q_M/q_C$  of zero gives CPI bias of -0.47
- 



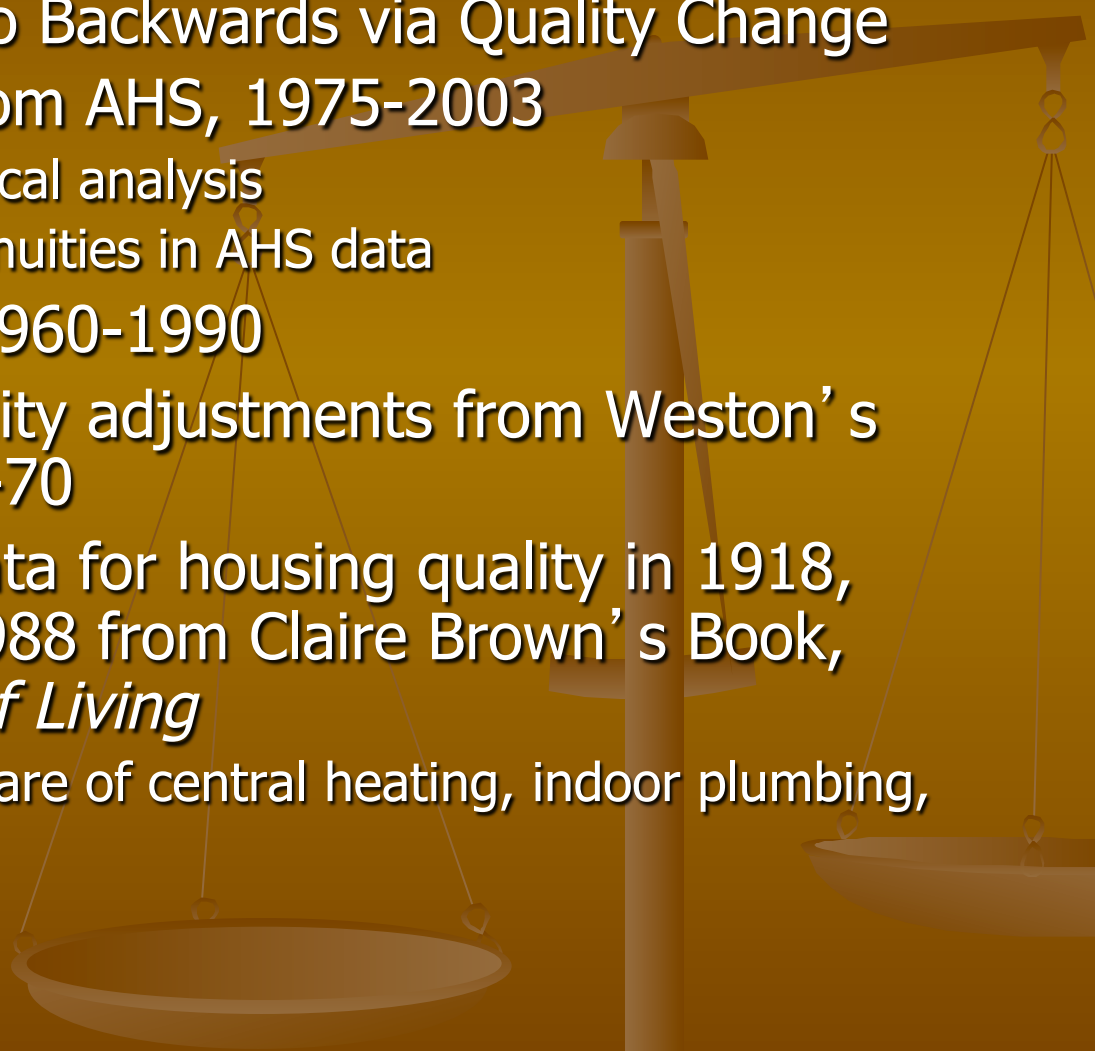
# Passes Robustness Test Because:

- Proportion moving ( $\rho$ ) of 0.34 is plausible, and my substitution of 0.17 is implausible
  - Value of  $b$  (excess of rent increases for movers) is more conjectural but also plausible
  - Hard to get bias smaller than -1 percent per year once the aging bias is included
- 

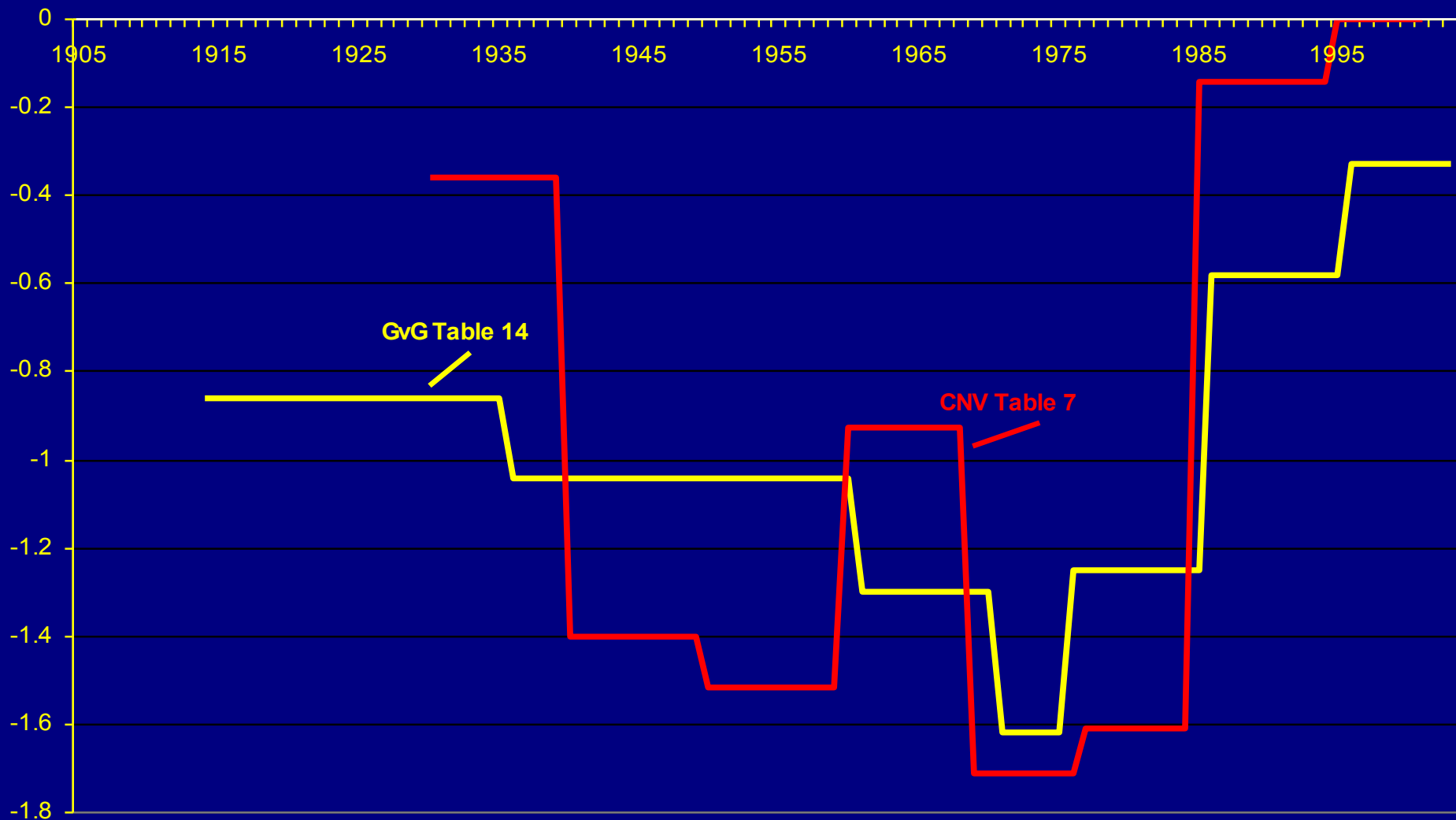
# Issue We Shouldn't Take for Granted: Aging Bias

- CNV Take This at Face Value
- Yes, Clearly a Source of Downward CPI Bias in the Past
- But What does it Mean?
  - Location: Inner-city vs. Suburbs
  - Omitted quality variables from my perspective as an Evanston landlord:
    - New high-rises have views
    - Central air conditioning, new kitchens
  - But do the older units actually decline in quality?
    - My coach house says “no”! Renovations not only by owner but by tenants!
      - Distinction between maintenance (roof, gutters) vs. improvements (e.g., circuit board, kitchen appliances, new and better floors)

# What GvG Added to What CNV had already Achieved

- Common Theme – Go Backwards via Quality Change
  - Regression results from AHS, 1975-2003
    - A more refined empirical analysis
    - Treatment of discontinuities in AHS data
  - Census regressions 1960-1990
  - Extracting crude quality adjustments from Weston's 1972 thesis for 1930-70
  - Use of CES survey data for housing quality in 1918, 1935, 1950, 1972, 1988 from Claire Brown's Book, *American Standard of Living*
    - Impute increase in share of central heating, indoor plumbing, and electrification
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# How do the CNV Bias Estimates Compare to GvG Table 14?



# Implications of CPI Bias

- CNV and GvG agree that bias was greater 1942-78
  - Growth in real consumption and real GDP overstated
  - Golden age of productivity growth 1940-70 overstated
    - Bulge in bias in 1970s worsens the productivity slowdown
    - Low Bias in 1990s implies bigger productivity revival
  - 1% annual bias for 30% of the CPI implies 0.3% annual upward bias for real consumption, 0.2% for real GDP
    - These are big numbers in the “battle of the basis points”
  - The next step in historical research, try to create a consensus CPI bias estimate that varies over each decade as CPI methodology has shifted
  - This research makes that goal much closer than it was five years ago
- 