

# **Price Index Bias in the 20<sup>th</sup> Century for the United States: Understanding Economic Growth**

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# Background to My Interest in Historical Price Index Bias

- Writing a book on the hidden, previously unrecognized sources of improvements in the standard of living that are not included in Maddison or any other statistics
- Part of the missing improvements in the standard of living fall under the standard dimensions of CPI bias
  - Quality change, late introduction of new goods, outlet substitution bias, new goods problem
- But others do not, and I've suggested six dimensions

# Six Dimensions: Lifting the Veil

- (1) larger and better housing units
- (2) improvements in health and life expectancy
- (3) improvements in marketing including mail-order catalogues and ever-changing retail formats
- (4) easier and cheaper access to a wider variety of information (dating back to the telegraph)
- (5) the enormous improvement in the “quality of work” measured not just as declining work hours per year, but by the gradual replacement of the physical strain of farming, mining, and manufacturing by office and service occupations
- (6) the quantum change in the “quality of youth” and the “quality of retirement” which barely existed in 1900 (people worked until they died)

# Broadening the Concept of Price Index Bias for the Standard of Living

- CPI Problems (CPI only starts in 1914)
  - Missing new goods
  - Introducing them years or decades late
  - Bias after introduction (not all CPI bias is upward)
  - Outlet substitution bias
- Relating Outlet Substitution Bias to History of Marketing
  - Replacement of local small general store with
    - Big urban department stores
    - Grocery chain stores
    - Sears and M&W catalogues initially mainly for rural
    - Later Wal-Mart and internet

# New Products Span a Wide Range Not Previously Considered

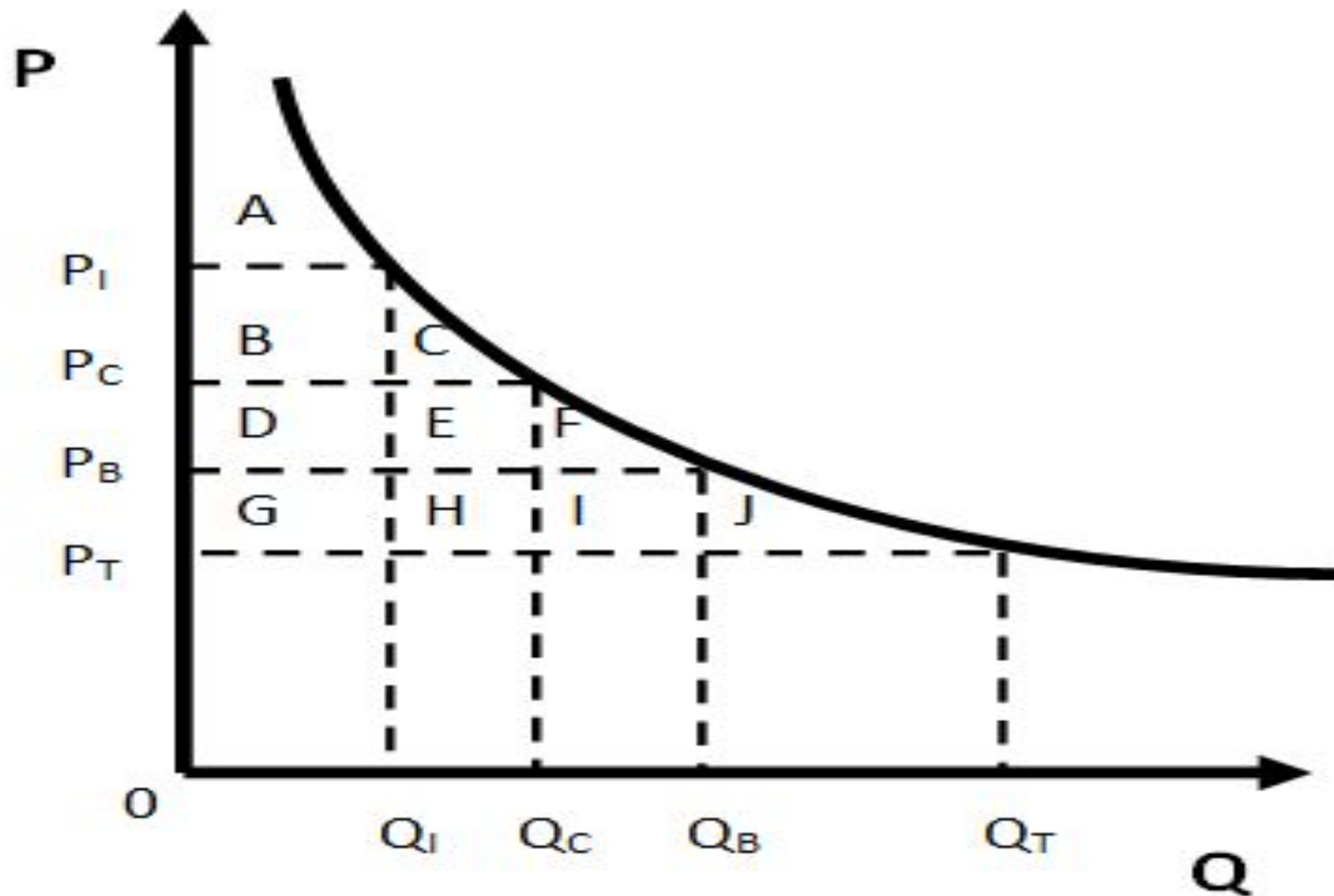
- Improvements excluded from GDP start with #1 Housing
  - Indoor plumbing
  - Central heating
  - Electrification
- #2 Health: Increasing life expectancy
  - Infant mortality, life-threatening diseases
  - Not just medical technology
    - Urban sanitation infrastructure made indoor plumbing possible (Mokyr-Stein 1997)

# The Current “Consensus” Record on Real Per-capita Consumption

- This consists of NIPA 1929+, Gallman 1869-1909, and Lebergott 1900-1929
  - With some background detail from Shaw 1869-1919
- Going beyond this official record involves coping with the fact that almost much of what is consumed now had not been invented in 1869.
- A static graph helps to think about this

# Simplifications in the Consumer Surplus Diagram

- Takes account of new goods, late introduction into CPI, and post-introduction CPI bias
- Source of decline in  $P$  and increase in  $Q$  is a steady rightward shift in the unobserved supply curve for the product due to innovation
- This graph will abstract from shifts of demand curve
  - Changes of income
  - Changes in population
  - Changes in prices of related goods
  - Changes in tastes
  - Development of complementary inventions
  - Quantity is quality-corrected so that is taken into account, so think of vertical axis as computer quality-adjusted price and horizontal as speed/memory/ancillary quality of computer box



**Figure 1-1**

**Mismeasurement of Consumer Surplus  
Created by a Newly Invented Product**

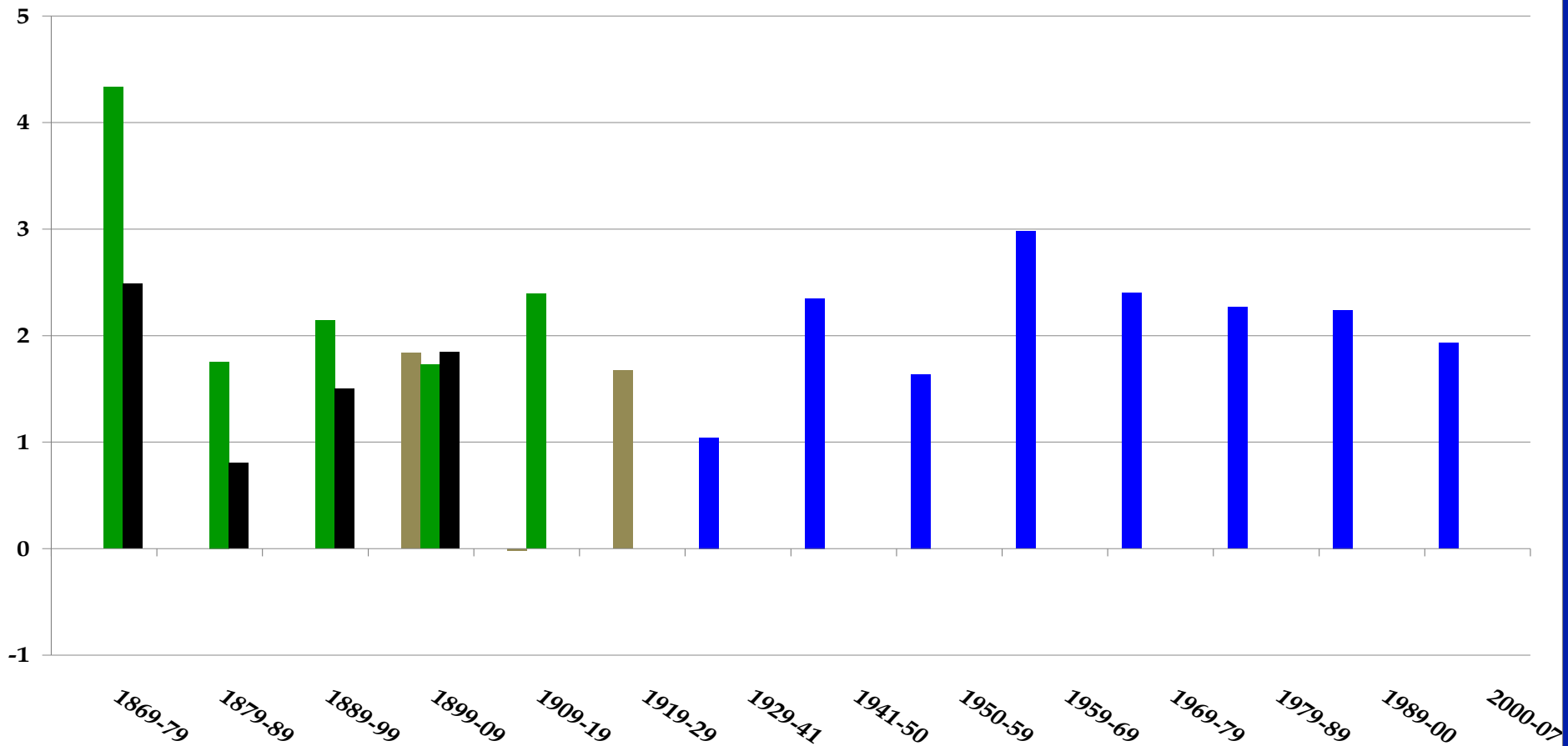


# How Broadly Can This Be Applied?

- This framework has already been applied to high-tech goods, including computers in 1980-2010 and automobiles in 1910-1940
- Can we go beyond modern products to deal with the three necessities, food, clothing and shelter?
- Clothing and shelter have been studied, food has been subject to remarkably little research

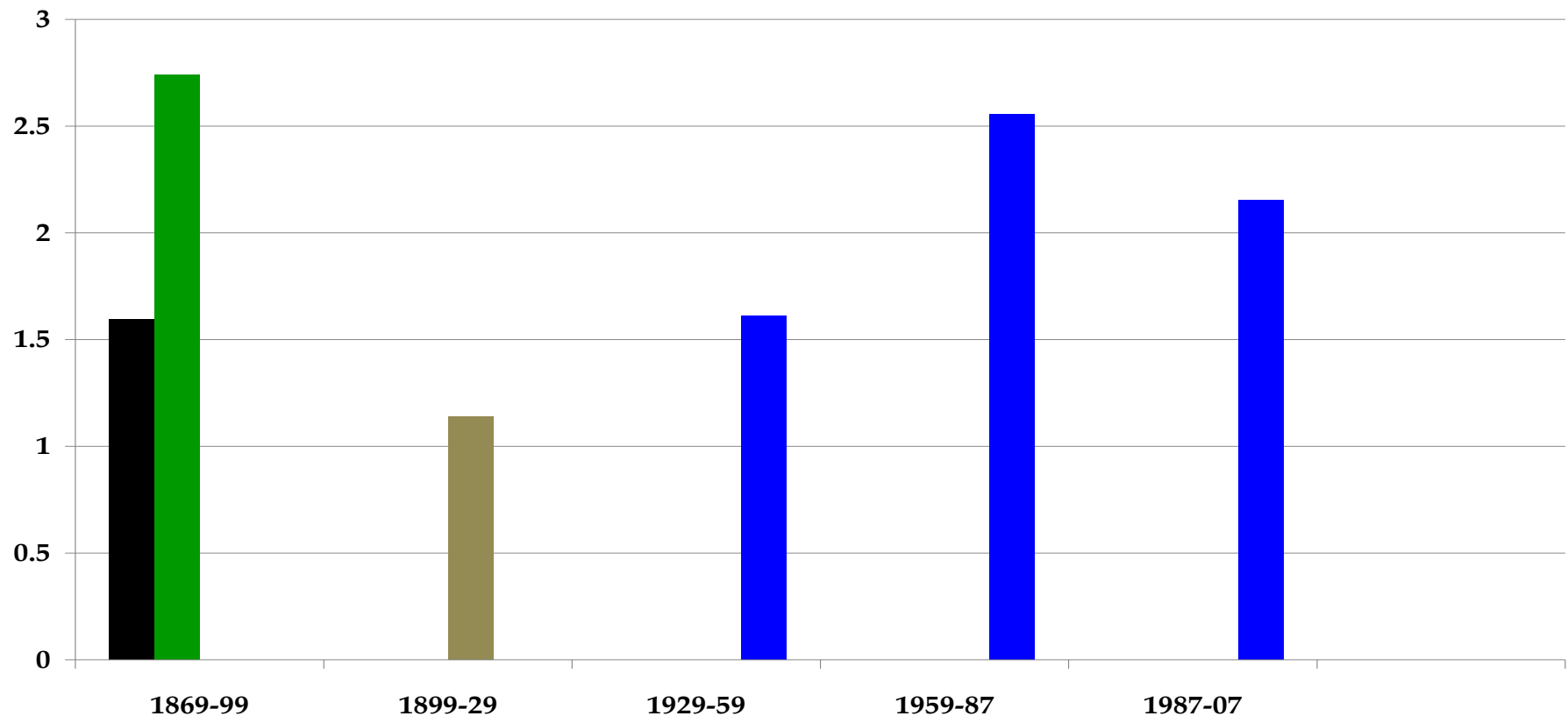
# Conventional Growth Rates, 1869-2007 by ~ Decade

Figure 1-2 Real Consumption Per Capita in Annualized Annual Growth Rates for Selected 10 year Intervals, 1869-2007 (Shaw's goods destined for consumption, NIPA PCE, Gallman, Lebergott)



# Puzzles Clearer over 30-year Intervals

Figure 1-3. Real Consumption Per Capita in Annualized Annual Growth Rates, Selected 30 year Intervals, 1869-2007 (Shaw's goods destined for consumption, NIPA PCE, Gallman, Lebergott)



# Questions from Data

- Why is measured Cons pc so low 1900-29?
  - Could most of the social benefits in this period have taken the form of unmeasured consumer surplus from new products?
  - Example: automobile ubiquitous by 1929 but not introduced into the CPI until 1935
  - We'll get help from Raff-Trajtenberg (1997)
- 1869-1900?
  - Rees 1890-1914 vs. black box 1869-90 and 1914-29
  - Which price indexes are actually used in the Gallman GDP estimates 1869-1909?

# Many dimensions behind the scenes

- 1869-1900: people read by oil lamps, went to privies outside, were heated by stoves not central heat, and the city and the farm were driven by the horse rather than the motor (although the RR connected them)
- Dimensions of expansion of RR and telegraph, 1869-1900
  - Population 2x
  - RR track 5x
  - Telegrams sent 7x
  - Postal stamps sold 10x

# But with all this, after 31 years life around 1900 was still dismal

- NYC 1907
  - 1.5 persons per room
  - 1/3 of rooms “dark” with no windows
  - 20% with bathrooms, 31% with toilets
  - 0% electricity
- Big problem, unsettled here
  - What percent of population were urban upper class, middle class, working class, northern rural, and southern rural?

# Questions Raised by Rees Apparel Results

- Can the 1% annual rate of relative decline be interpreted as a measure of shrinkage of retail/wholesale margins, increased efficiency of retail?
- What's going on with Shaw price indexes and resulting deflated real values in 1869-79?
- Further work needs to be done on other sources of CPI for 1860-90 surveyed by Officer (2009)

# Drawing into Question Lebergott's Slow Growth 1900-1930

- 1900 only ¼ of Pittsburgh streets had sewers
- Working class families had to share toilet facilities, some of which had to be emptied
- Most working class families had to obtain water outside the house
- Only 1/5 of all premises had a bathtub
- A typical housing unit is quoted at 500 sq ft and often housed a 4-person family and one or more boarders
- Tenants weren't at the bottom of the ladder, boarders were



# The Cheerful Poem from the *National Labor Tribune* ~ 1900

- In cellars chill and dingy, oft
- In alleys with foul filthy ground
- Or crowded to a lonely loft
- These toiling ones are mostly found;
- An ancient stove, with sooty scrap
- A box, a bench a broken chair;
- A few patched duds in which to wrap
- Their weary limbs, fed on scant fare.

# Samples of Research Already Done

- Rees on apparel 1890-1914 linked to Gordon 1914-1993
- Raff-Trajtenberg on autos 1906-1941
- Gordon-vanGoethem on housing 1914-2005
  - Complementary with Nakamura *et al* revealing sources of CPI bias

# Summary of Results in Recent Research

- Apparel Rees (1961), 1890-1914
  - Sears catalog basis
  - Raises question as to how many people actually bought from Sears catalogue
  - Omits drop in price as customers shift from rural general stores to Sears; thus understates price index bias
    - Analogy – the vast literature on computer prices never estimates the huge price decline as mainframes were replaced by PCs
  - General result, apparel prices decline by 1% per year relative to WPI (no CPI for this period)

# Gordon Apparel 1914-1993

- Distinction between matched-model indexes and hedonic indexes
- Analogy to studies of PCs 1980-2010
  - Price decreases occur with new model introductions
  - Hedonic indexes decline faster than matched model indexes
- Women's apparel.
  - Hedonic includes all the data, matched models virtually none
  - Downward CPI bias by 1.28 percent per year for womens' dresses, 1914-1988. Near zero pre-1947, much higher post-1947.

# Raff-Trajtenberg on Autos, 1906-41

- During 1906-40 quality-adjusted prices declined at 5 percent per year
- During 1906-15, the decline was even faster
- Auto prices not introduced into the CPI until 1935.
- Thus for the period 1906-35, the price of autos was implicitly proxied by the growth of everything else that was covered by the CPI.

# Gordon – van Goethem on Housing, 1914-2003

- Begins with a stark fact: between 1940 and 1987 CPI rises 2.0 percent *slower* than gross rent per apartment
- Could the 2.0 percent difference be explained by quality change?
- Regressions based on comprehensive data after 1975
- More creative: estimates of quality change 1914-75

# Dimensions of Quality Change Before 1975

- Can control for room size and condition, 1930-1970
- Control for presence of the Big Three quality attributes starting in 1914
  - Electricity, central heating, indoor plumbing
  - Biggest impact of indoor plumbing prior to 1935 and of electrification prior to 1950
- A detailed study of rental prices in Evanston IL yields a downward CPI bias of about 1.4 percent per year

# Conclusions

- Yes, there is evidence
  - It is contradictory, downward bias for apparel and rents vs. upward bias for durable goods
- But no, there is a near-total dearth of evidence on new-product bias
  - Electricity and the internal combustion engine revolutionized American life 1900-1930
  - This is Lebergott's slow growth period
  - Is it feasible for further research to overturn Lebergott by estimating consumer surplus triangles for the Great Inventions?