Quality: The Embodied Intangible

Bart Hobijn

Federal Reserve Bank of New York

May 2008

Outline

- Importance of quality adjustment
- Relevance for monetary policy
- 'Consensus' view
- Some puzzling facts
- Theoretical challenges

Why is adjustment for quality change important...

- Comparability of units of measurement underlying quantity indexes over time:
  - Output
  - Capital inputs
  - Productivity
  - Standard of living
  - *Cost-of-living*

An Example

Nintendo Game Consoles

1986
NES
$129.99

1991
SNES
$249.99

1996
N64
$299.99

2001
GCN
$199.99

2006
WII
$249.99

Five game consoles, their introduction year and price

An Example

Nintendo Game Consoles

1986
NES
$129.99

1991
SNES
$249.99

1996
N64
$299.99

2001
GCN
$199.99

2006
WII
$249.99

Price per unit is not the right measure

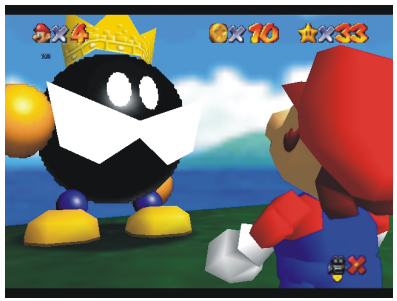
An Example

Nintendo Game Consoles

1986
NES
$129.99

1991
SNES
$249.99

1996
N64
$299.99



2001
GCN
$199.99

2006
WII
$249.99

Performance per unit is very different and got better over time

An Example

Nintendo Game Consoles

1986
NES
$129.99

1991
SNES
$249.99

1996
N64
$299.99

2001
GCN
$199.99

2006
WII
$249.99

From 1986-2006, prices of non-tv video equipment declined 87%

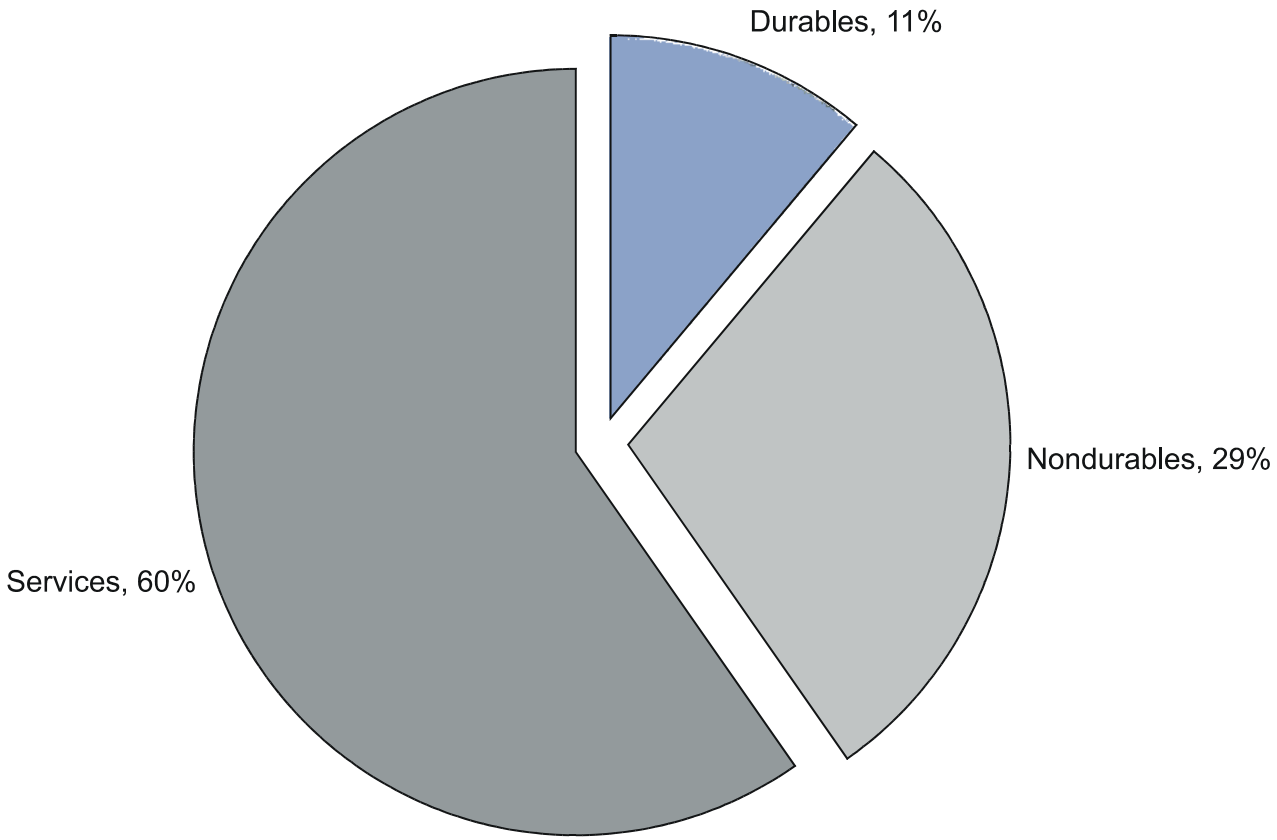
Relevance for monetary policy

From Mario to monetary policy...

- Federal Reserve's mandate is "to promote effectively the goals of maximum employment, *stable prices*, and moderate long-term interest rates."
- "When prices are stable, people can hold money for transactions and other purposes without having to worry that inflation will eat away at the *real value of their money* balances."
- *Real value of money:* How much 'utility' can you buy with your dollars, rather than how many units can you buy.

Relevance for monetary policy

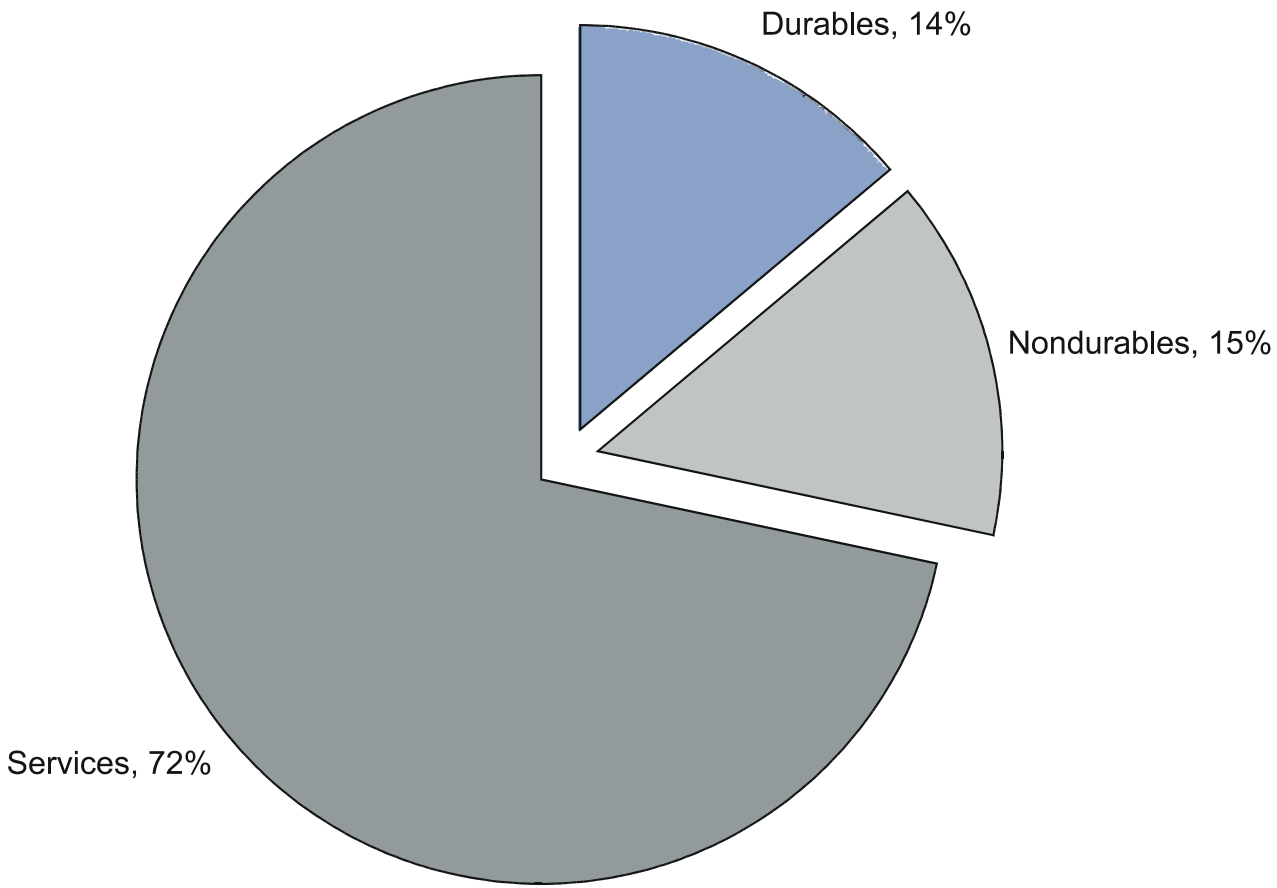
PCE deflator as a measure of price stability



11% of personal consumption expenditures in 2007 was on durables

Relevance for monetary policy

PCE deflator as a measure of price stability



14% of 'core' PCE in 2007 was on durables

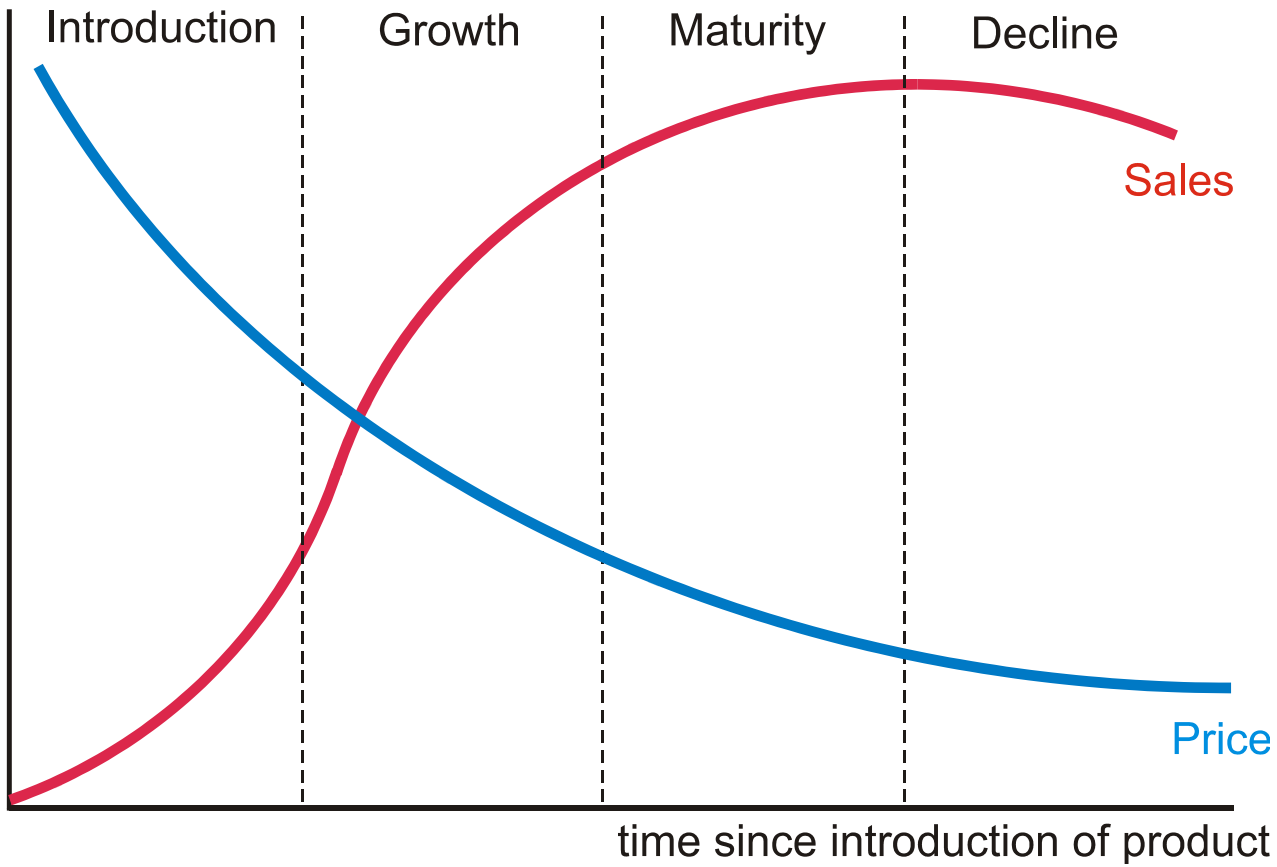
Consensus view

Quality improvements in durables are underestimated... Therefore overstating inflation

- Boskin Commission, 1996: Unmeasured quality growth accounts for 0.6% upward bias in CPI inflation
- Bils and Klenow, 2001: Durables quality growth in CPI understated by 2.2%
  - Estimation of Engel-curves
- Bils, 2005: Durables quality growth in CPI understated by 2.5%
  - Product substitution bias and market shares

Some puzzling facts

The product life cycle



Some puzzling facts

Pricing along the product life cycle

- Price declines steeper for products in early stage of life cycle, higher quality products
  - **Introduction**: Prices are high because of skim pricing strategy for a high profit margin as early adopters buy and firm seeks to recoup development cost quickly.
  - **Growth**: Maintained at high level if demand is high, or reduced to capture additional consumers.
  - **Maturity**: Price reductions in response to additional competition.
  - **Decline**: Prices lowered to liquidate inventories of discontinued products.

Some puzzling facts

My stylized version of the product life cycle

- If *price per quality profile constant across cross-section of models* sold:
  - Price per quality increasing in quality at every point in time
  - Newest models introduced at highest price per quality ratio
    "The newest features are the most expensive"
  - Heterogeneity of consumers important for understanding life cycle demand

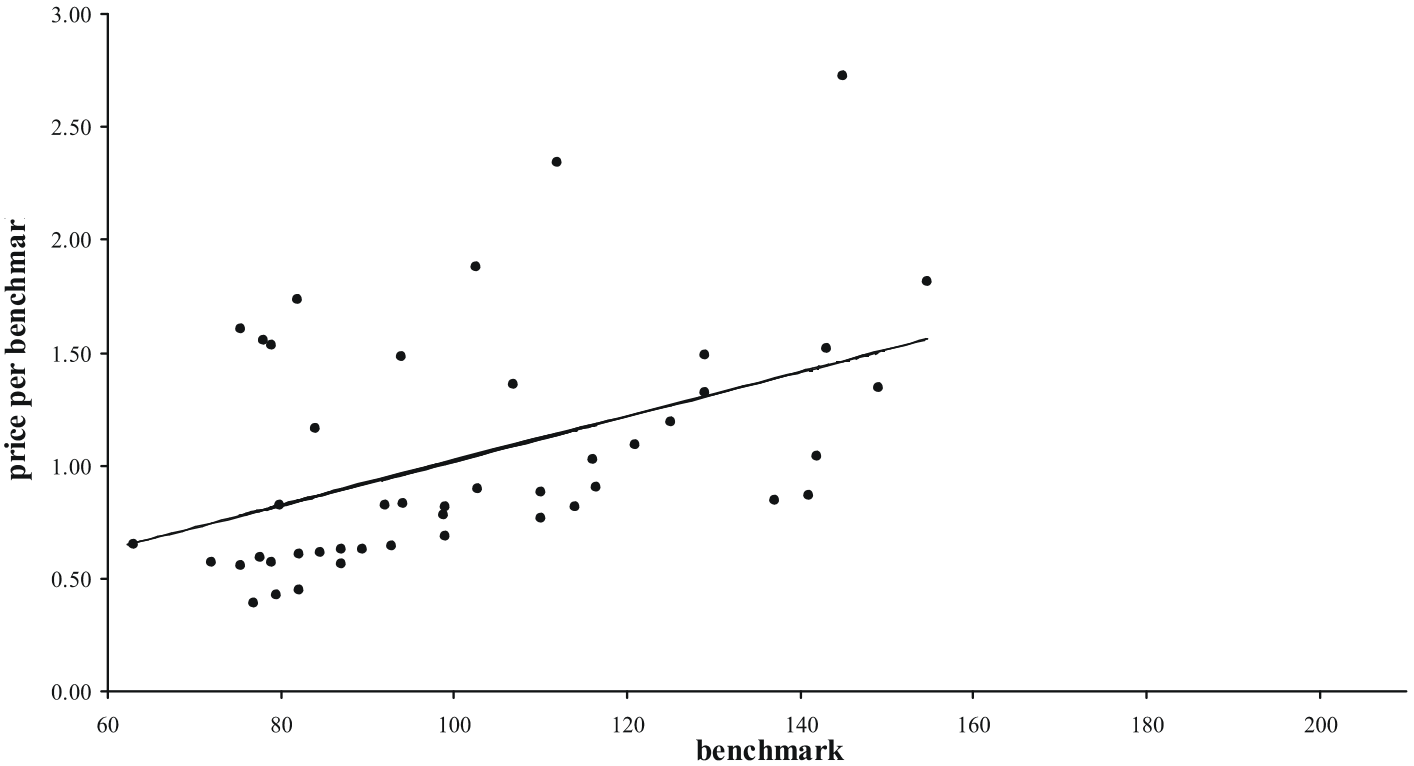
Some puzzling facts

Example: CPU prices

- Use good with:
  - Established measure of quality/performance.
  - High product turnover
- CPUs (October 2001-March 2003):
  - Benchmark ratings Tom's Hardware
  - Many processors
  - Weekly data on prices SharkyExtreme

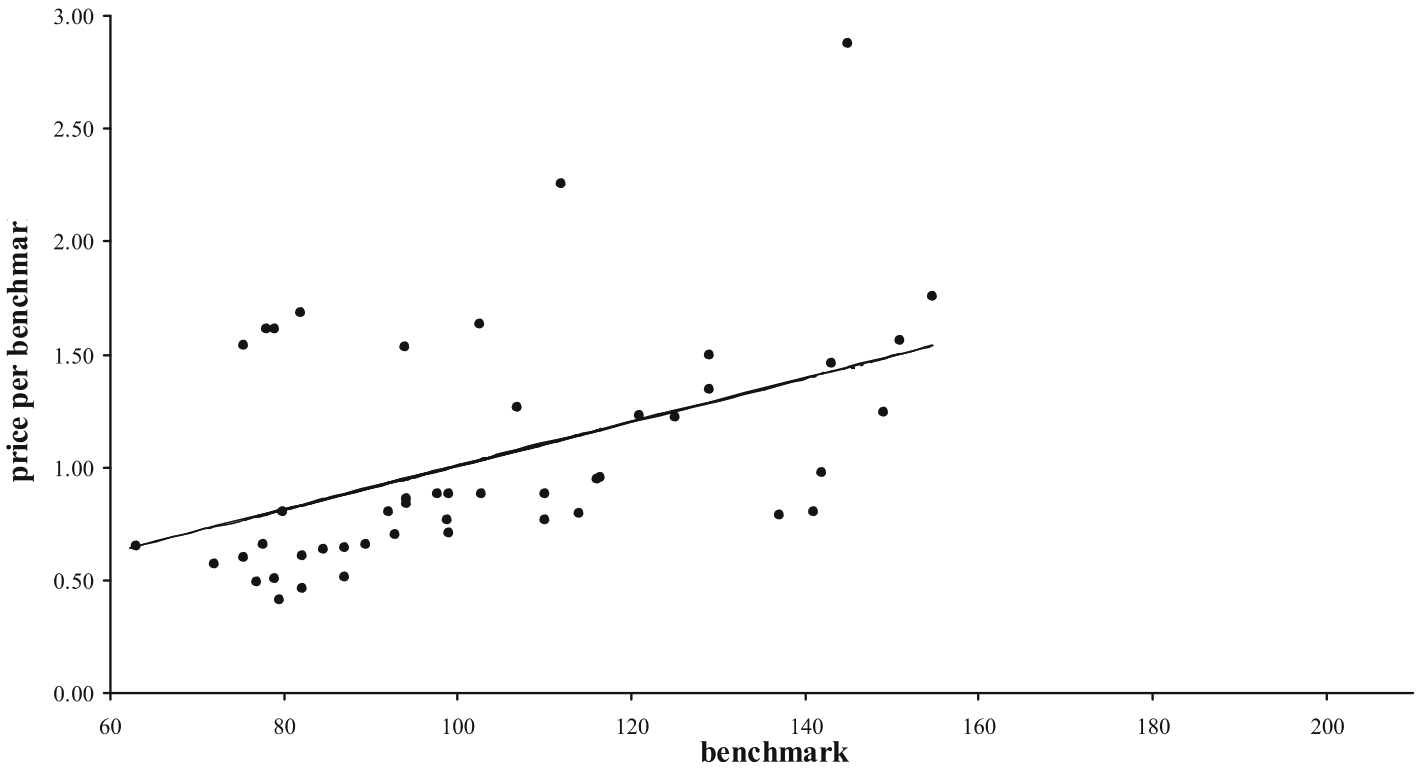
CPU Prices

October 28, 2001



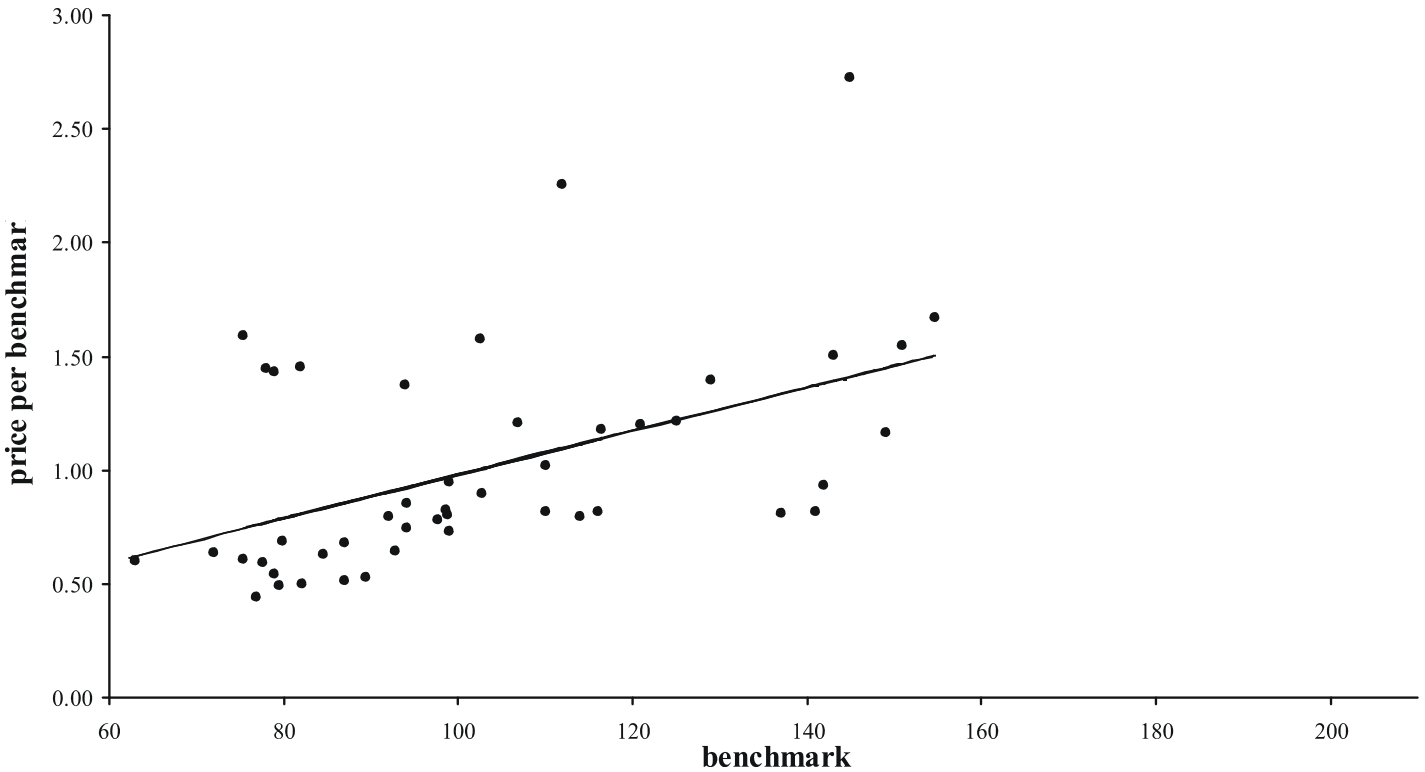
CPU Prices

November 25, 2001



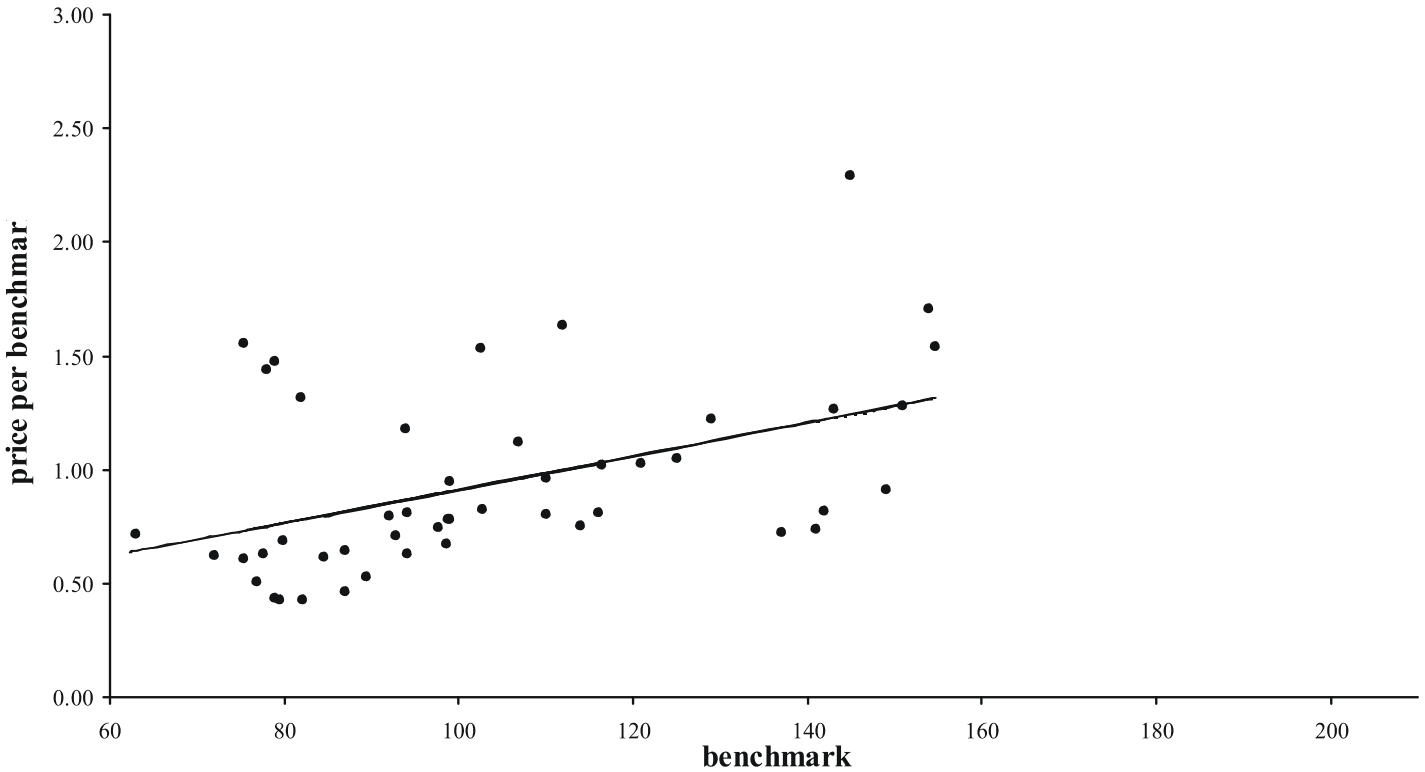
CPU Prices

December 30, 2001



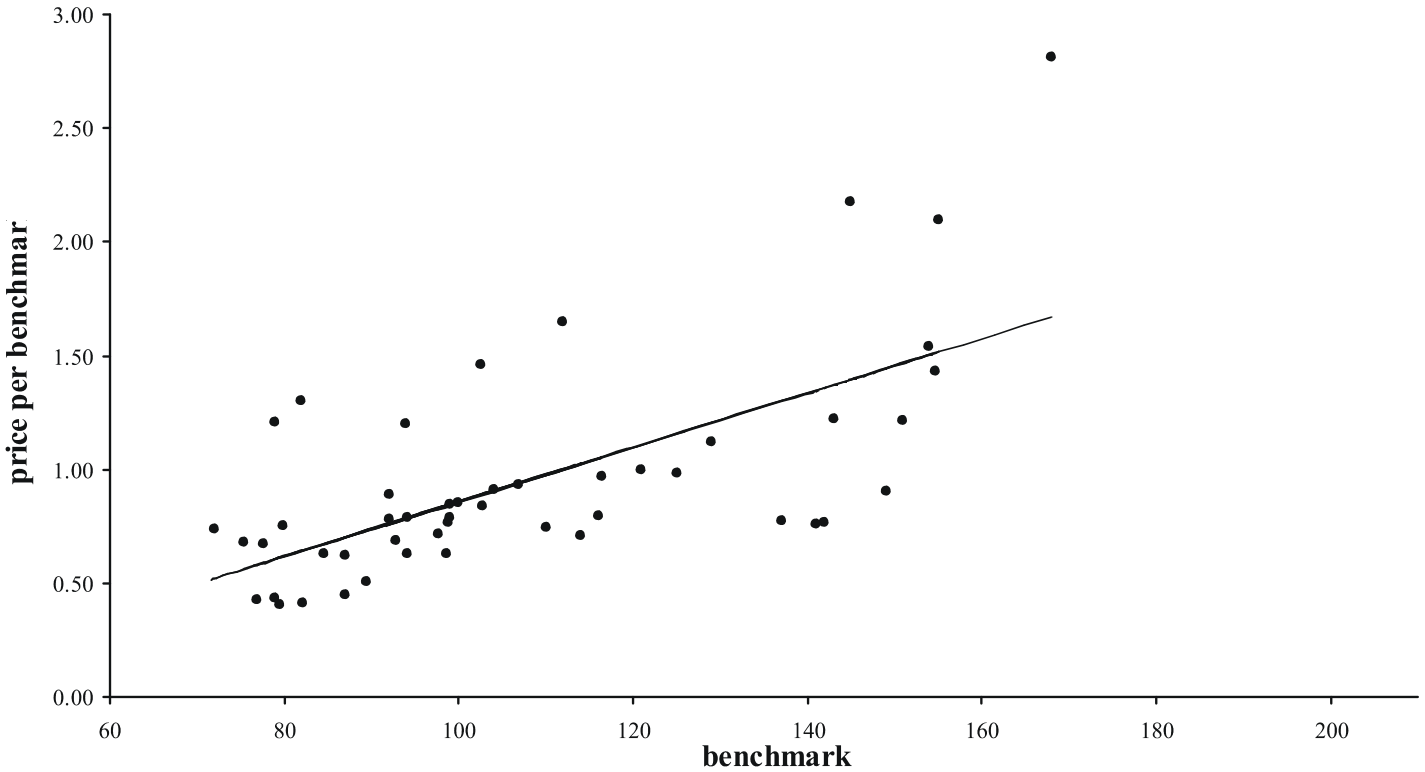
CPU Prices

January 27, 2002



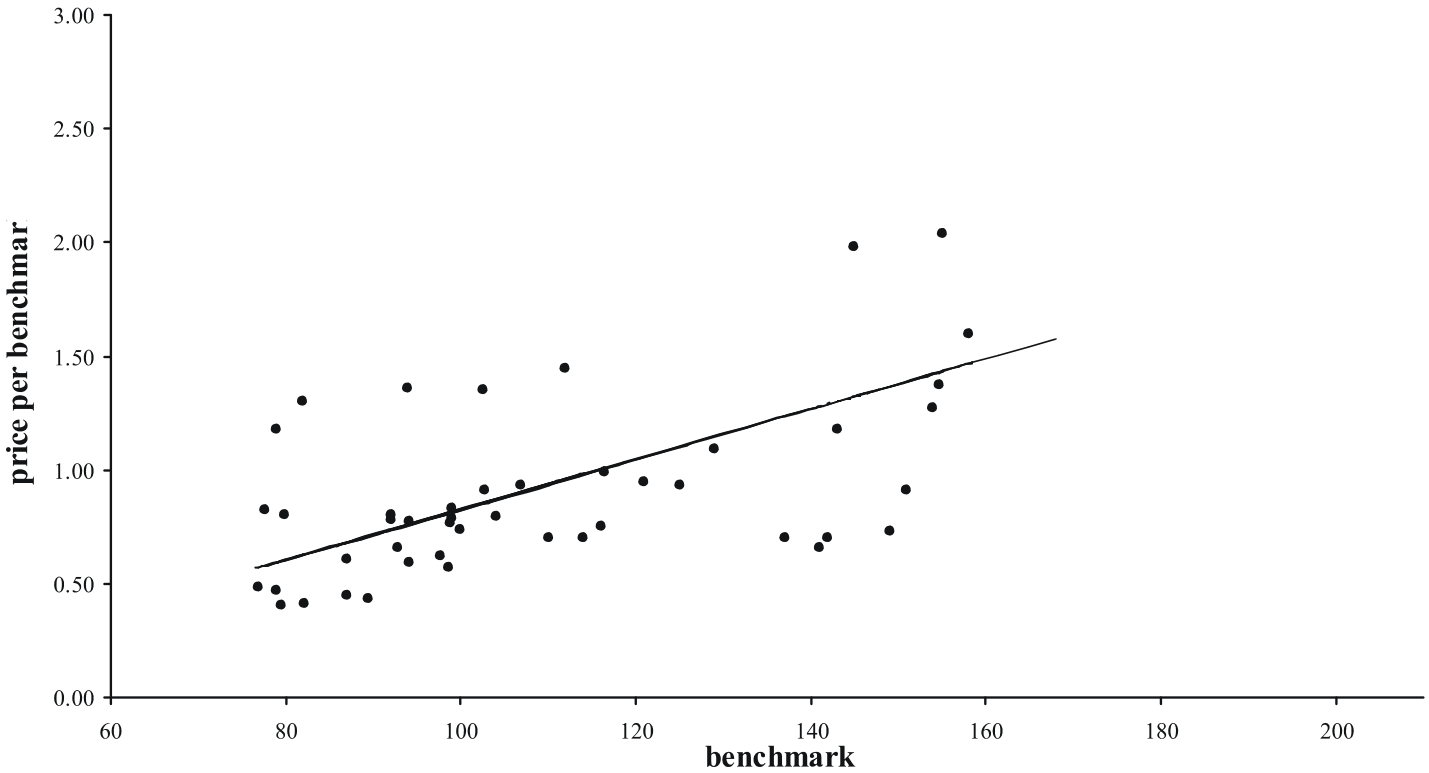
CPU Prices

February 24, 2002



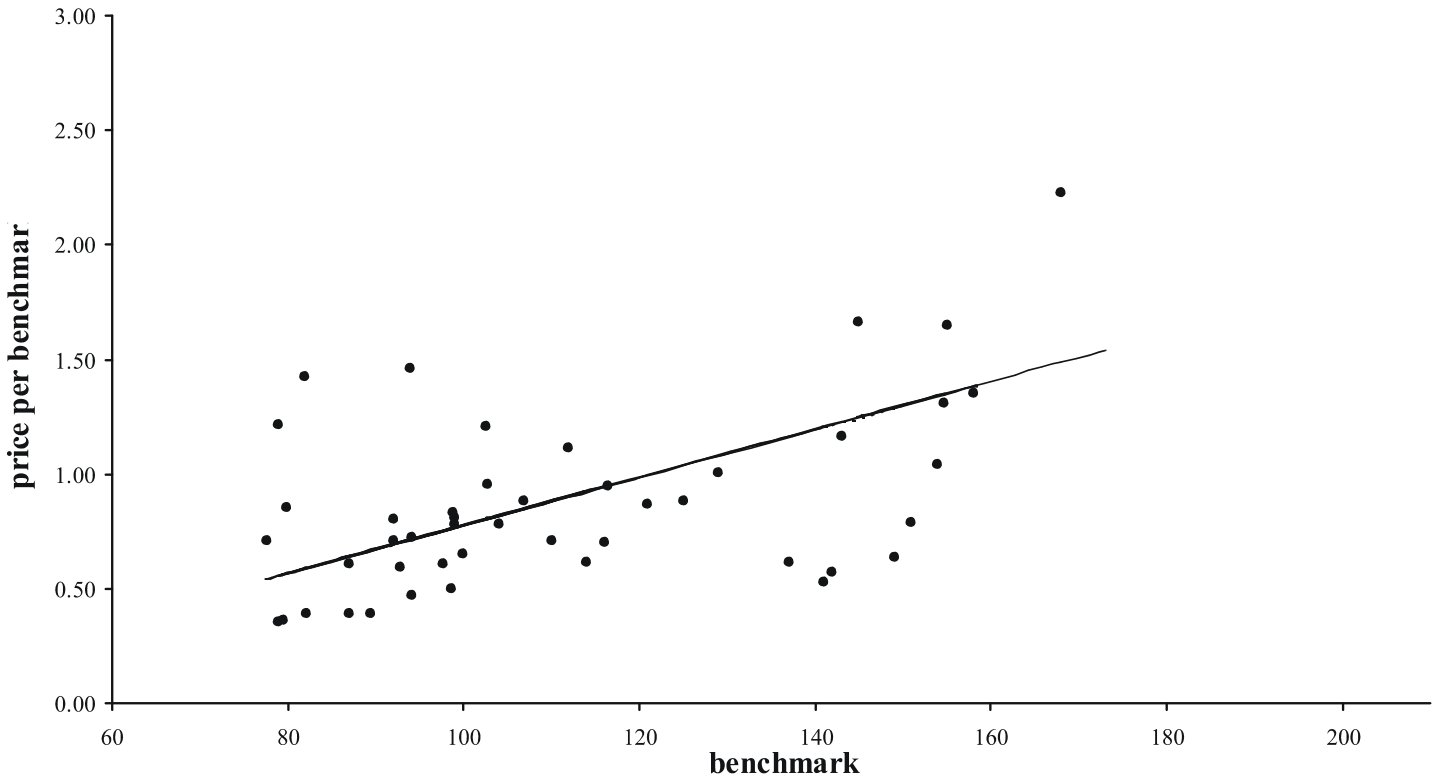
CPU Prices

March 24, 2002



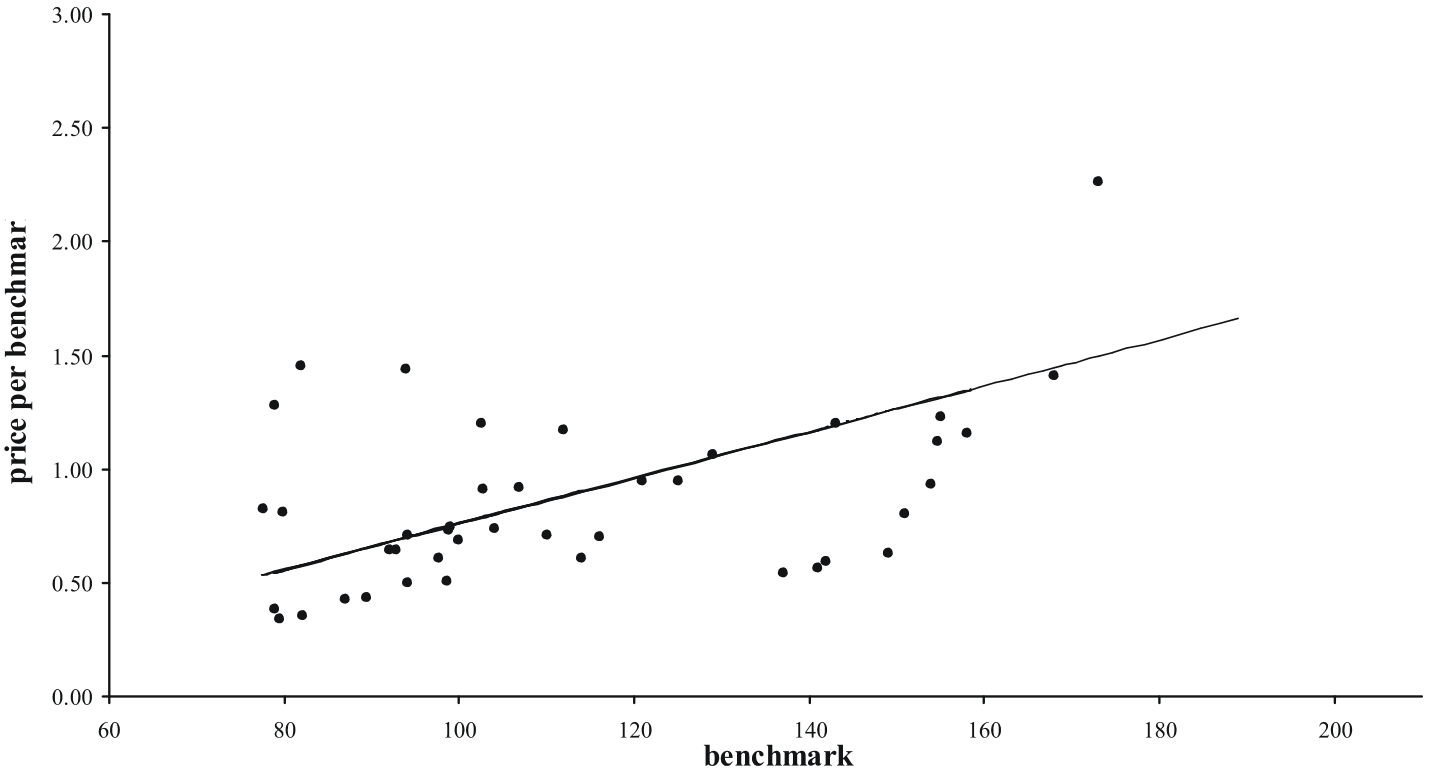
CPU Prices

April 29, 2002



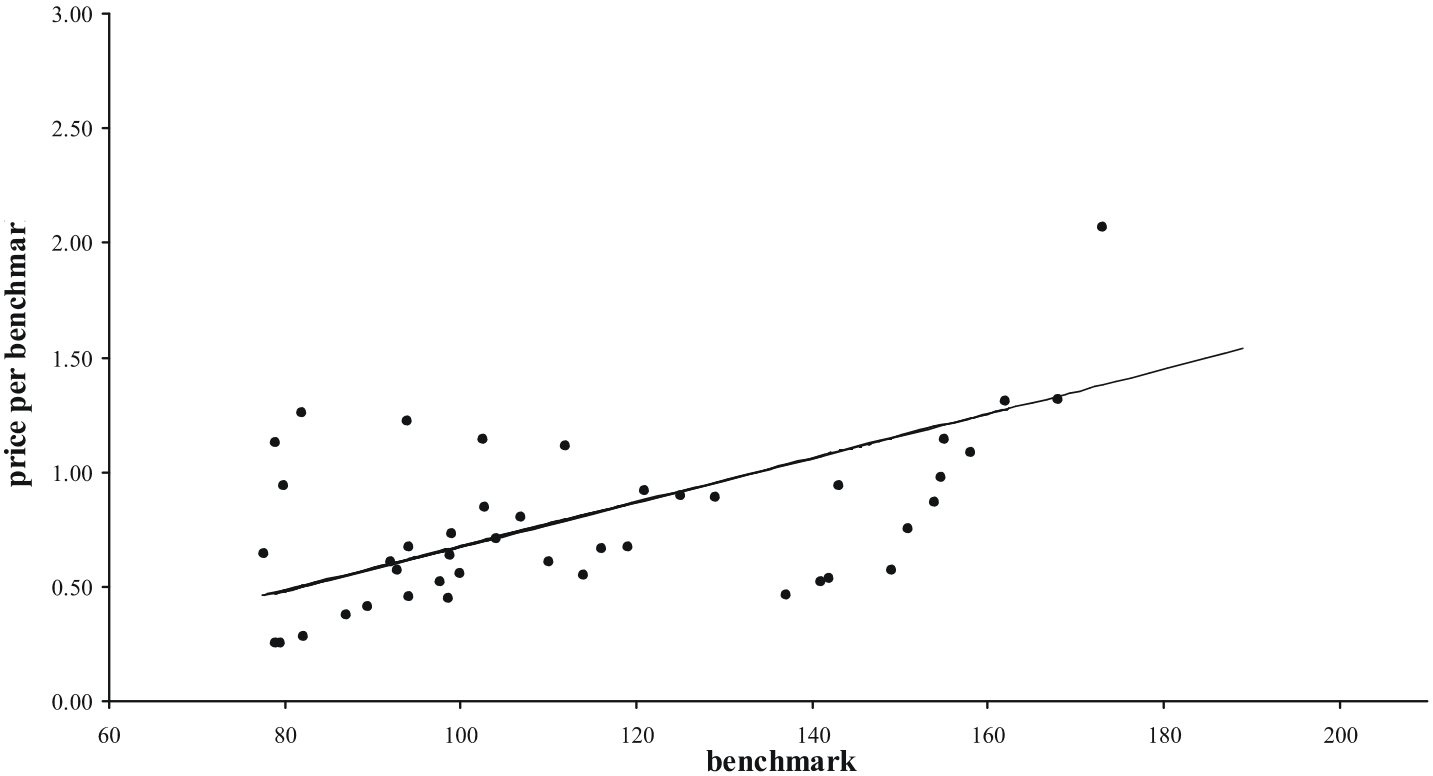
CPU Prices

May 27, 2002



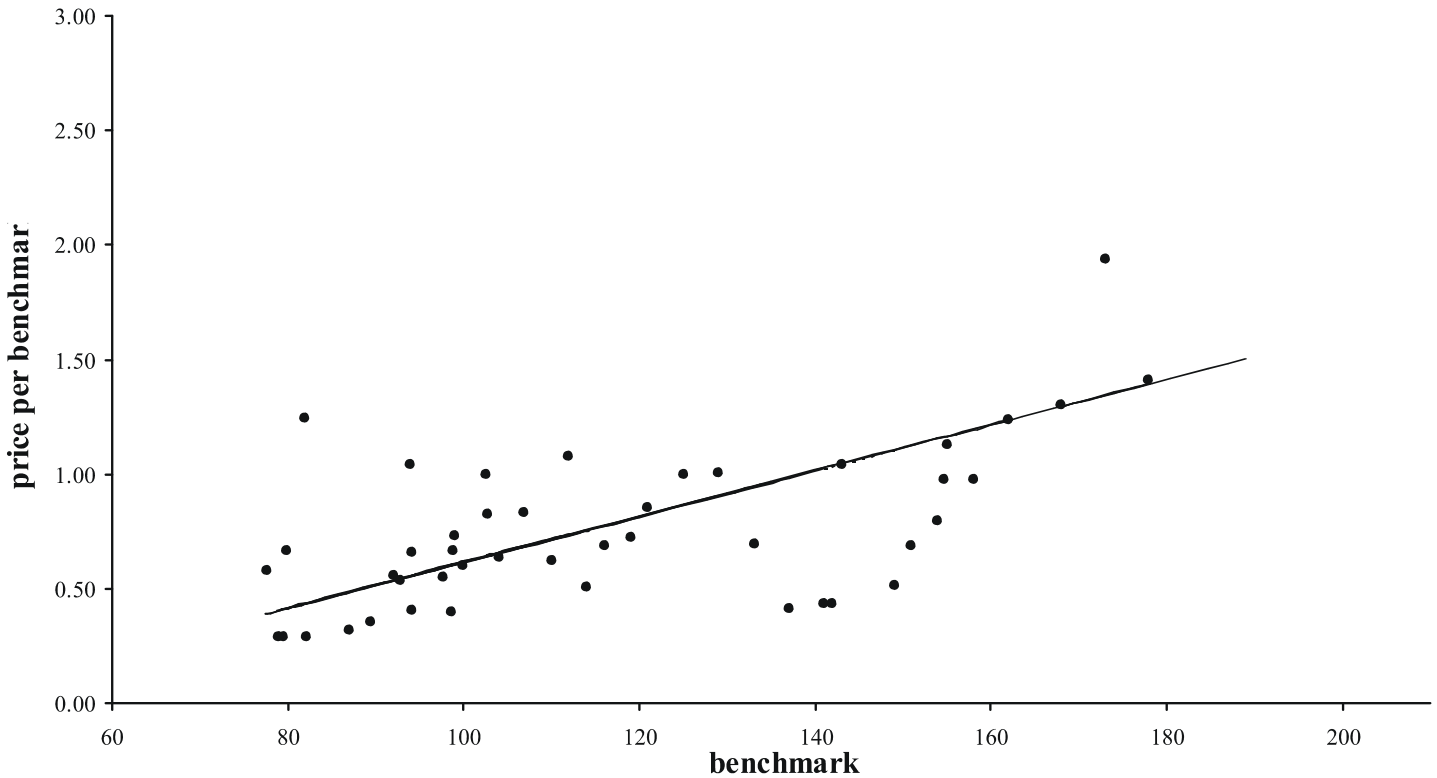
CPU Prices

June 24, 2002



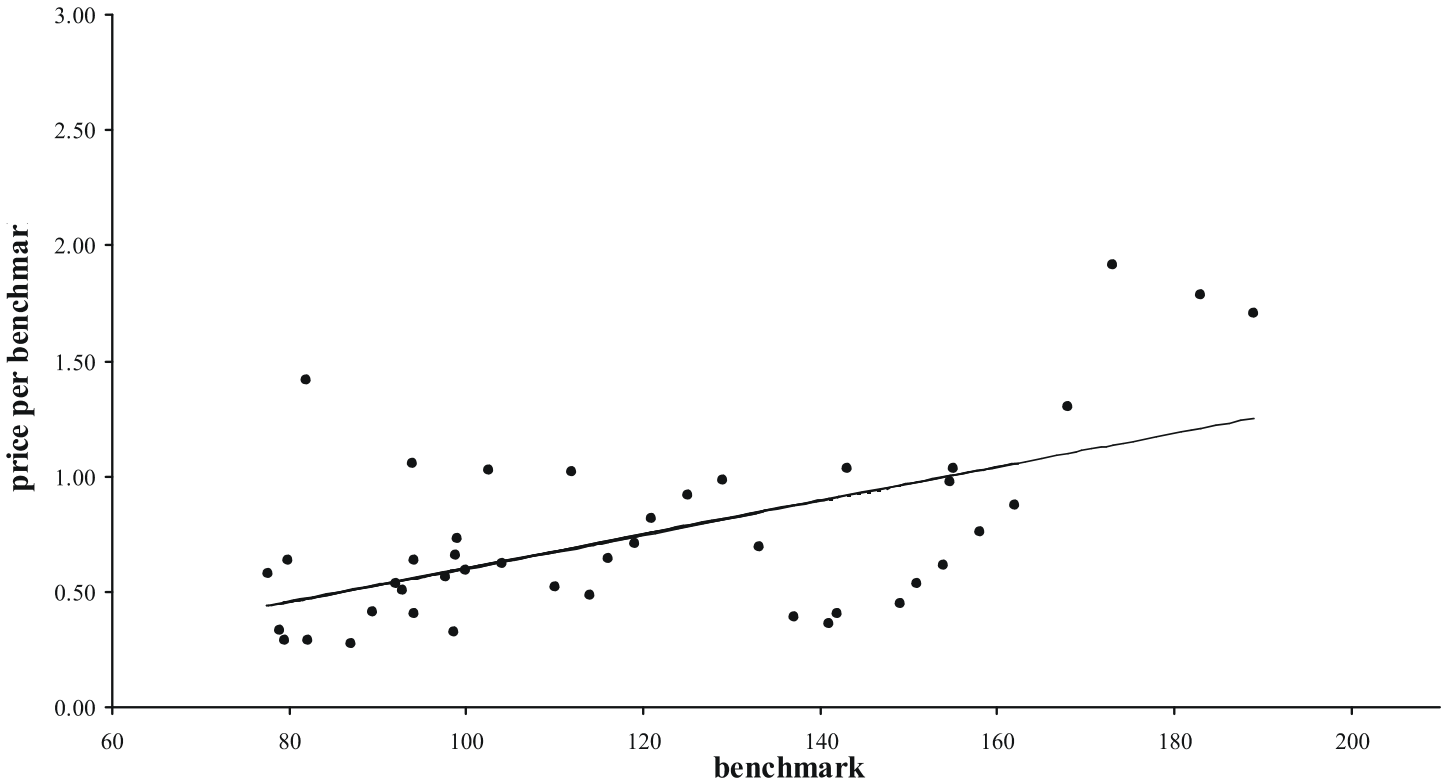
CPU Prices

July 29, 2002



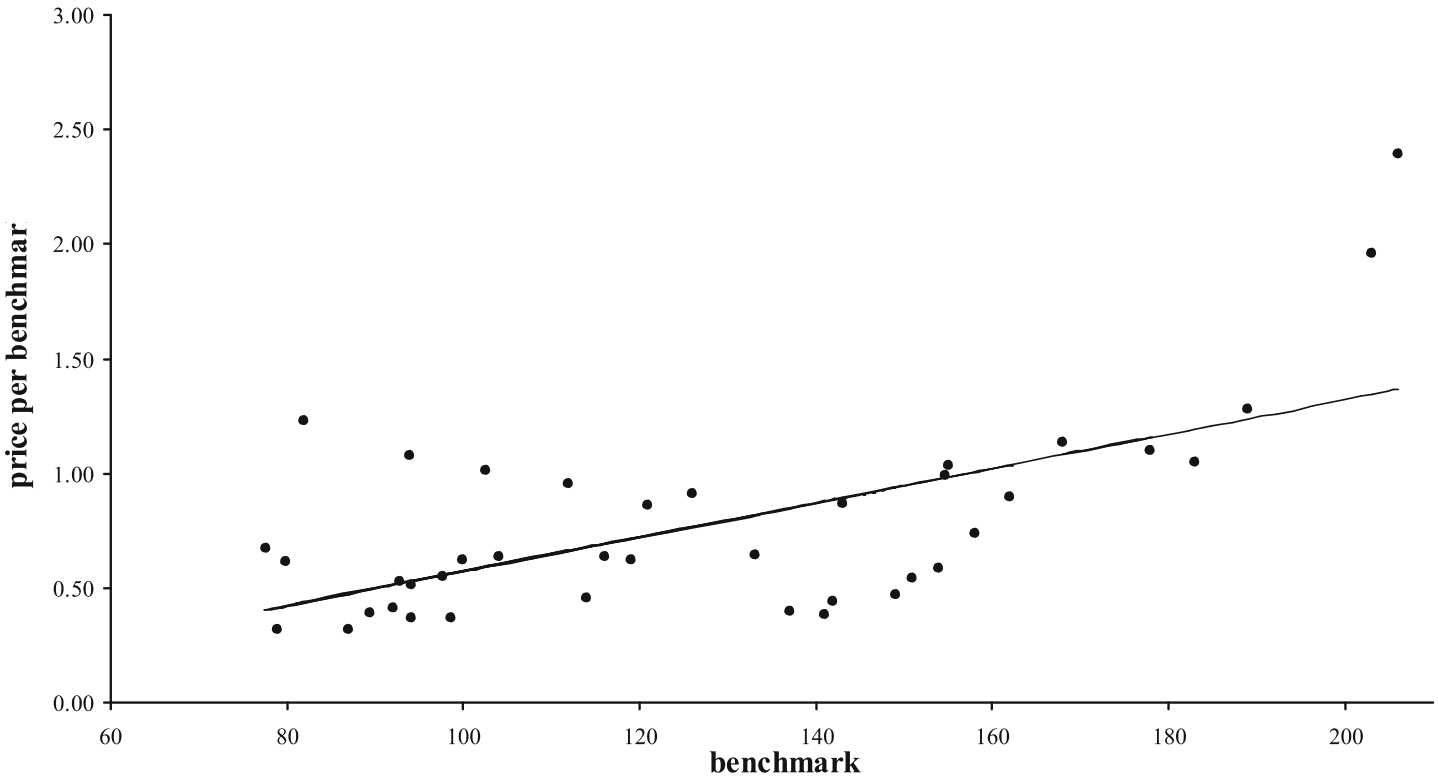
CPU Prices

August 19, 2002



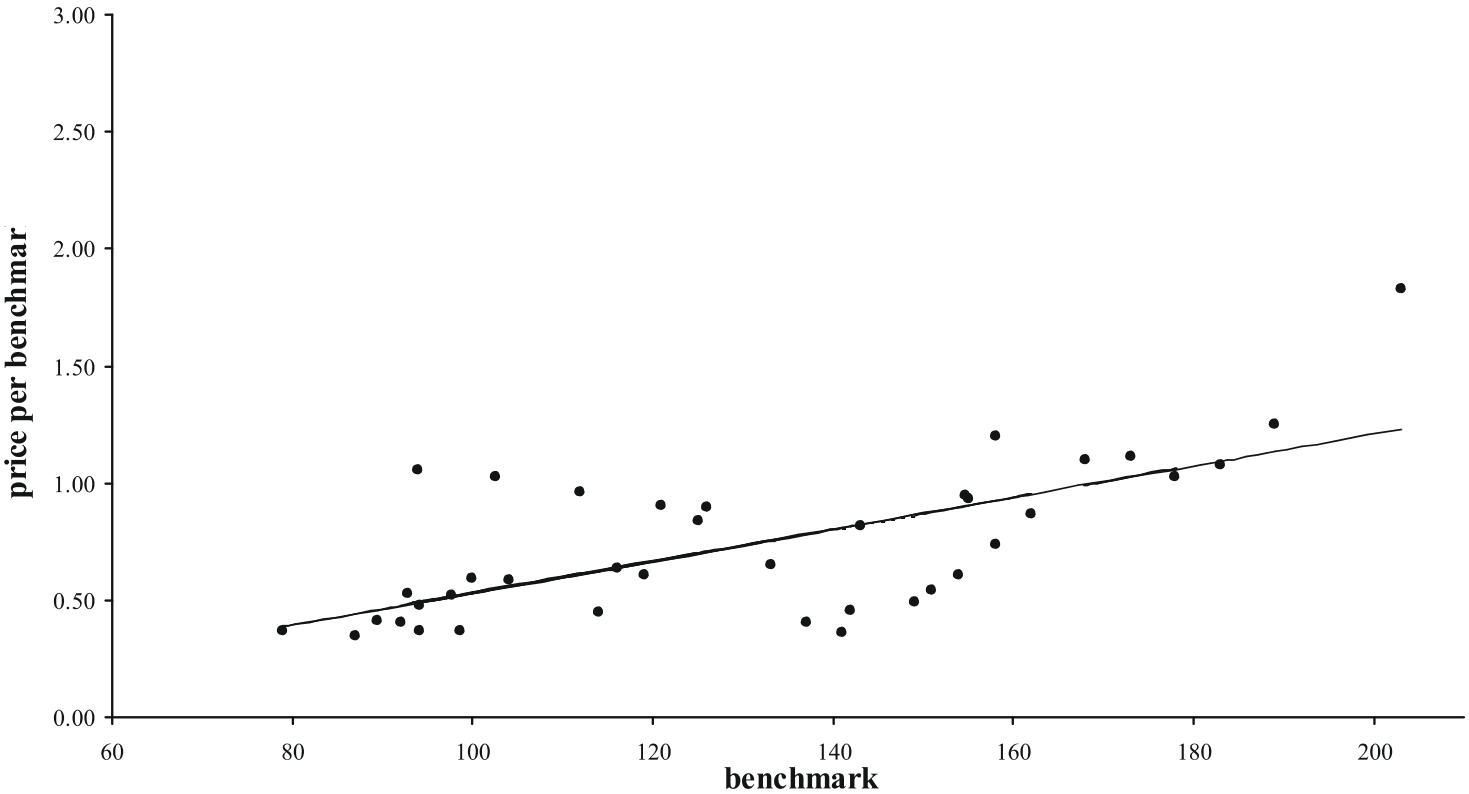
CPU Prices

September 30, 2002



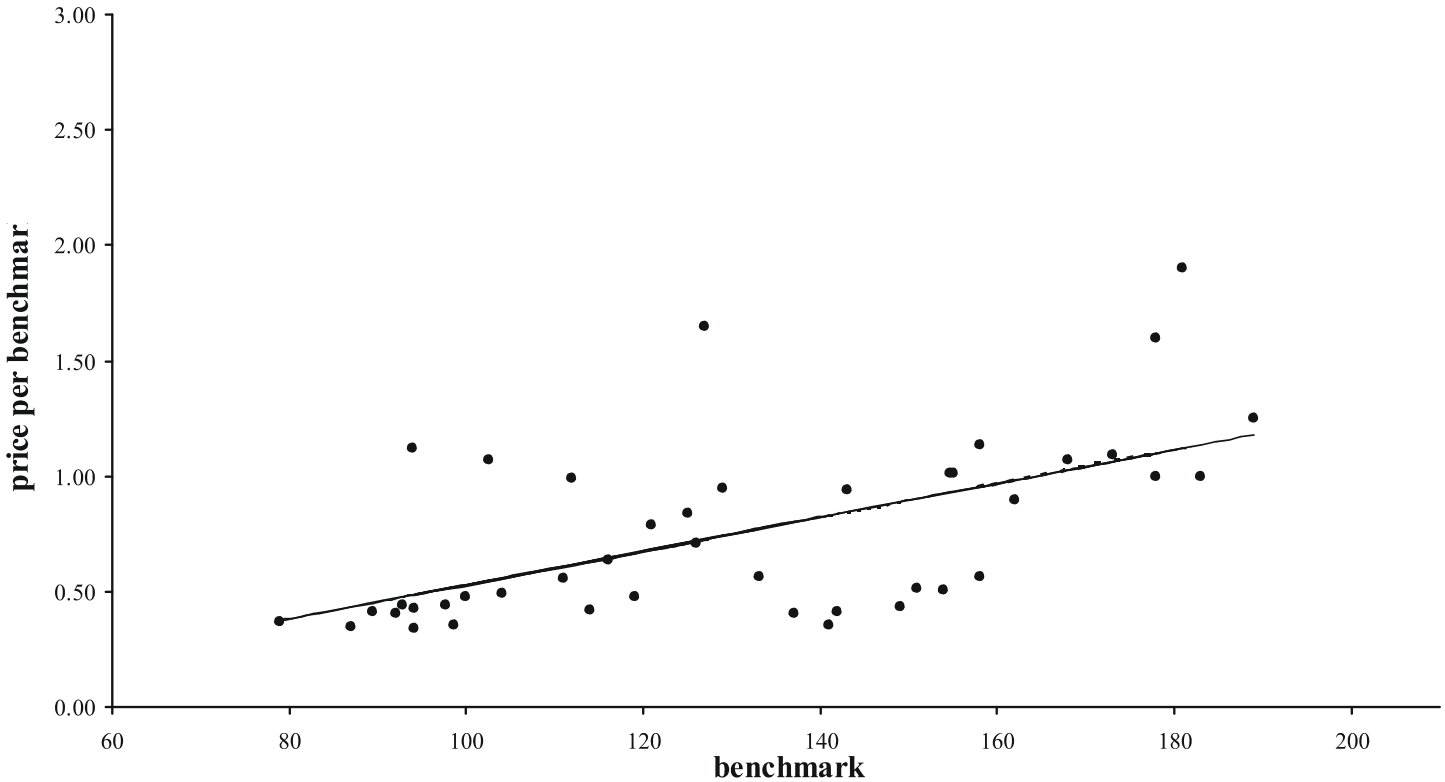
CPU Prices

October 28, 2002



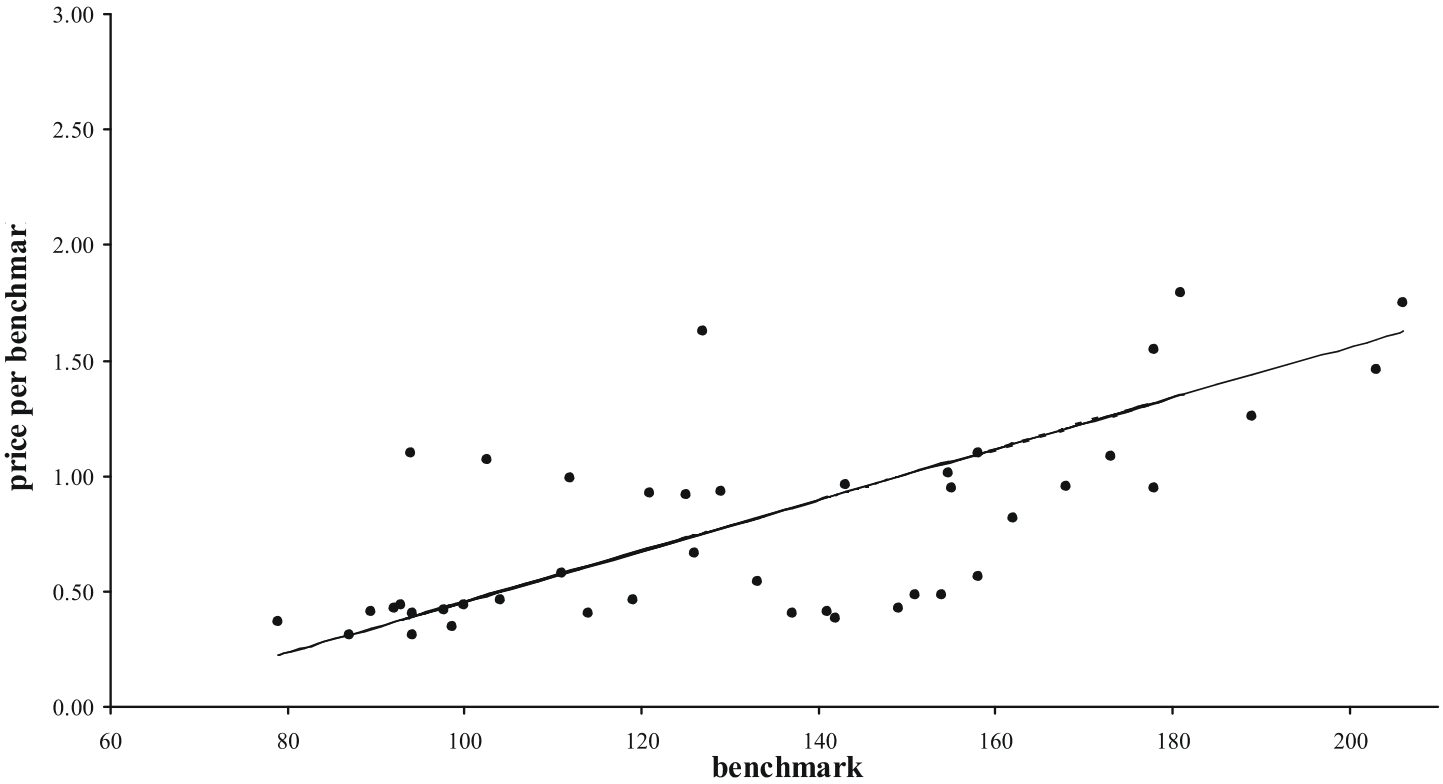
CPU Prices

November 25, 2002



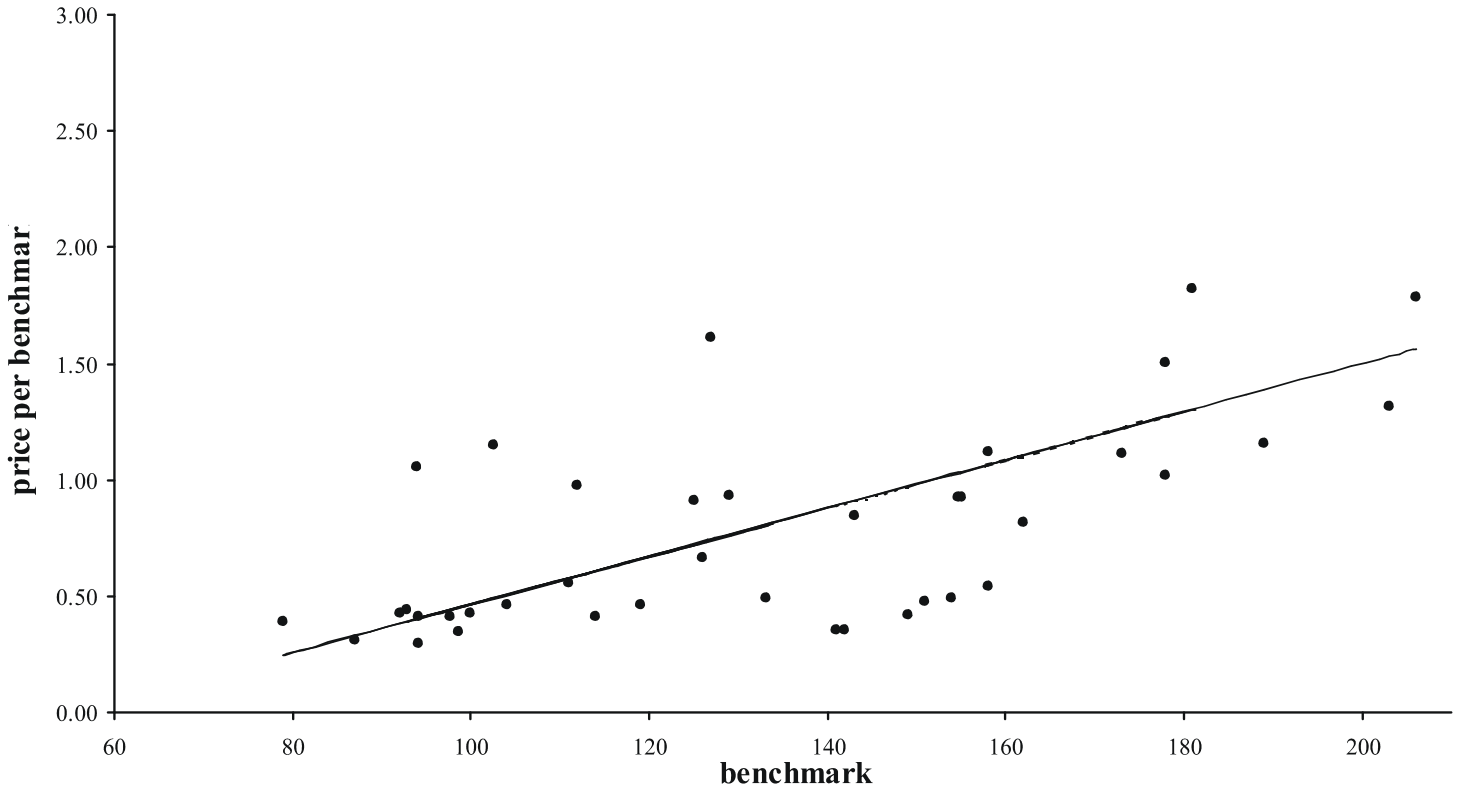
CPU Prices

December 30, 2002



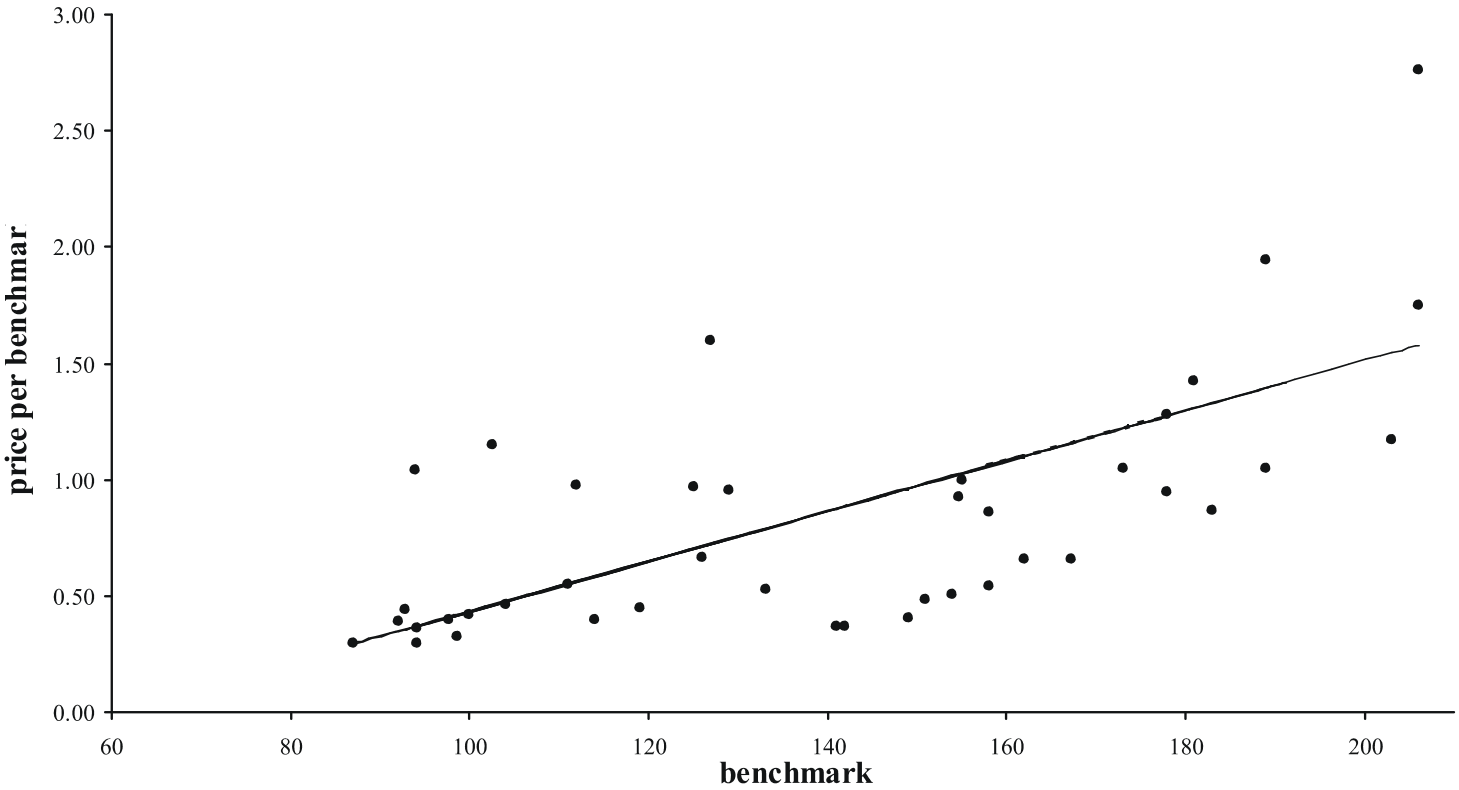
CPU Prices

January 27, 2003



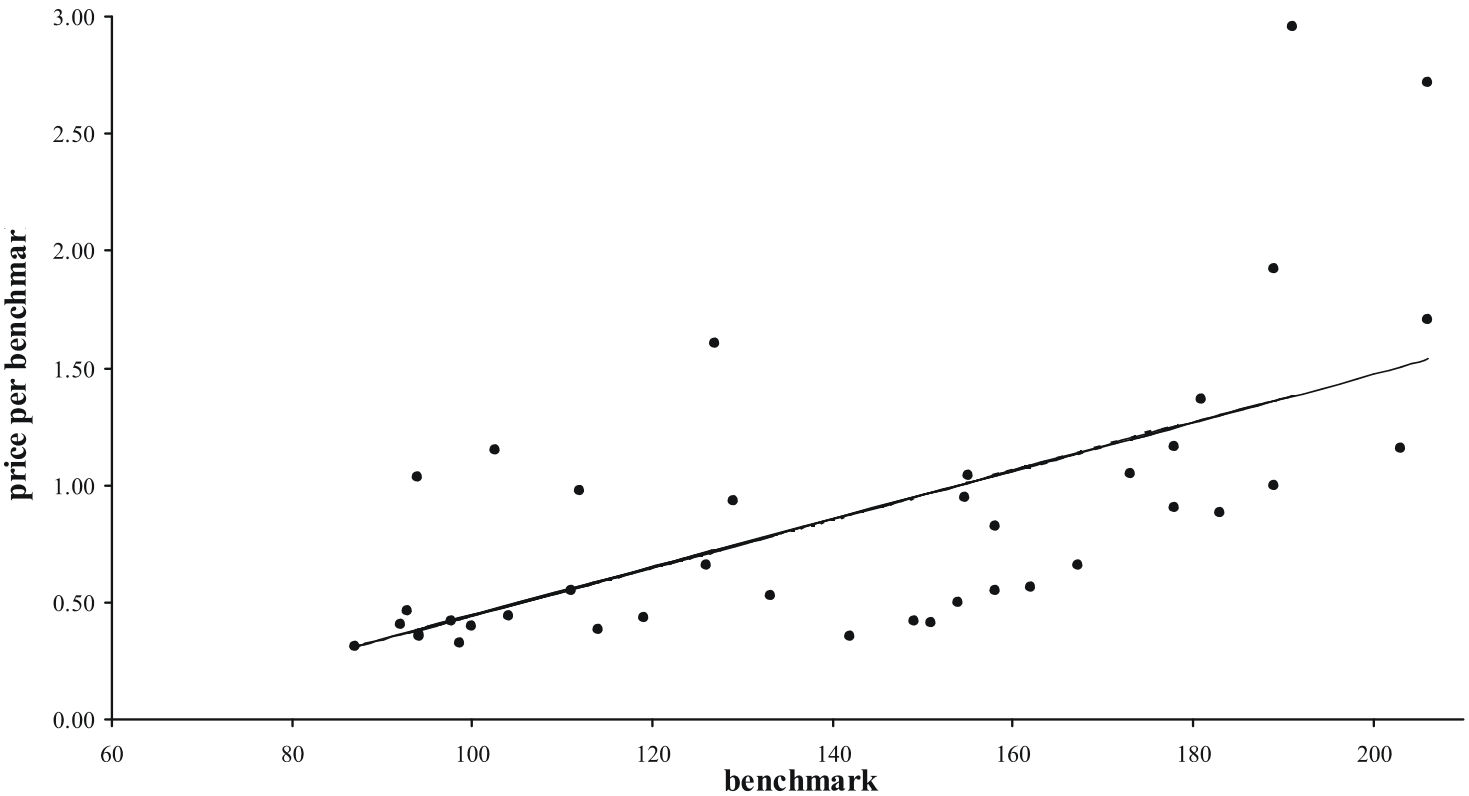
CPU Prices

February 24, 2003



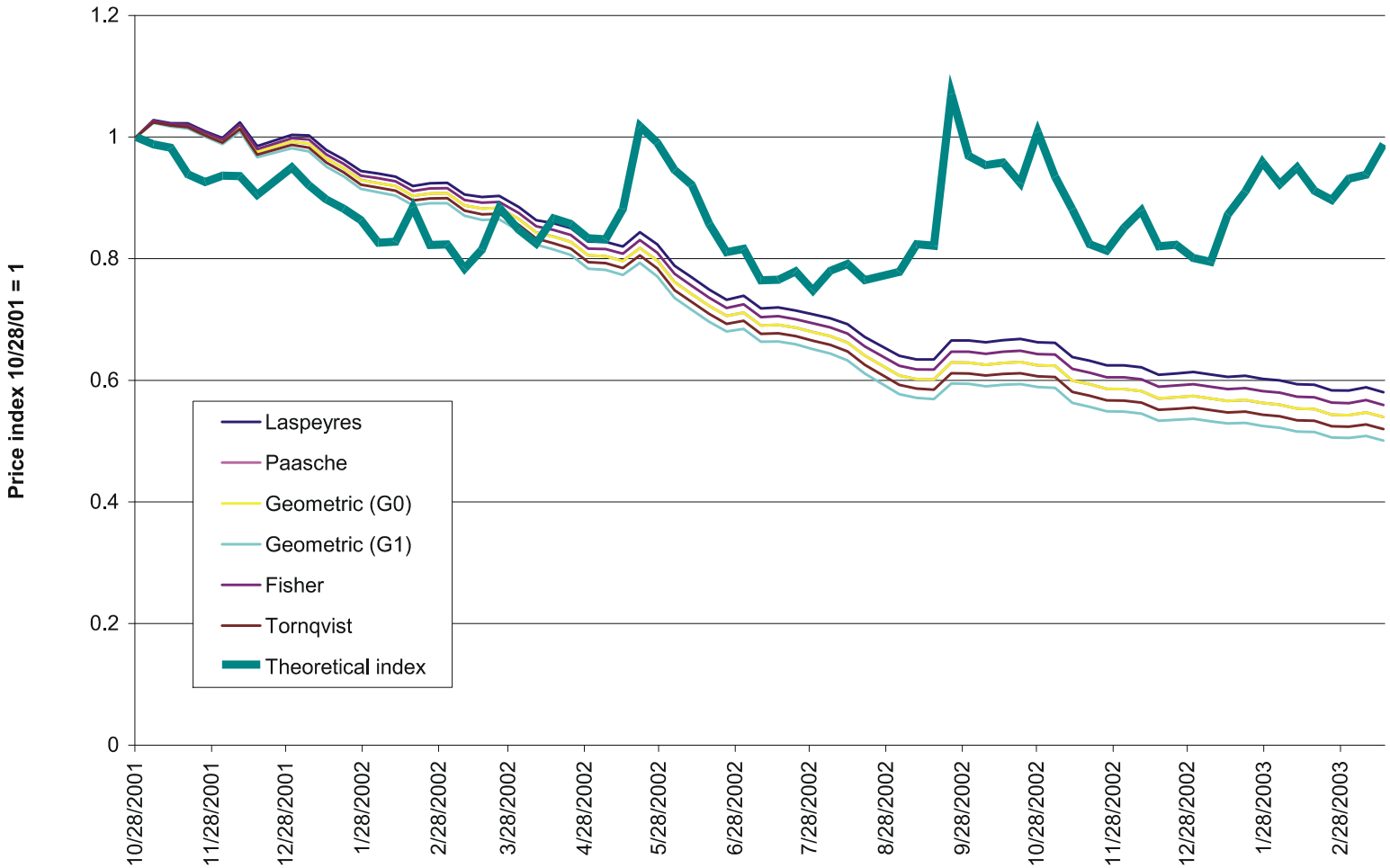
CPU Prices

March 17, 2003



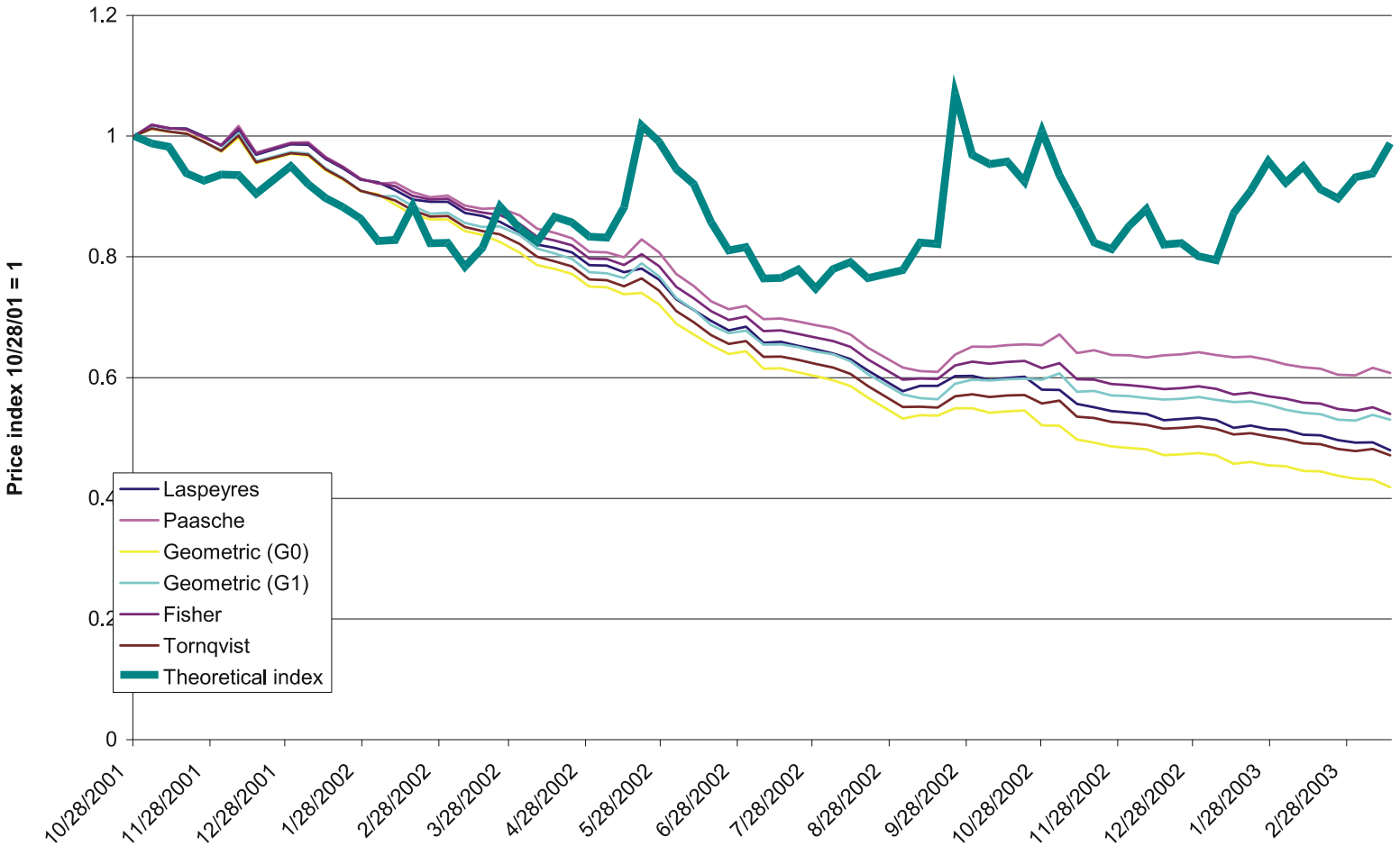
CPU Prices

Matched-Model price indices assuming CES preferences with e.o.s. 1.5



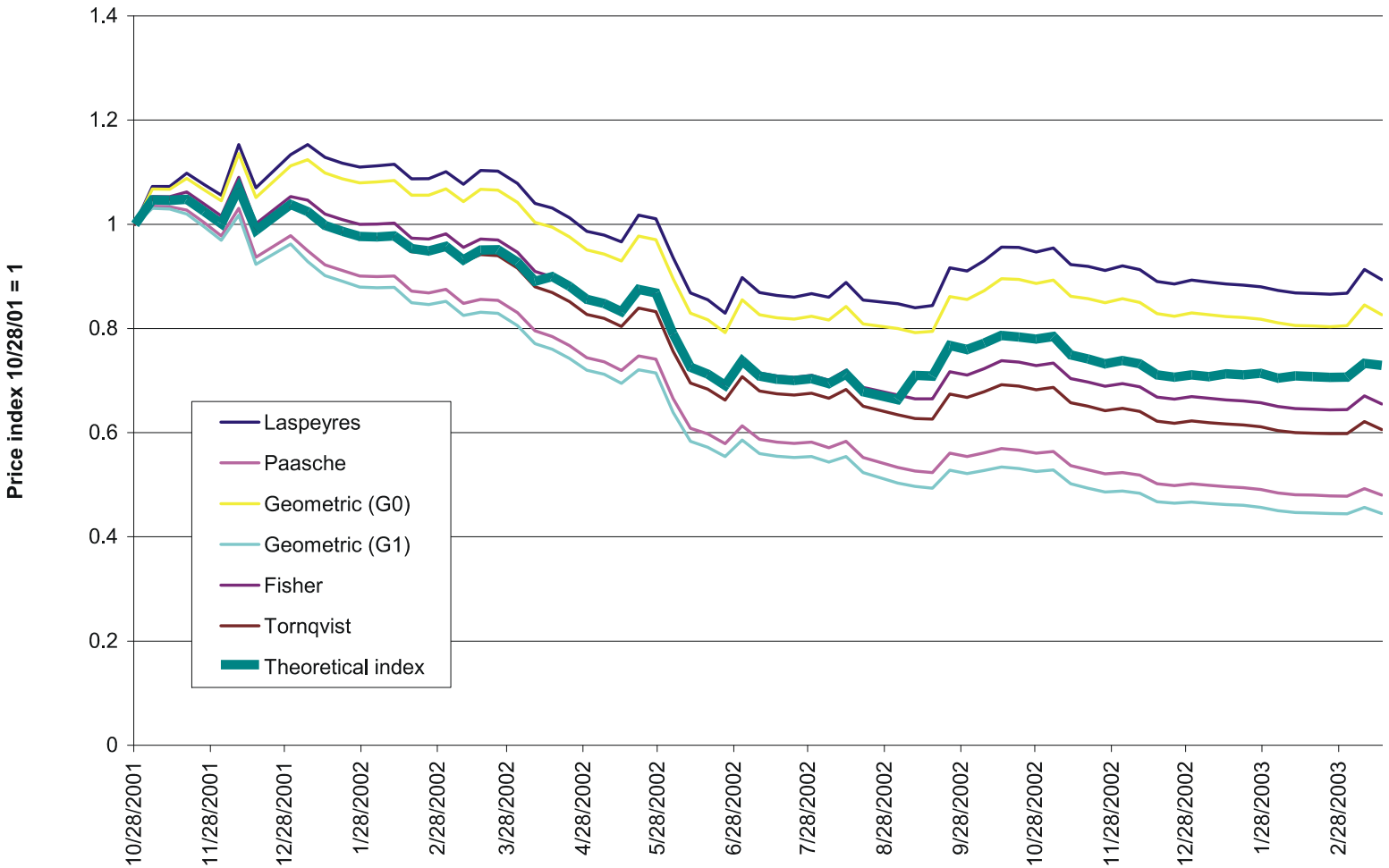
CPU Prices

Hedonic price indices assuming CES preferences with e.o.s. 1.5



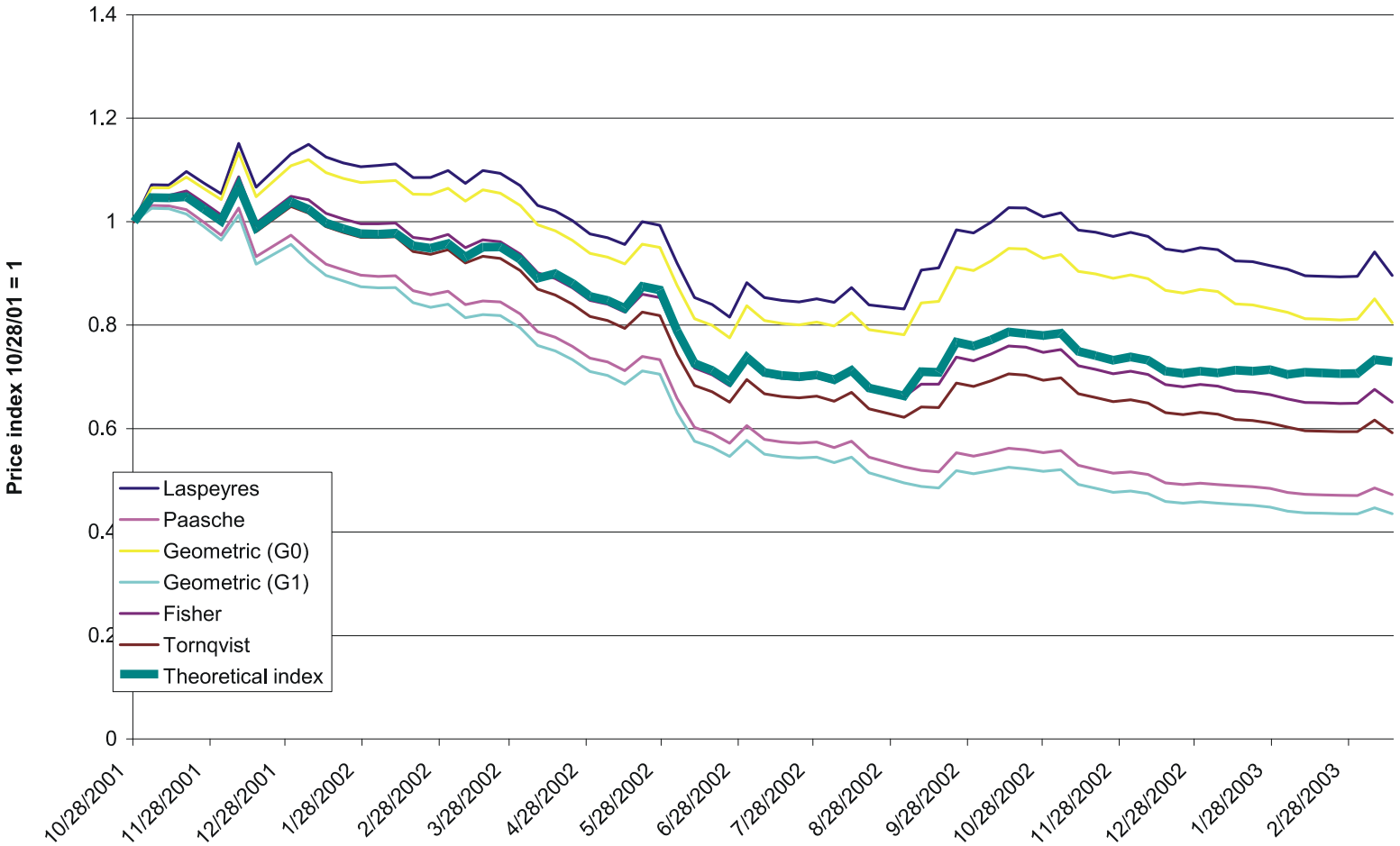
CPU Prices

Matched-Model price indices assuming CES preferences with e.o.s. 5



CPU Prices

Hedonic price indices assuming CES preferences with e.o.s. 5



Some puzzling facts

CES preferences not appropriate

- CES implies increasing market share over whole product cycle

Theoretical challenges

From models of creative destruction and product cycles to price measurement

- Necessary, but maybe not sufficient, ingredients
  - **Indivisibility** of choice of durable good
  - **Heterogeneity** of consumers
  - **Monopoly** power of suppliers of durables
  - **Durability** of durables
- Structural estimation rather than price index methods?

Theoretical challenges

My own attempts at trying to meet these challenges

- “Spurious Investment Prices” (with Alisdair McKay), mimeo, Federal Reserve Bank of New York
- "On Both Sides of the Quality Bias in Price Indexes", FRBNY Staff Report #157, December 2002
- “Is Equipment Price Deflation a Statistical Artifact?”, FRBNY Staff Report #139, November 2001

Relevance for monetary policy

What is mandate consistent range?

- Overestimation of inflation one reason to aim for range of positive levels of inflation (expectations).
- Level of perceived bias in price index relevant for choice of 'mandate consistent' range of inflation.