Physician Fee Schedules, Price Levels, and Price Departure

Frank Schmid

Ratemaking and Product Management (RPM) Seminar
March 20-22, 2011
New Orleans, LA

Research Questions

- What is the rate of inflation in physician services provided in workers compensation?
- How does price departure (percentage difference between actual expenses and hypothetical expenses at fee schedule) respond to fee schedule changes?
- How do the price level of and the quantity of consumed physician services respond to changes in workers compensation medical fee schedules?
- When relative prices(1) change in response to fee schedules, do physicians substitute toward services that experience comparatively large price increases or, equivalently, comparatively small price decreases?

(1) The price of a service A increases relative to the price of service B if the ratio price(A)/price(B) increases. For instance, the price of service A my increase more (or decrease less) than the price of service B

Definitions

- The price level is the price of a bundle of services, where such bundle may comprise all services consumed within a given time period or may be a representative basket thereof
- A price index is a means of measuring the price level at a given point in time and a given geographic location
- The rate of inflation is defined as the percentage increase in the price index over time
- Different price indexes may offer different rates of inflation

Possible Implications of Fee Schedules

- Fee schedules are a means of controlling the price level of medical care by specifying price ceilings for individual medical services
- The introduction or the alteration of fee schedules may not only affect the price level of medical services, but also the quantity and the structure ("mix") of services consumed
  - Of particular interest is the expected price departure following a new fee schedule—price departure is easy to measure (but not necessarily easy to predict)
  - Similarly, changes in the structure of medical services are straightforward to measure (by means of comparing various types of price indexes), but may be difficult to predict
  - Responses in the quantity of services consumed (net of changes to the structure of these services) are difficult to measure because such measurement must happen at the level of the claimant (as opposed to the level of individual medical services) or even at the level of exposure (to the degree that quantity responses manifest themselves in claim counts)

Possible Physician Responses

- How do the levels of price and quantity respond to a change in fee schedule?
  - When *relative* prices change(1) (i.e., the ratio of MARs changes across CPT® codes), do physicians respond by substituting away from procedures that experienced a decline in relative price?
  - Do physicians respond to declines in the price level of the fee schedule by increasing the quantity of services?
  - Are such responses symmetric, i.e., does a reversal of the fee schedule reverse the response?
  - Are such responses permanent, thus implying a permanent departure from best practice or a permanent re-definition of what is considered best practice?

MAR: Maximum Allowable Reimbursement
CPT® : Current Procedural Terminology
(1) The price of a given service increases relative to the price of another service if the price of the former increases by a greater percentage or decreases by a lesser percentage

Price Index Methodology

- There exist three concepts for calculating a Medical Price Index
- The BLS (Bureau of Labor Statistics) discusses these three concepts in connection with Hospital Services

(1) The medical inputs method

Tracking transactions of individual services—price indexes shown below follow this approach

(2) Tracking medical treatments

"From this vantage point, a day spent occupying a hospital room and the time in an operating room are not separate consumer services, but individual components of *one* hospital visit which may be all or part of a medical treatment" (italics in original)

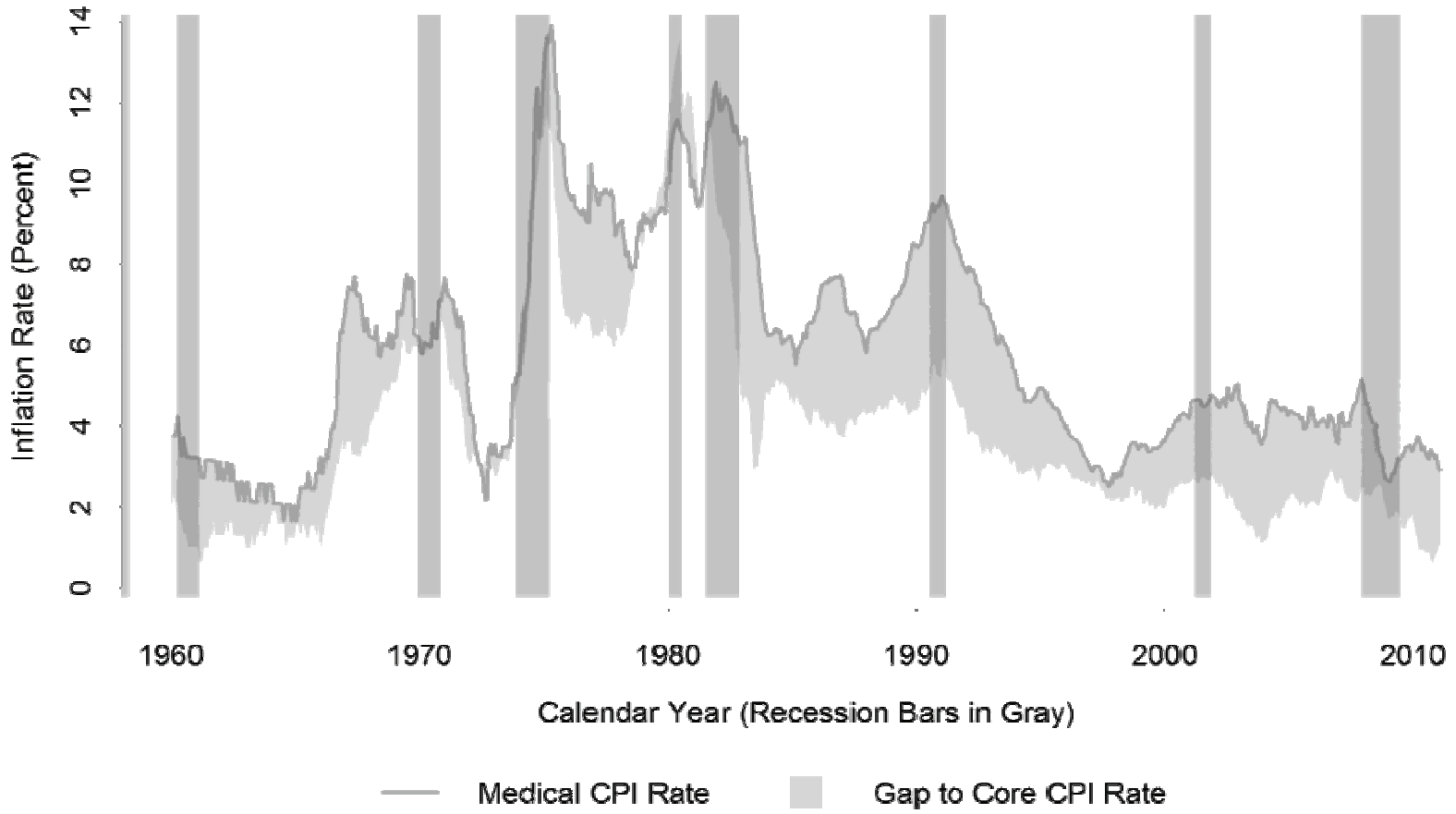
(3) The medical output method—the ideal method

"Measuring the value of different treatment outcomes is the subject of research in the industry, but is not yet considered a feasible methodology for the CPI medical care indexes"

Source: Bureau of Labor Statistics (BLS), http://www.bls.gov/cpi/cpifact4.htm

Medical Care Versus General Inflation

The Gap between the Two Rates of Inflation is Largely Due to a Lack of Quality-Adjustment of Treatment Outcomes



The Medical Care CPI is defined as the Medical Care component of the Consumer Price Index for all Urban Consumers (CPI-U). The Core CPI is defined as the CPI-U, all items less food and energy
Inflation rates are year-over-year
Not seasonally adjusted. Frequency of observation: monthly; latest available data point: January 2011
Source: FRED, https://research.stlouisfed.org/fred2; US Bureau of Labor Statistics (BLS), http://www.bls.gov

Service Categories

- We study the impact of fee schedule changes on…
  - …physician services by AMA service categories (or aggregates thereof)
  - …total physician services, aggregated across all service categories (except Anesthesia)
  - We distinguish four service categories

    [1] Surgery

    [2] Radiology

    [3] Medicine

    [4] Evaluation and Management & Pathology and Laboratory
  - Due to the sparseness of observations in Pathology and Laboratory, this service category was added to Evaluation and Management
  - Anesthesia was not included in the analysis due to the difficulty of identifying the number of units

AMA: American Medical Association
Surgery, Radiology, Medicine, Evaluation and Management, and Pathology and Laboratory are AMA Categories

Price and Quantity Indexes

- Service categories are aggregates, which means that they consist of a bundle of services—each service is identified by CPT® code
- Price and quantity indexes are calculated to establish price and quantity levels by service category—these indexes are subsequently aggregated across service categories to the total of physician services
- Chained Fisher price and quantity indexes are employed
  - The Fisher(1) price index is defined as the geometric mean of Laspeyres(2) and Paasche(3) price indexes

(1) Irving Fisher (1867-1947), American economist and statistician
(2) Ernst Louis Étienne Laspeyres (1834-1913), German economist and statistician
(3) Hermann Paasche (1851-1925), German economist and statistician

Laspeyres and Paasche Price Indexes(1)

- The Laspeyres price index answers the following question (when used as a monthly index and the base period being the prior month):

  If American households spent $100 last month on the bundle of goods and services that they then consumed, how much money would they have to spend this month if they wanted to consume the same bundle of goods and services?

- The Paasche price index answers the following question (when used as a monthly index and the base period being the prior month):

  If American households spend $100 on a bundle of goods and services this month, how much money would they have had to spend last month had they wanted to consume that same bundle of goods and services?

(1) The formula of the Laspeyres (Paasche) *quantity* index is identical to the formula of Laspeyres (Paasche) price index with prices and quantities trading places

The Laspeyres and Paasche Price Indexes in Comparison

- Assuming "normal" consumer behavior (which implies substituting away from goods and services that have become comparatively more expensive), the Laspeyres index overestimates the rate of inflation, whereas the Paasche index underestimates it(1)
  - This property leads to a testable hypothesis: If (and only if) in the wake of changes to the fee schedule, physicians substitute toward services that have experienced a comparatively higher increase in MAR, then the Laspeyres index delivers a lower rate of inflation than the Paasche index

(1) International Labor Office (2004) *Consumer Price Index Manual: Theory and Practice*, Geneva, p. 266

The Fisher Ideal Index

- The Fisher index is sometimes called *Fisher Ideal Index*, since it is the only price index that passes a set of 20 tests that have been proposed as consistency checks(1)
- Although the Laspeyres and Paasche indexes pass many of these tests, there is one test in particular that these two indexes fail: the time reversal test(2)
  - Reversing the direction of time (by comparing a given month to its prior month instead of following the natural course of time) changes the rates of inflation obtained from the Laspeyres and Paasche price indexes
  - The failure of the time reversal test implies that the Laspeyres and Paasche indexes cannot be used for cross-sectional comparisons (e.g., when comparing price levels between Ohio and Indiana)

(1) International Labor Office (2004) *Consumer Price Index Manual: Theory and Practice*, Geneva, p. 296.
(2) Ibid., p. 267

Scanner Data

- Medical transactions generate scanner data, which are records of transactions for which both prices and quantities are observed
- The scanner data nature of medical transactions allows for the calculation of Paasche (price and quantity) indexes and thus of Fisher (price and quantity) indexes
  - By contrast, the BLS (Bureau of Labor Statistics) relies on sampling shelve prices in grocery stores when measuring food prices for the CPI. If the BLS could rely entirely on scanner data (as recorded at the grocery store checkout), then (a) the BLS would not have to sample prices (but instead would have the population of paid prices) and (b) the BLS would know the current bundle of goods and services (and thus could calculate the Paasche price index and, as a consequence, the Fisher price index)

The Data Set

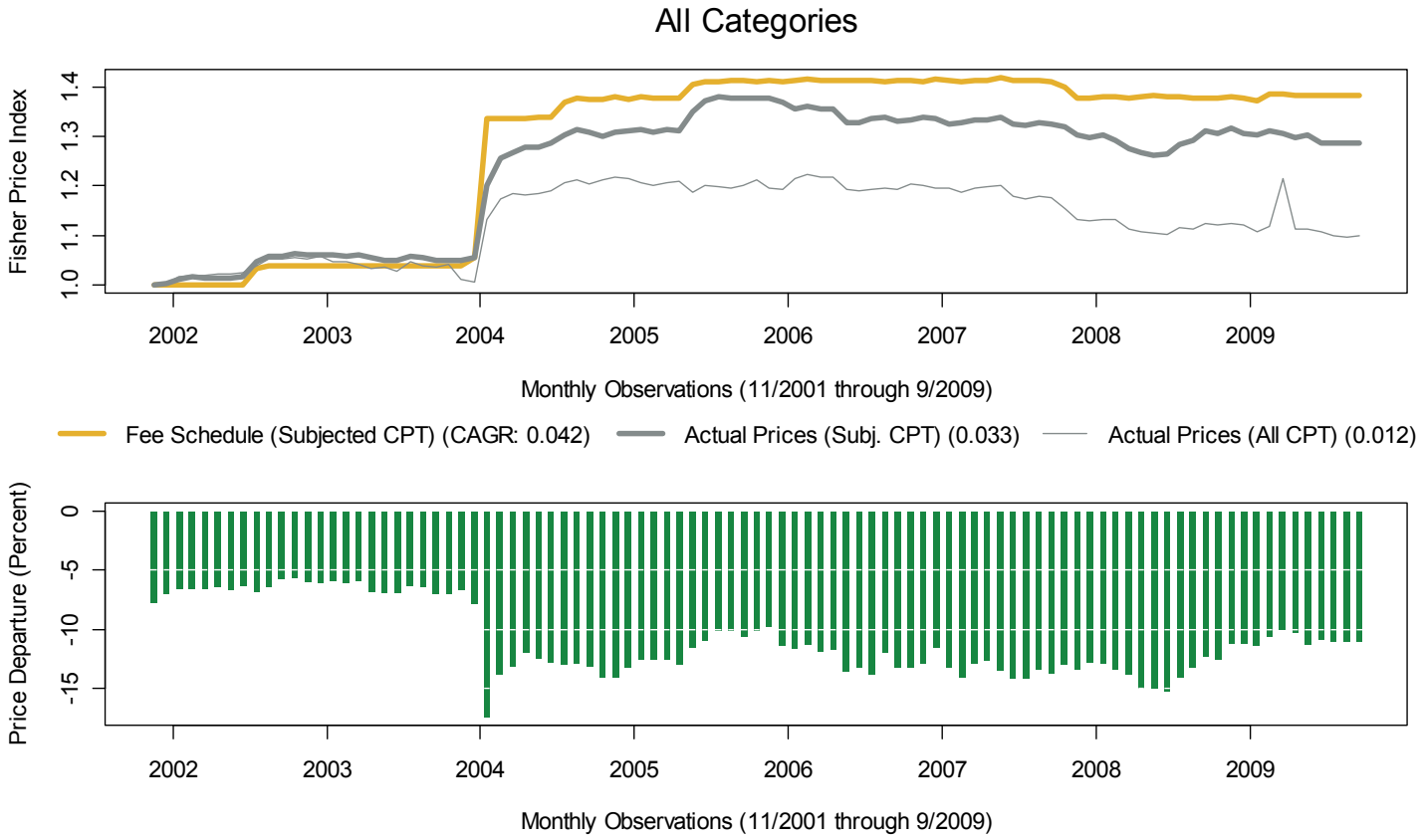
- The data set comprises workers compensation medical transactions data for Florida, Georgia, Maryland, and Utah—the data set, which has been provided by insurance carriers, ranges from 2000 through 2009
- For 2000 through 2009, we have information on the medical fee schedules in place at the time
- We edited the data set drawing on expert knowledge and we cleansed the data using statistical tools of outlier detection
  - For details on some of the data cleansing tools, see the appendix

Coverage of CPT® Codes

- There are 7,131 CPT® codes with at least one transaction in at least one month during the analyzed four-year time period
- After applying statistical tools of outlier detection, of these 1,789 CPT® codes…
  - 5,524 CPT® codes (or 77.5 percent) occur in more than one month for at least one state.
  - 1,698 (or 23.8 percent) enter the price indexes (by means of occurring in adjacent months)(1)
  - 1,471 (or 20.6 percent) enter the price indexes in every month for at least one state
  - 263 (or 3.7 percent) enter the price indexes in every month in all four states

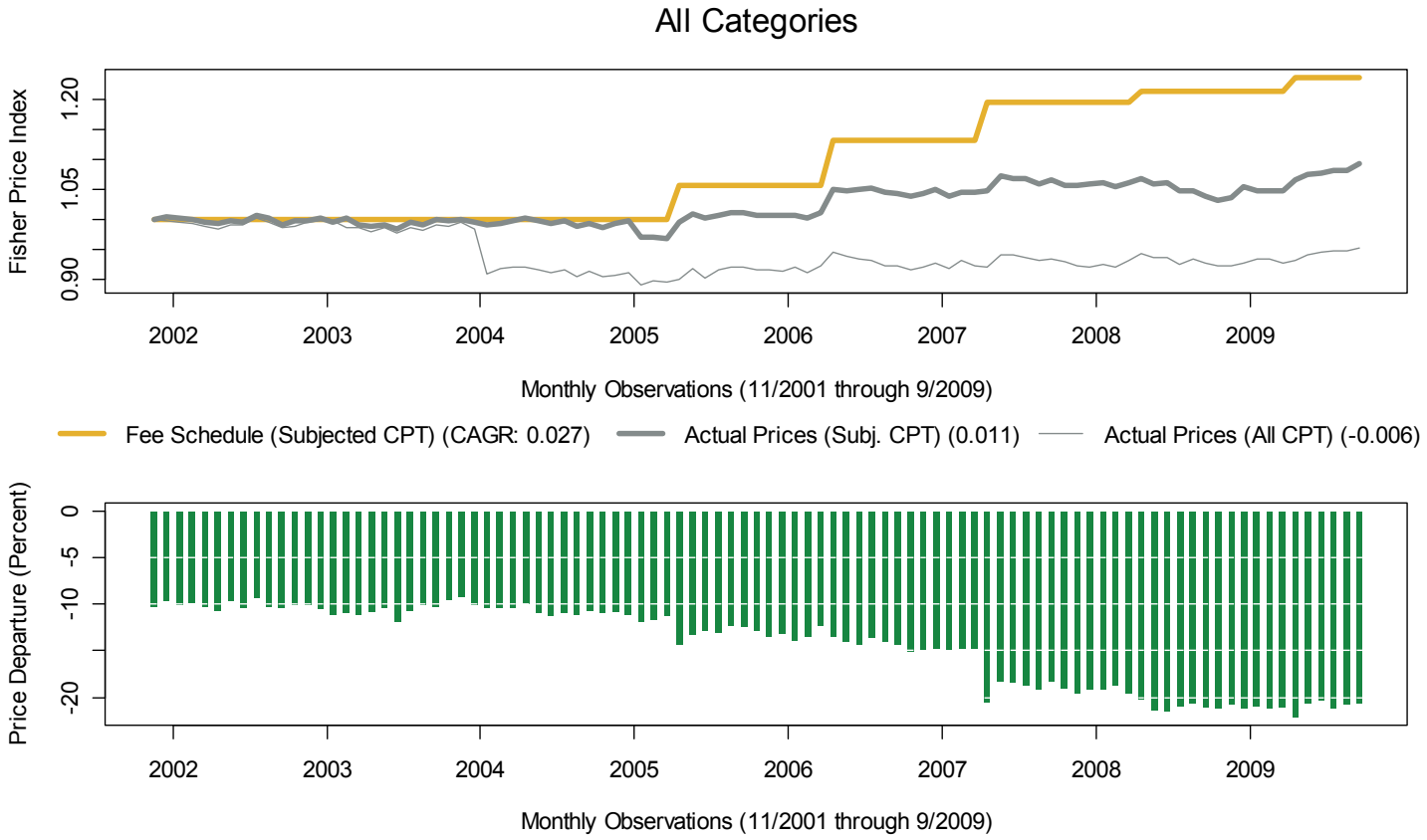
(1)This data set still makes up 73.5 percent of records in the original dataset. This percentage is computed by comparing the records comprising the "newer" price and quantity in the price index and the corresponding raw data

Florida
Fee Schedule, Price Level, and Price Departure



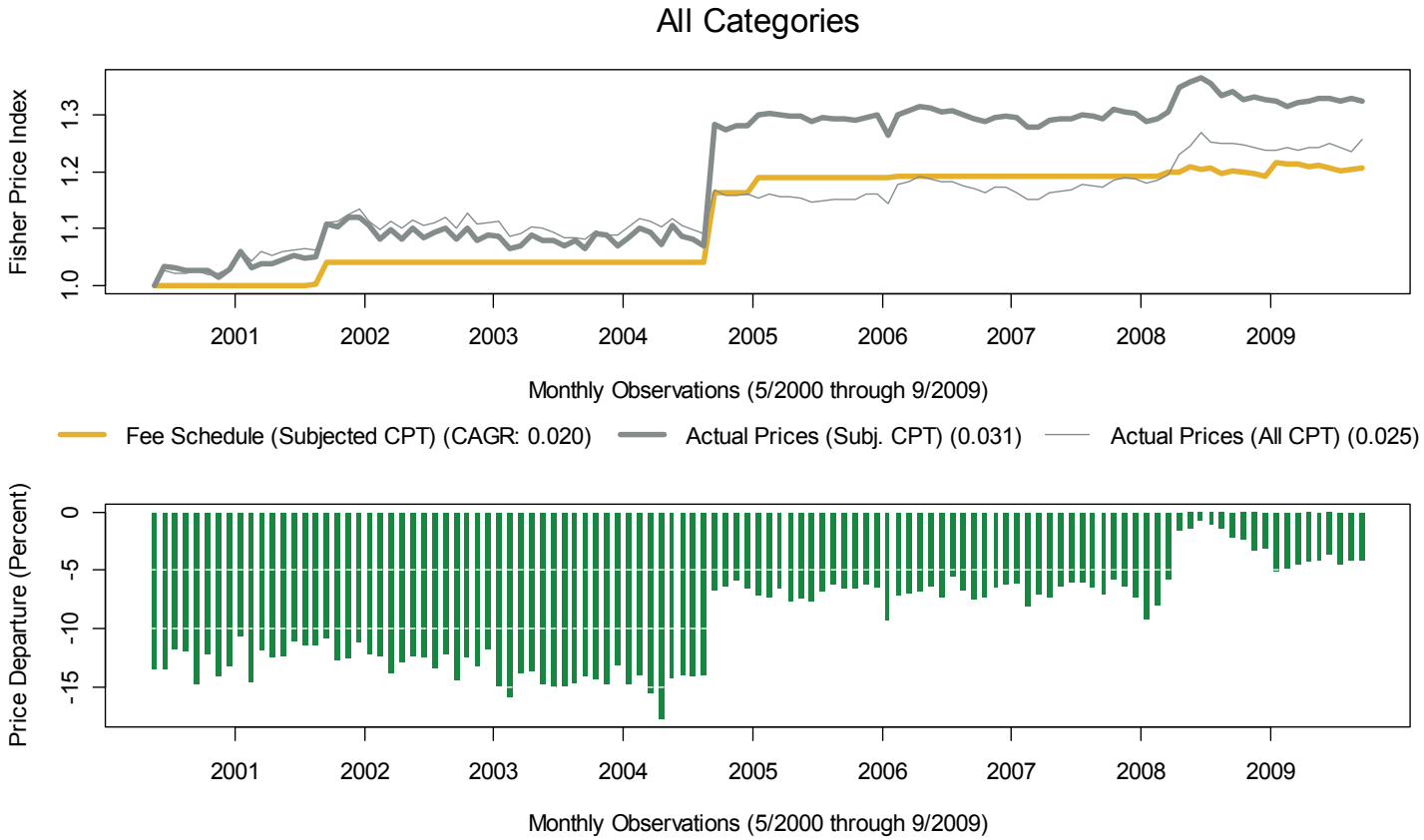
Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

Georgia
Fee Schedule, Price Level, and Price Departure



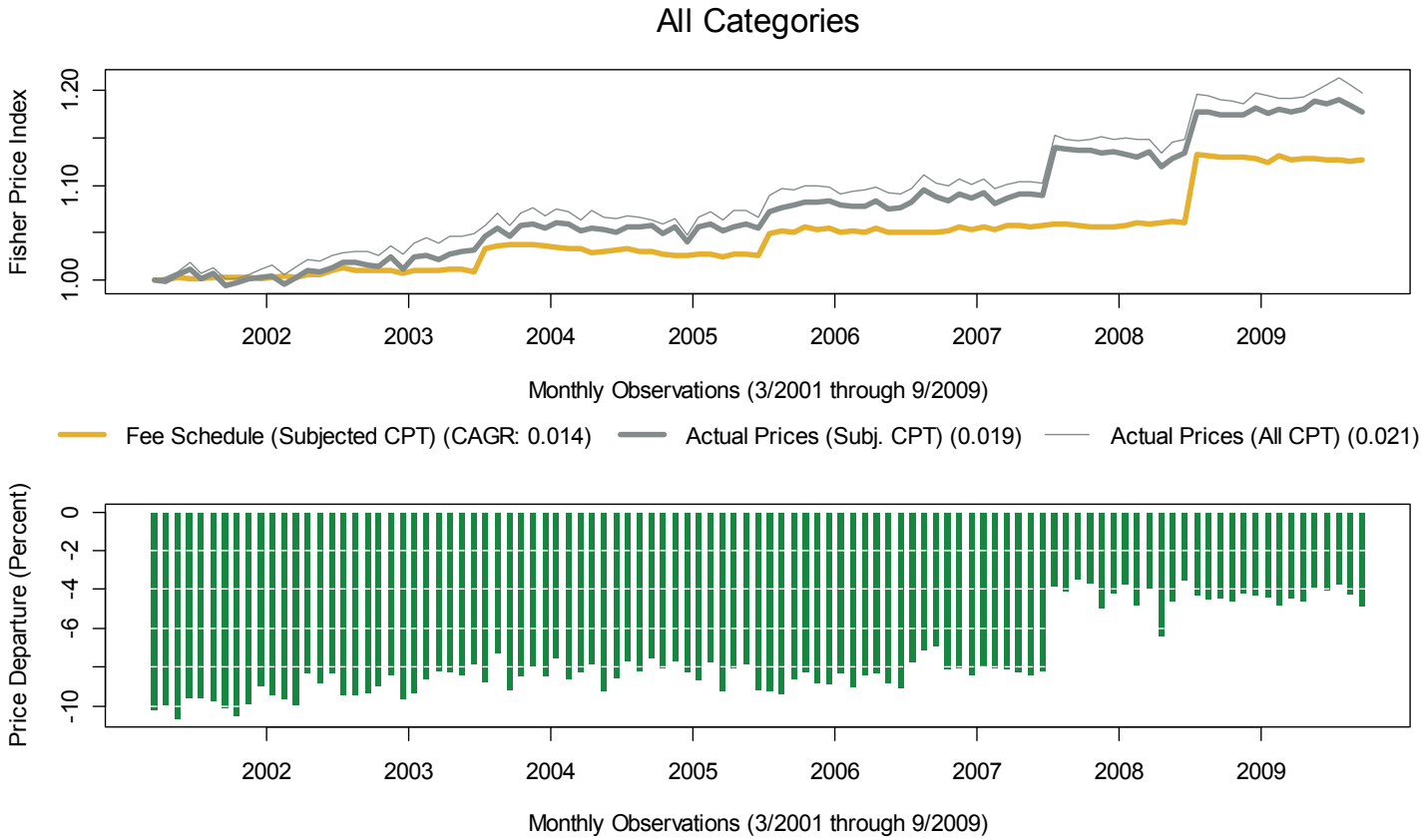
Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

Maryland
Fee Schedule, Price Level, and Price Departure



Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

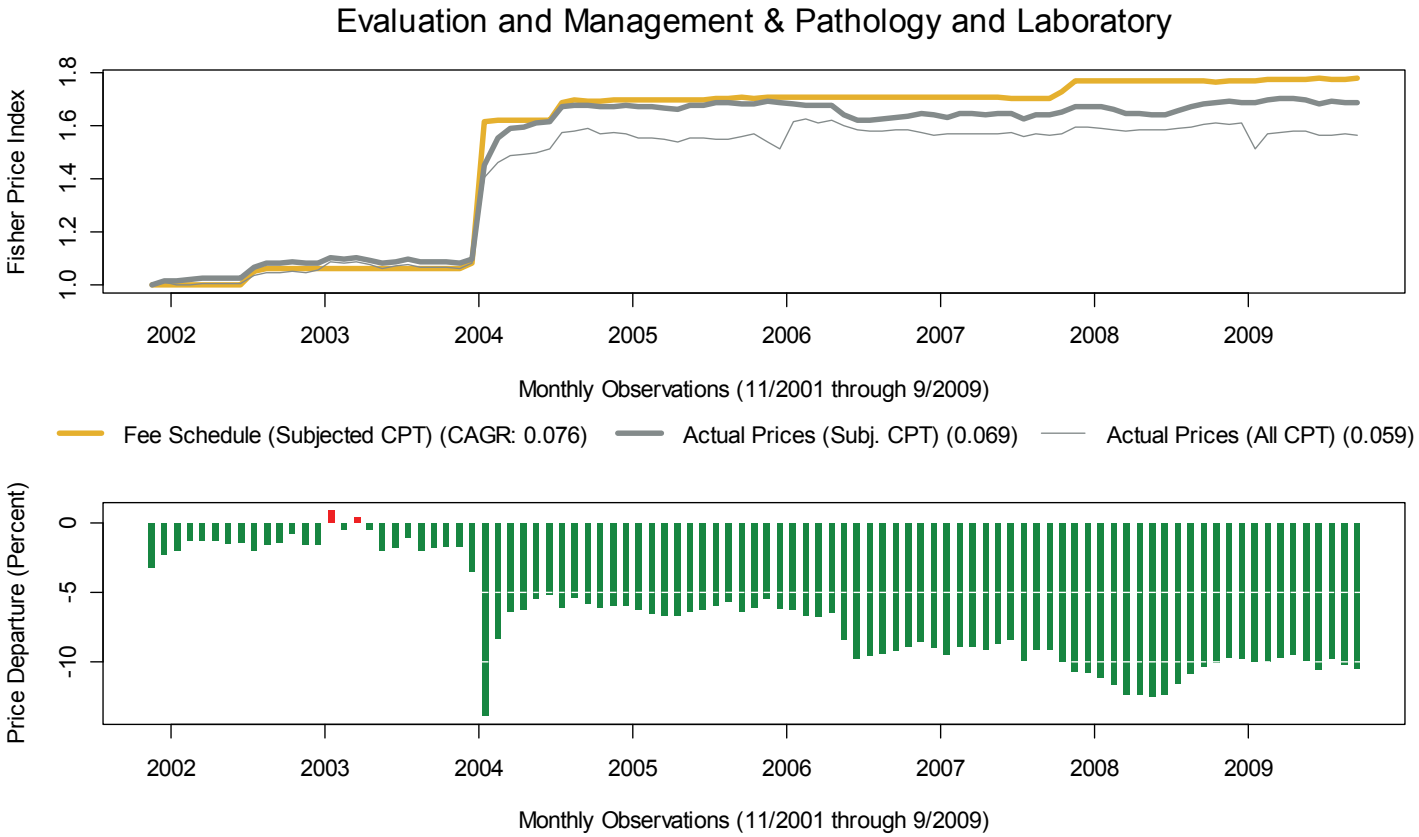
Utah
Fee Schedule, Price Level, and Price Departure



Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

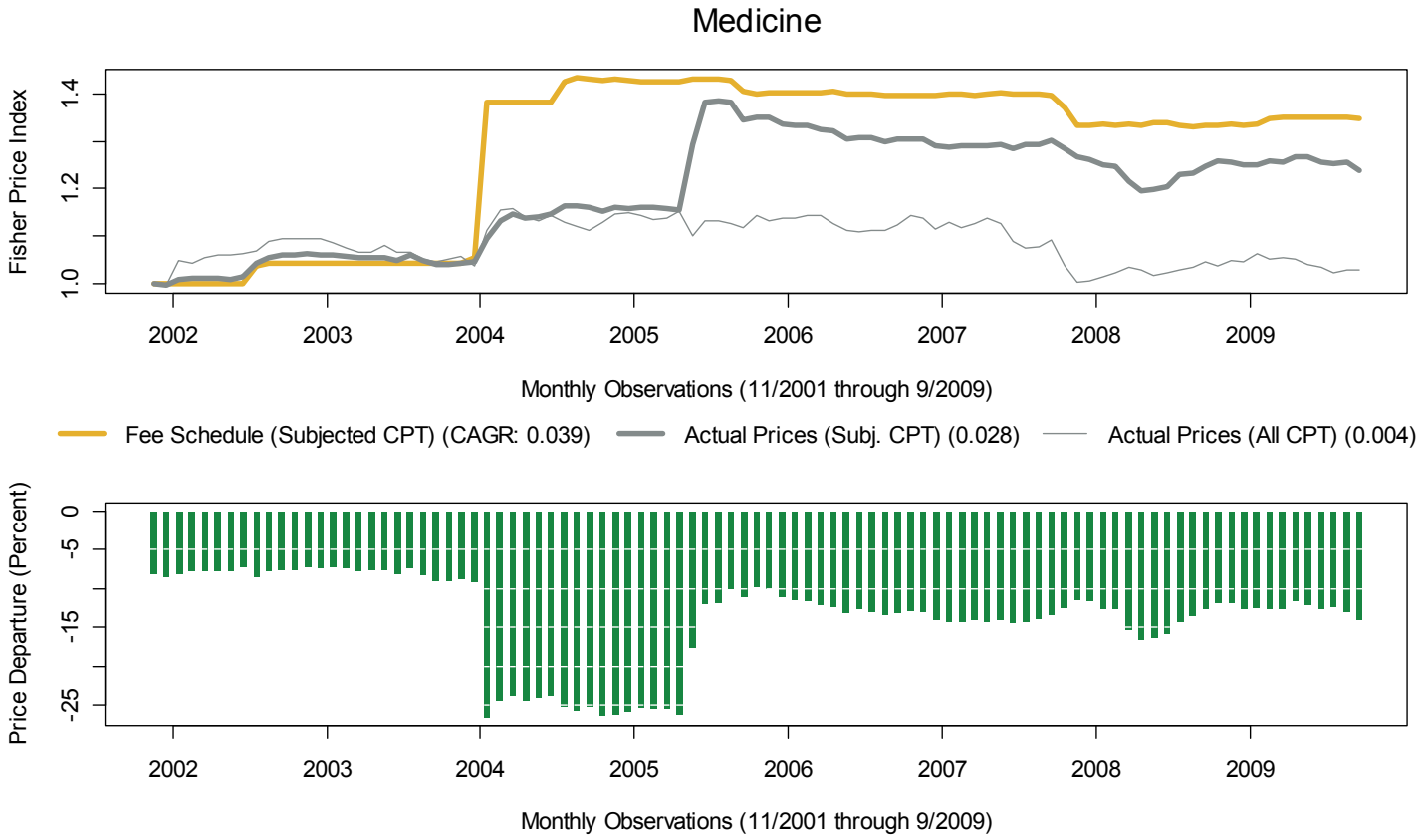
Florida

Actual Price Increases Follow Fee Schedule Closely



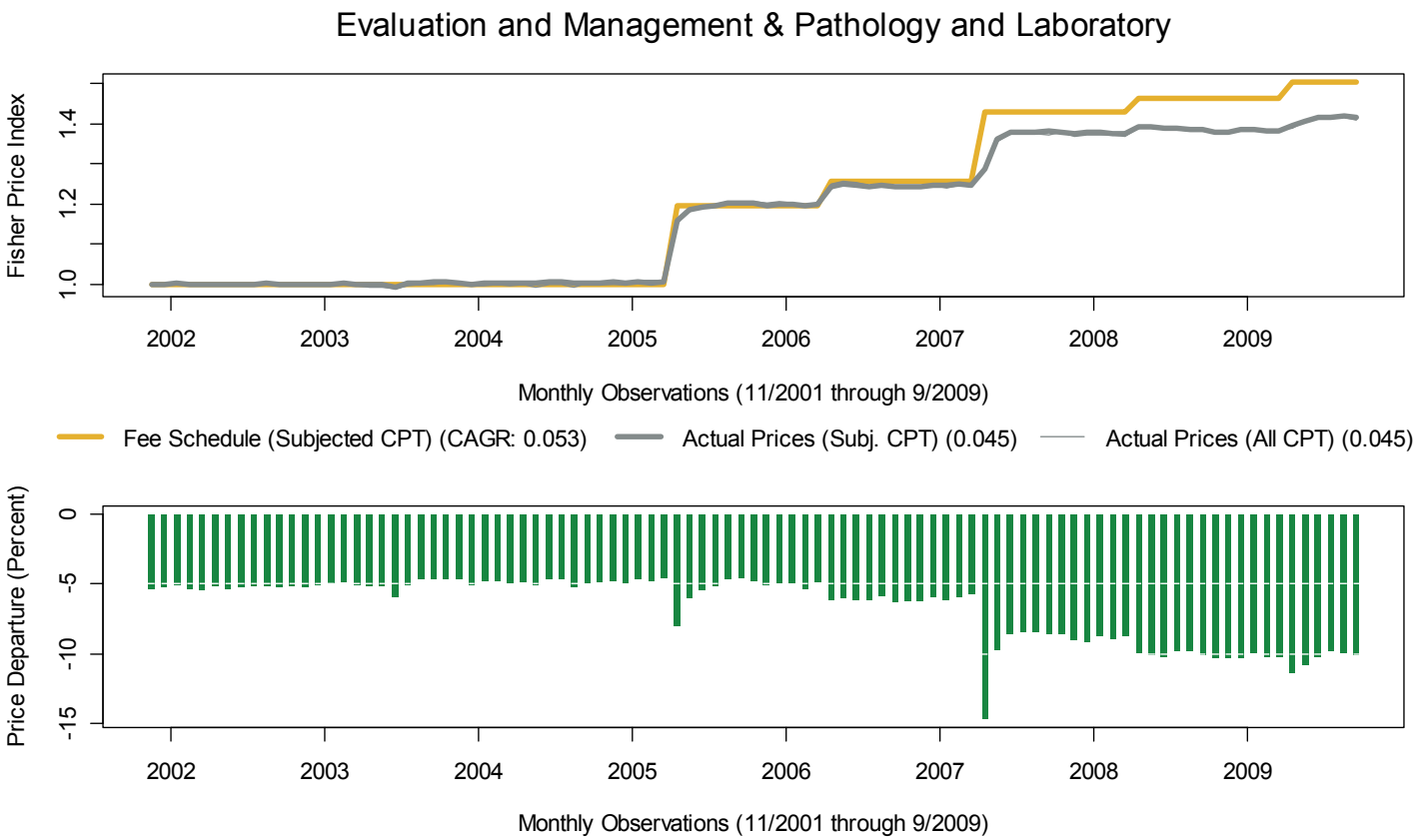
Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

Florida
Actual Prices Increased With a Substantial Lag



Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

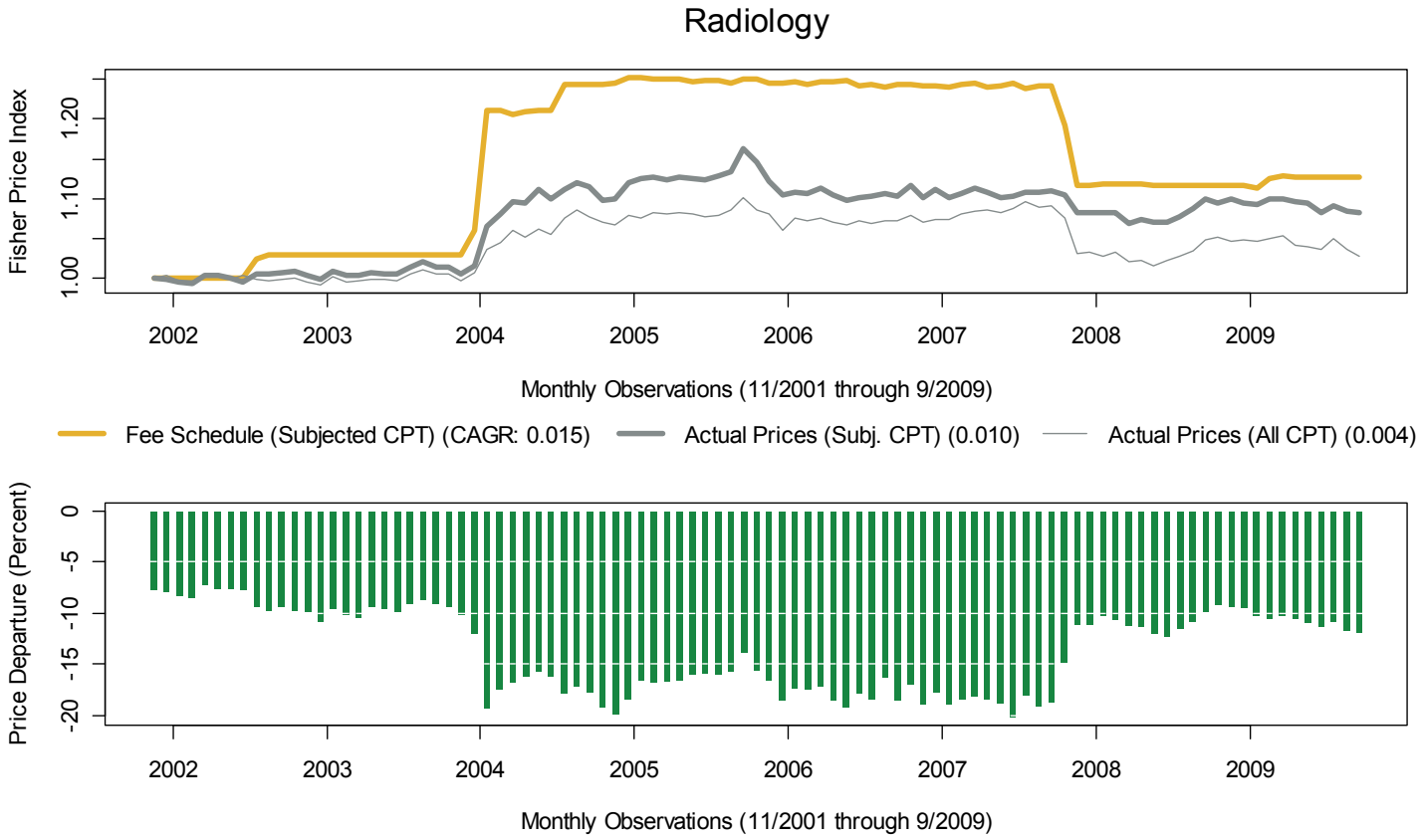
Georgia
Actual Price Increases Are Not Keeping Up



Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

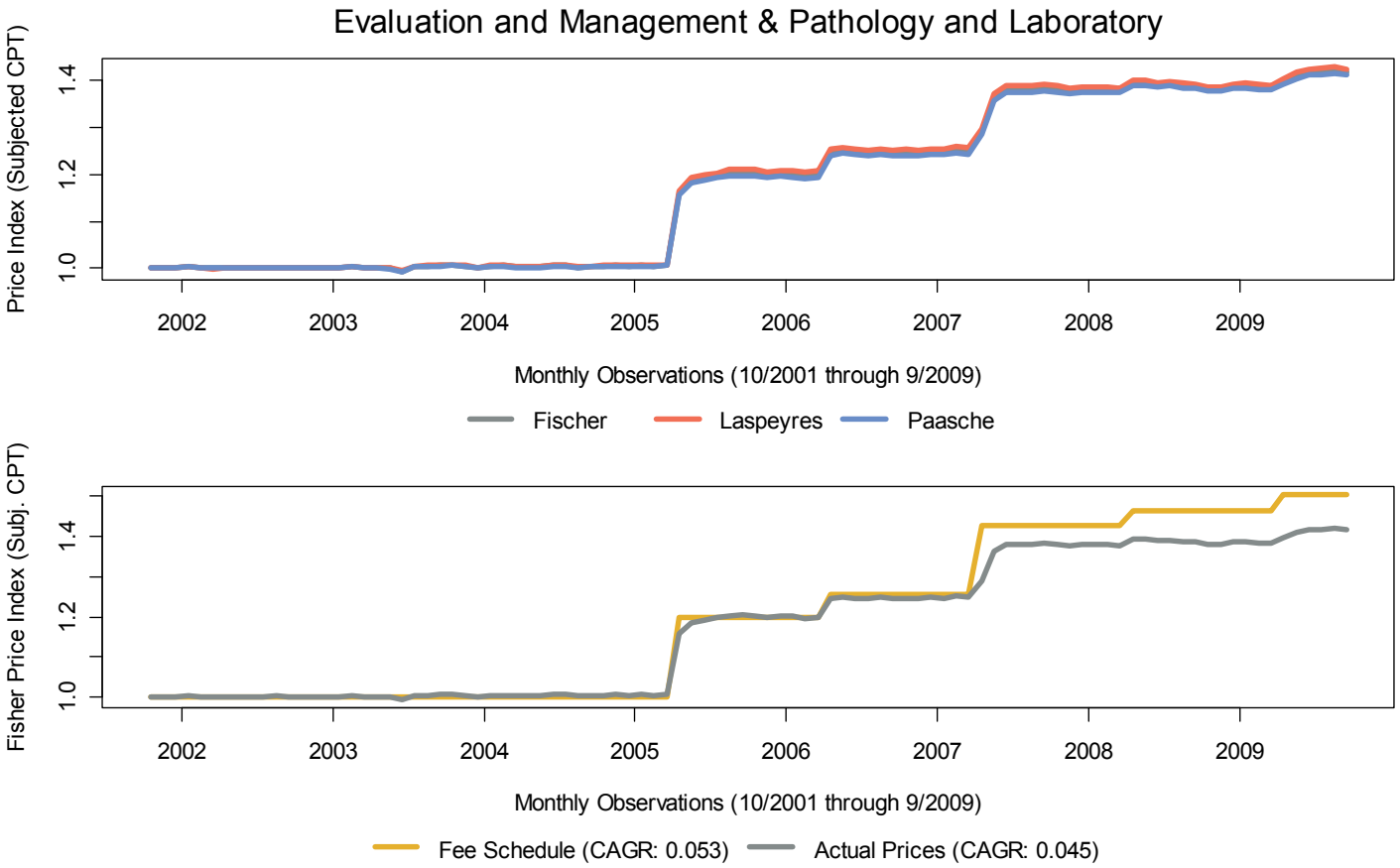
Florida

Fee Schedule Responds to Actual Price Increases Not Keeping Up



Price indexes are shown at actual and at fee schedule prices. Two types of price indexes at actual prices are shown: (1) comprising only CPT codes subject to a maximum allowable reimbursement (MAR) stipulated in dollar terms (hard MAR, for short) and (2) comprising all CPT codes. In the price departure computation, only CPT codes with hard MARs are included. Alternatively, the price index at MAR and the price departure are computed (but not shown) based on all CPT codes, implicitly assuming no price departure for CPT codes that are not subject to hard MARs.
Price indexes change only if prices change. Price departure, on the other hand, may change without prices changing.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

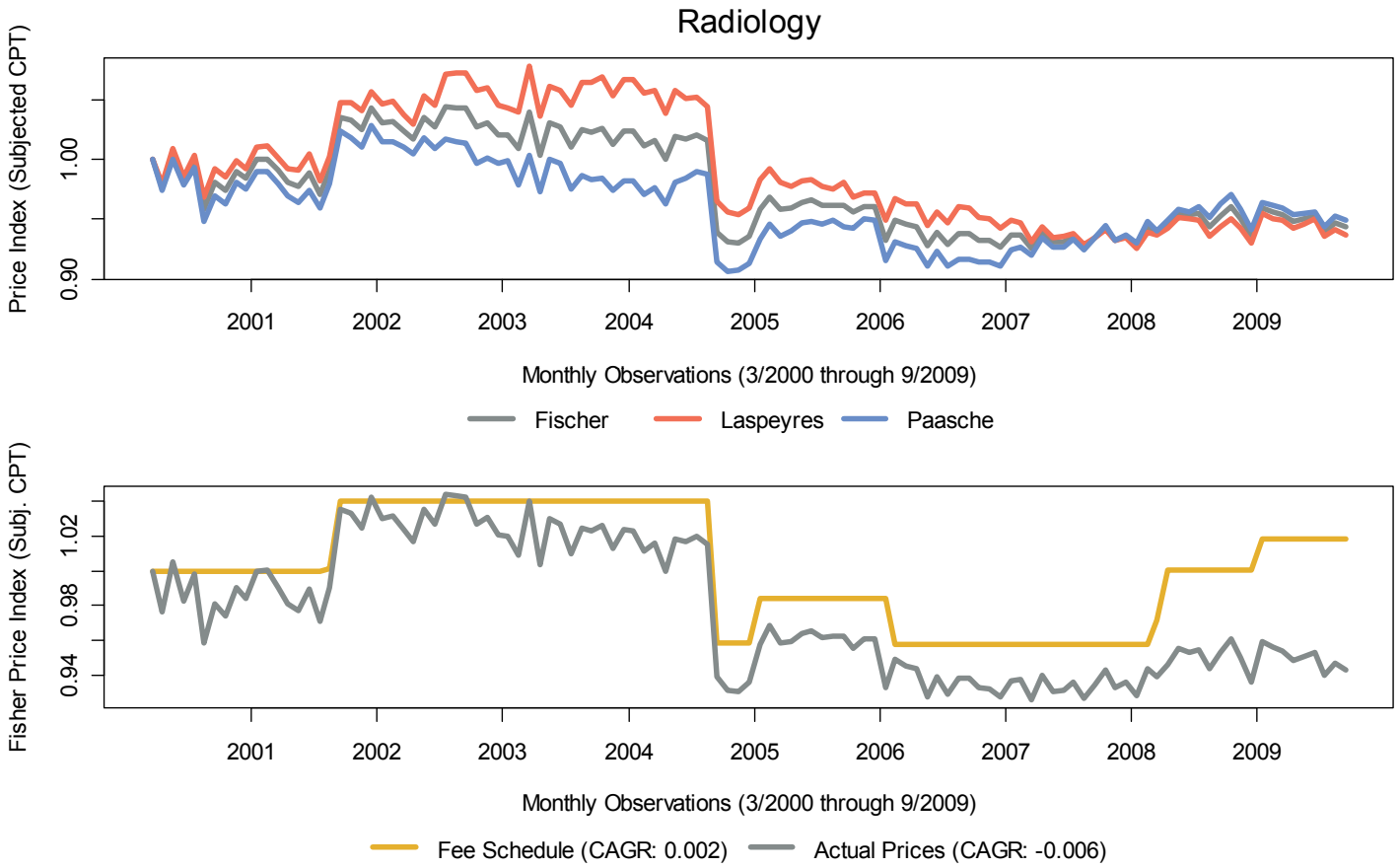
Georgia
No Substitution Effect Occurs



The substitution effect is defined as a change in *relative* quantities in response to a change in *relative* prices. If, for instance, within an AMA category, actual prices for all CPT codes increase by the same percentage, then there cannot be a substitution effect. If relative prices change but there is no response in relative quantities, then again there is no substitution effect. If (and only if) the Laspeyres index increases more (or decreases less) than the Paasche index, then there is substitution toward services whose relative prices have decreased. Conversely, if (and only if) the Laspeyres Index decreases more (or increases less) than the Paasche index, then there is substitution toward services whose relative prices have increased.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

Maryland

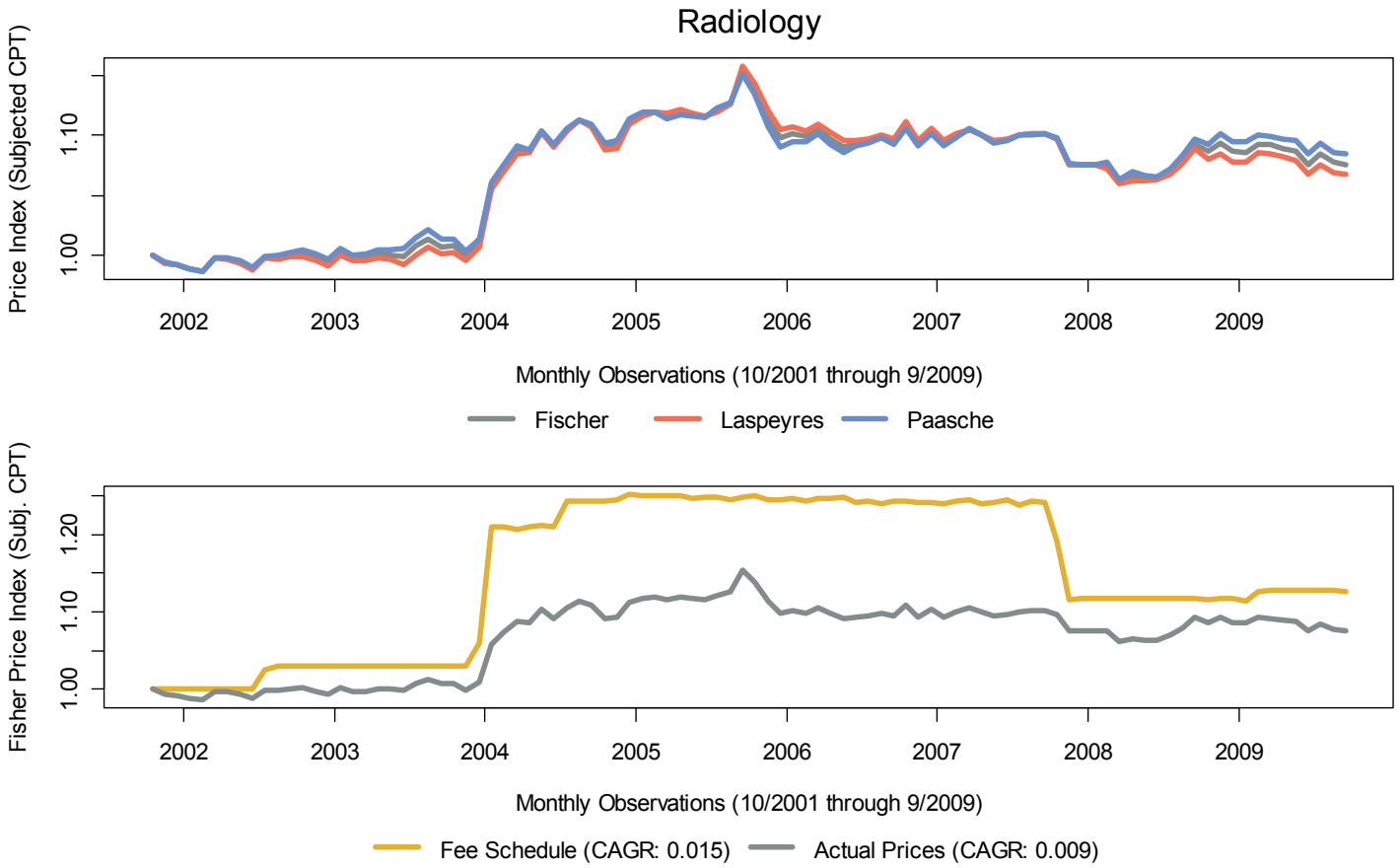
Symmetric Substitution Responses to Reversal in Fee Schedule Price Level



The substitution effect is defined as a change in *relative* quantities in response to a change in *relative* prices. If, for instance, within an AMA category, actual prices for all CPT codes increase by the same percentage, then there cannot be a substitution effect. If relative prices change but there is no response in relative quantities, then again there is no substitution effect. If (and only if) the Laspeyres index increases more (or decreases less) than the Paasche index, then there is substitution toward services whose relative prices have decreased. Conversely, if (and only if) the Laspeyres Index decreases more (or increases less) than the Paasche index, then there is substitution toward services whose relative prices have increased.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

Florida

No Substitution Responses to Reversal in Fee Schedule Price Level



The substitution effect is defined as a change in *relative* quantities in response to a change in *relative* prices. If, for instance, within an AMA category, actual prices for all CPT codes increase by the same percentage, then there cannot be a substitution effect. If relative prices change but there is no response in relative quantities, then again there is no substitution effect. If (and only if) the Laspeyres index increases more (or decreases less) than the Paasche index, then there is substitution toward services whose relative prices have decreased. Conversely, if (and only if) the Laspeyres Index decreases more (or increases less) than the Paasche index, then there is substitution toward services whose relative prices have increased.
CAGR: Cumulative Annual Growth Rate. AMA: American Medical Association

Conclusion and Research Outlook

- Prices respond to changes in fee schedules, sometimes immediately and other times with a lag of many months
  - Then again, fee schedules also respond to prices
- State-level price departures can be stable for many years but then shift in response to material fee schedule changes
  - Predicting the direction and magnitude of this response is a matter of future research
- There is little evidence of permanent substitution effects in response to fee schedule changes
- Responses in the quantity of services are a subject of ongoing research

Appendix
Outlier Detection

- We apply a box-and-whiskers plot to the observed transaction prices on the logarithmic scale,(1) using the following algorithm (where percentiles on the raw scale are indicated by capital letters and percentiles on the logarithmic scale are indicated by lower-case letters):
  - If P_{75} <>P_{25}, then we define our price fences as p_{75} + .6 and p_{25} -.6. Records with a paid value above p_{25} -.7 and a paid/submit ratio greater that .5 are also retained
  - If P_{75} =P_{25}(2), then we define our price fences as p_{85} + .2 and p_{15} -.2
  - Records within these hinges are used to calculate category wide fences, p_{90} + .5 and p_{10} -.5
- All Records within all of these fences are retained unedited and are used to calculate the average price and median units

(1) We use the natural logarithm

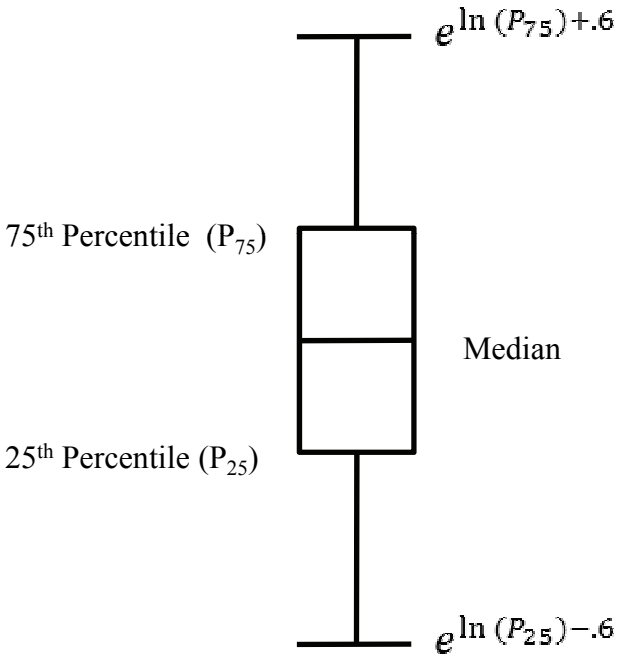
(2) The distributions of prices by CPT® code may be multi-model; such multi-modality may originate in variation in reimbursement transaction rates across the reimbursing institutions. Because the frequency distribution of reimbursing institutions may be highly skewed in a given CPT® code, setting the fences dependent on the 25th and 75th percentiles gives rise to the risk of discarding entire institutions as outliers

Appendix
Outlier Management

- All Records within all of these fences are retained unedited
- Records with a price above any relevant price fence have their price reset to the mean price for that CPT® code — this retains the quantity without having a significant impact on the price for the price index
- Records with prices below the lower price fence are tested for questionable units values
  - First, the price is tested with the units reassigned to the median number of units.(1) If this falls within the price fences(2) then the units value is reassigned to the median units value and price is recalculated appropriately
  - If the price falls below the lower price fence after reassigning the units to the median units, then the price is tested assuming the units = 1 (and the price = paid). If the price falls within the price fences, then the units are reassigned to 1 and the price is recalculated appropriately
  - All remaining records are discarded as nuisance transactions
- CPT® codes with less than 12 records in a given state in a given year are excluded from the price index computation(3)

(1) The median is usually equal to unity
(2) We only use the regular fences, not those dependent on a paid to submit ratio
(3) These records are included in the discount calculation

Appendix
Tukey's Schematic Plot (Box and Whiskers)



- Shown is Tukey's schematic plot the objective of which is to report major location parameters (median, 25th, and 75th percentiles) of a data set and to identify outliers (1)
- The actual shape of the plot depends on the data set it is applied to
- The hinges (to bars of the box) identify the limits of the inner quartile, which comprises 50 percent of the data
- The fences signify (1) the sum of the 75th percentage and .6(2) in log space, approximately the 75th percentile * 1.8 and (2) the difference between the 25th percentile and .6 in log space, approximately the 25th percentile divided by 1.8 respectively
- Values beyond the fences are considered outliers

Source: John W. Tukey (1977) Exploratory Data Analysis, Reading (MA): Addison-Wesley

(1) When applied to an actual data set, the schematic plot is typically called a box plot

(2) We used a constant additive adjustment in place of the inner-quartile difference employed by Tukey to avoid unreasonably high price fences after converting back to dollar space

Appendix
Laspeyres and Paasche Price Indexes Arithmetic

- The Laspeyres price index (P_L) and the Paasche price index (P_P) are calculated as follows:(1)

$$P_L \equiv \frac{\sum_{i=1}^{n} p_i^1 q_i^0}{\sum_{i=1}^{n} p_i^0 q_i^0} \qquad P_P \equiv \frac{\sum_{i=1}^{n} p_i^1 q_i^1}{\sum_{i=1}^{n} p_i^0 q_i^1}$$

where p and q indicate prices and quantities, respectively, 0 and 1 indicate the base period and the current period, respectively, and n is the number of items

- In order for the Fisher index to be a chained index, the base period of the P_L and P_P indexes must be the time period immediately preceding the current period (as opposed to a more distant past time period)(2)

(1) International Labor Office (2004) *Consumer Price Index Manual: Theory and Practice*, Geneva, p. 265
(2) Ibid., p. 280