A Simple Econometric Model for Hospital Reimbursements in Workers Compensation

Presented by:

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Casualty Actuaries of the Southeast
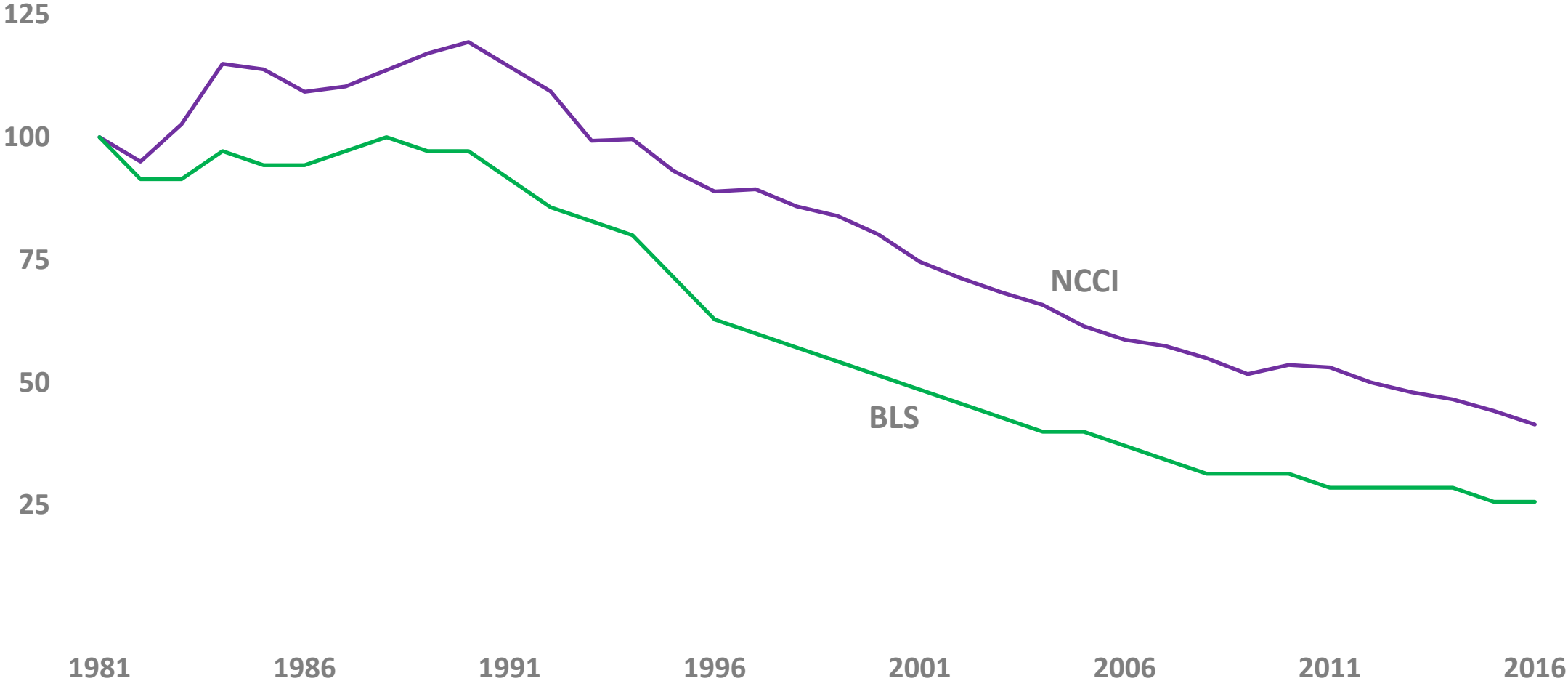Spring Meeting
March 23, 2021

Agenda

- Background – Workers Compensation (WC) Medical Cost Overview

- Background – WC Medical Fee Schedules

- Hospital Outpatient Fee Schedule Model

- Model Testing and Performance

WC Medical Cost Overview
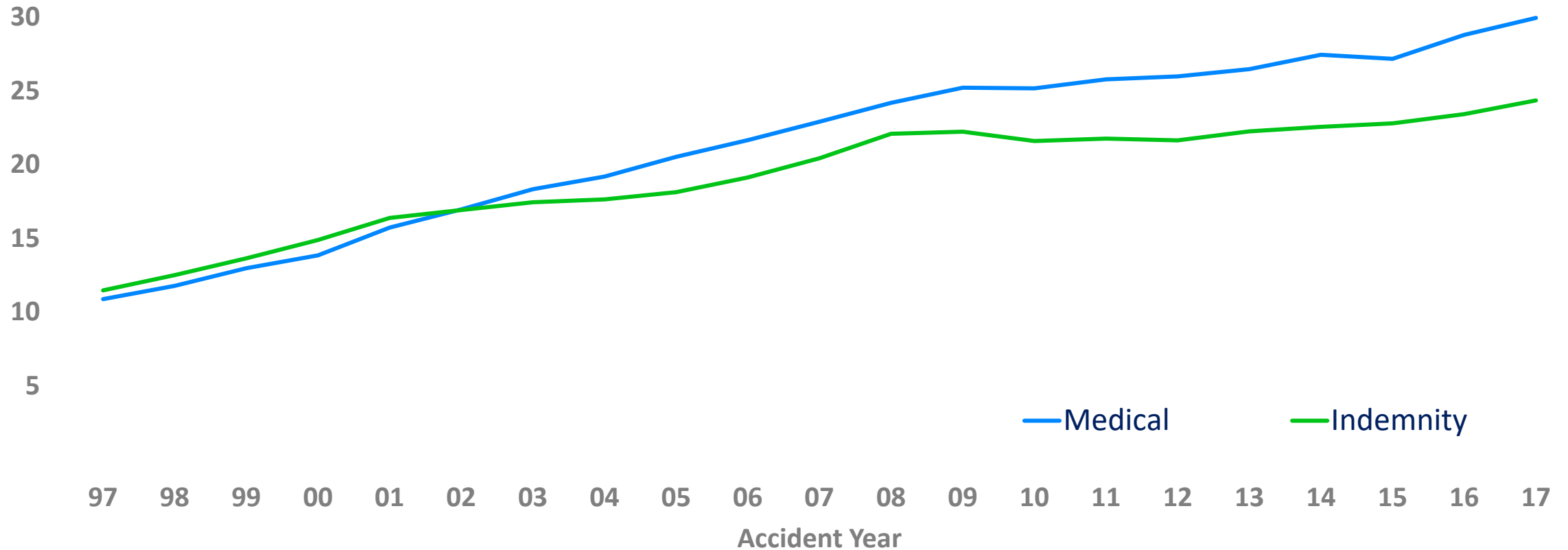
Lost-Time Claim Frequency

Index 1981 = 100

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BLS

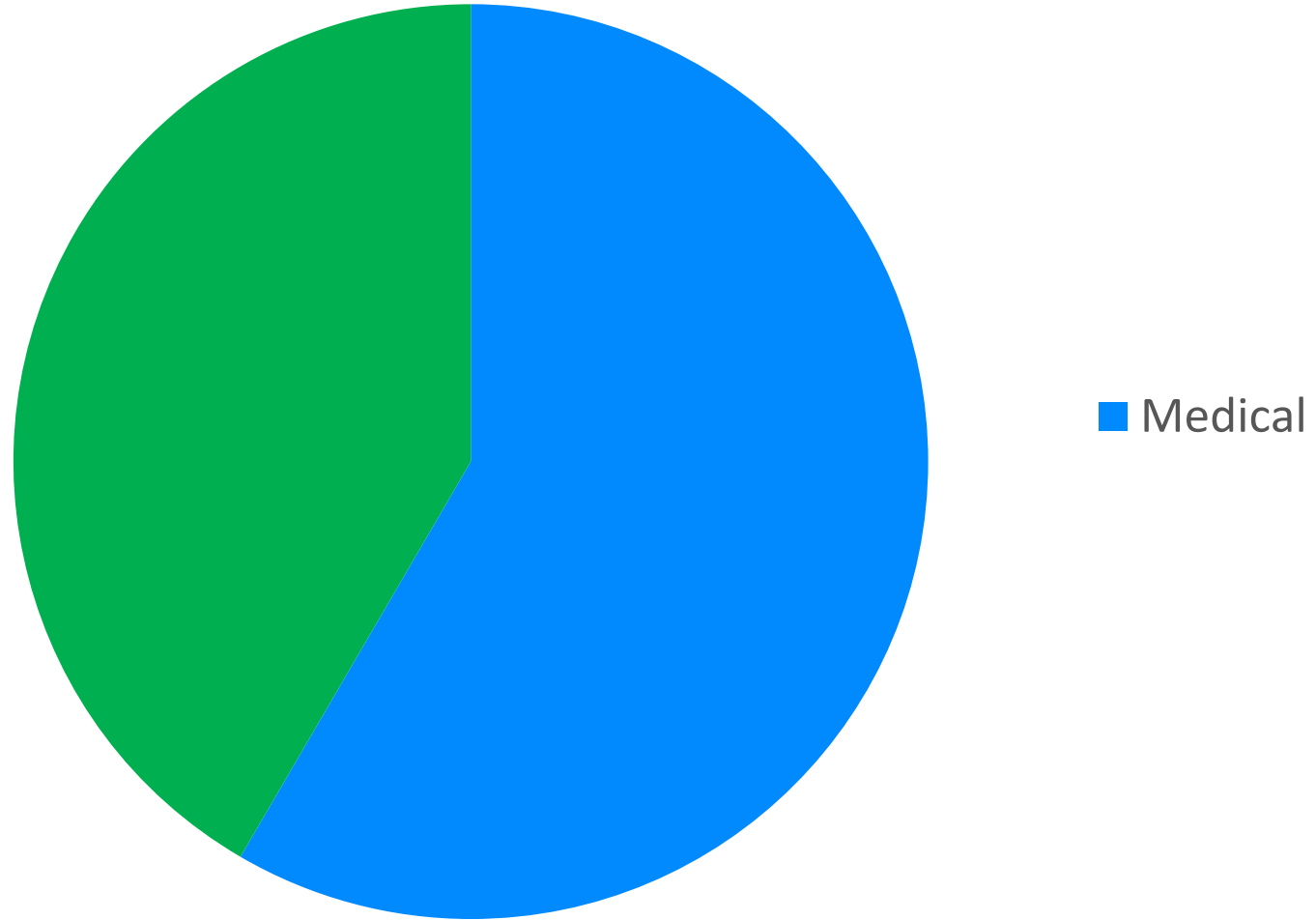1981   1986   1991   1996   2001   2006   2011   2016

WC Average Lost-Time Claim Severity

Private Carriers and State Funds—NCCI States

Severity ($ Thousands)

Medical   Indemnity

Accident Year
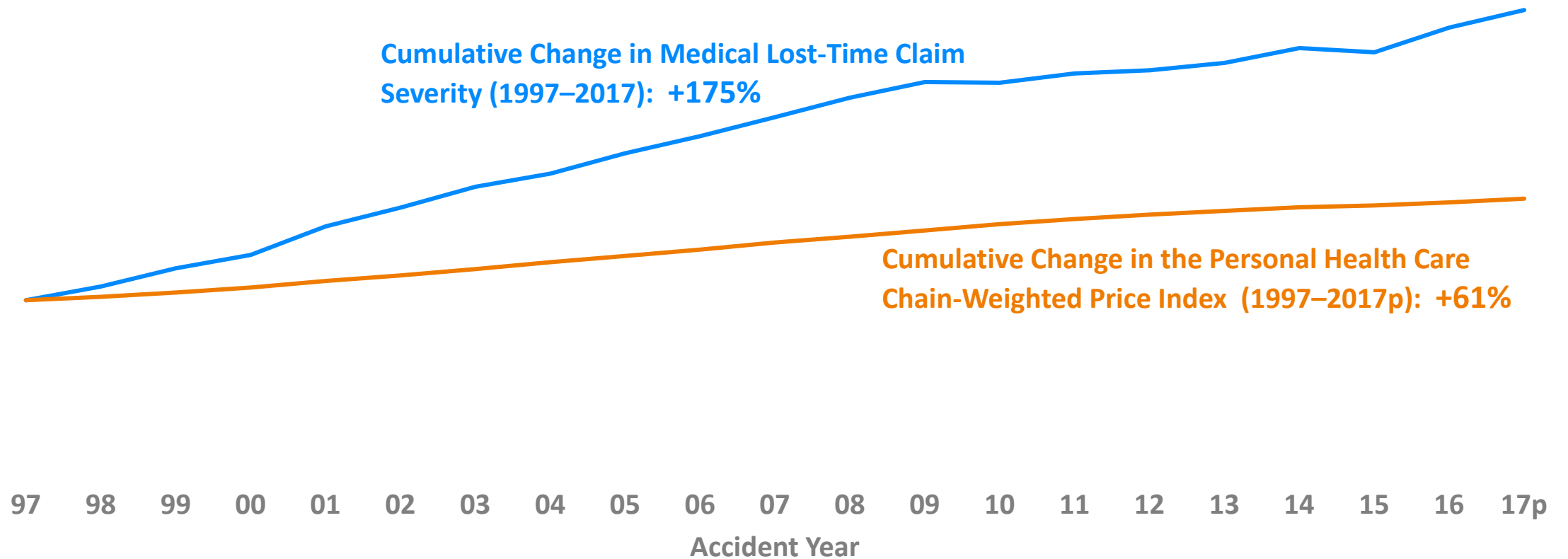
Medical Costs Dominate in WC

■ Medical

WC Average Medical Lost-Time Claim Severity

Private Carriers and State Funds—NCCI States

Cumulative Change in Medical Lost-Time Claim Severity (1997–2017): +175%

Cumulative Change in the Personal Health Care Chain-Weighted Price Index (1997–2017p): +61%

97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17p

Accident Year

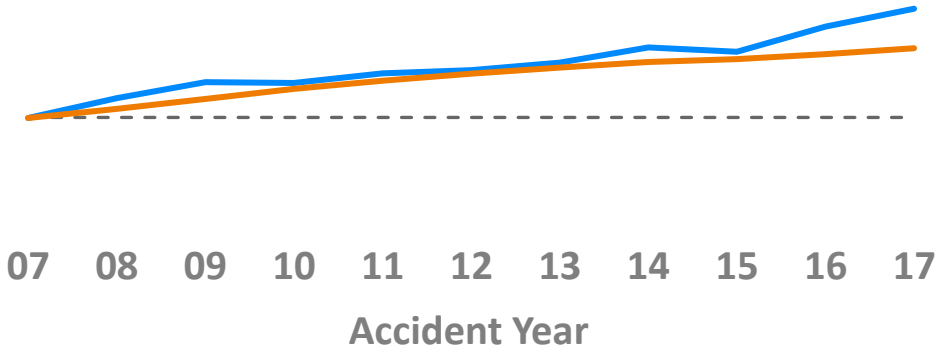# Medical Severity vs. Price Inflation

Private Carriers and State Funds—NCCI States

Medical lost-time claim severity grew approximately **4.5%** per year **faster** than medical care prices

97 98 99 00 01 02 03 04 05 06 07

Accident Year
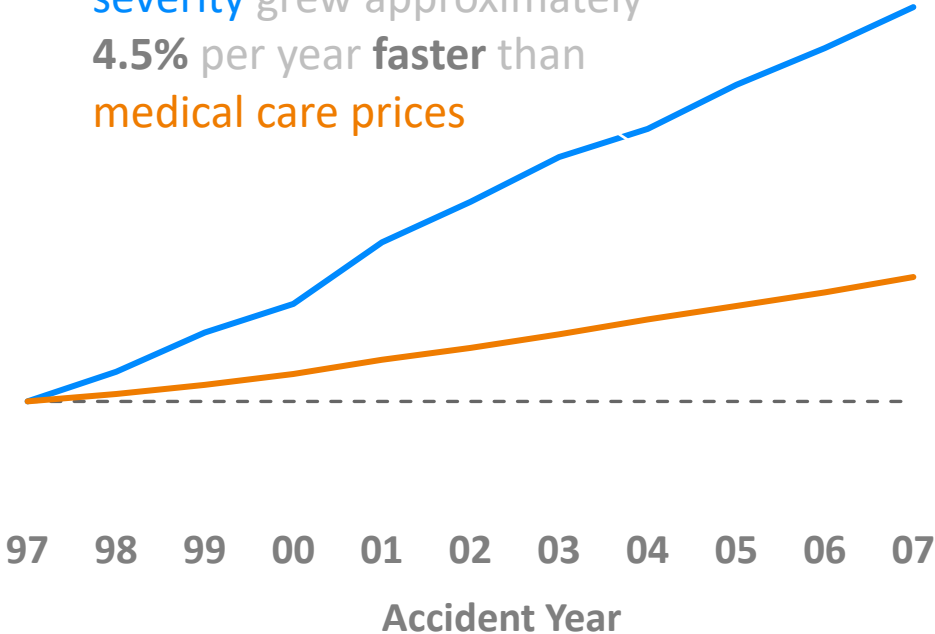
Change in Medical lost-time claim severity and medical care prices **tracked** one another

07 08 09 10 11 12 13 14 15 16 17

Accident Year

Countrywide Distribution of Medical Costs

39%
Physicians

19%
Hospital
Outpatient

13%
Hospital
Inpatient

9%
Drugs

8%
DME, Supplies,
and Implants

7%
Ambulatory
Surgical Centers

5%
Other
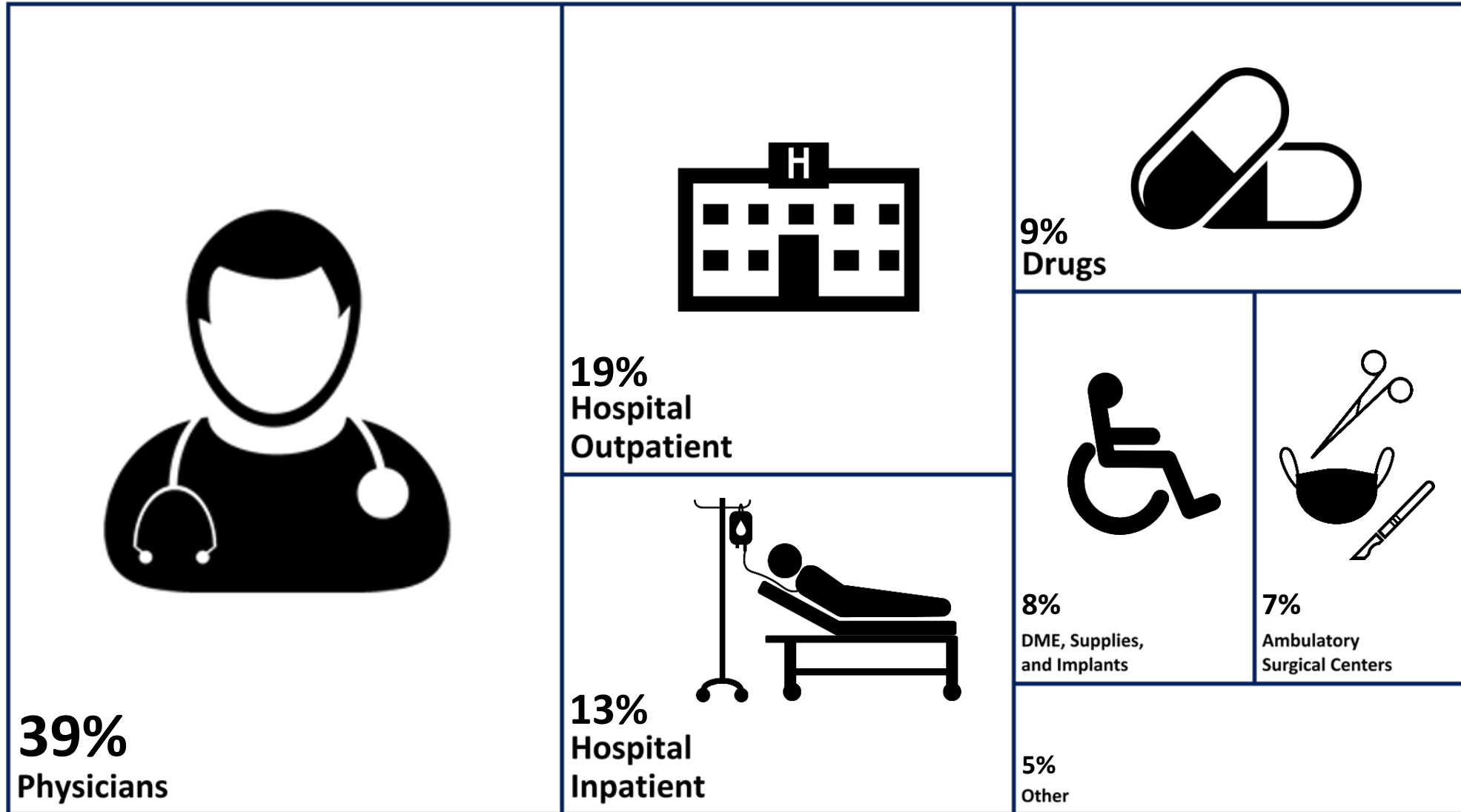
WC Medical Fee Schedules

What is a Fee Schedule?

- A fee schedule is a catalog containing:
  - A list of alphanumeric codes identifying a wide array of medical services or groups of services
  - The associated Maximum Allowable Reimbursement (MAR) for each code

- Represents a *system-wide* medical cost containment tool

- Workers compensation fee schedules are created by state legislatures and typically updated by rule

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A Fee Schedule Excerpt

CPT CODE	2018 FEE		CPT CODE	2018 FEE
90901	$59.28		97164	$55.84
97012	$39.01		97165	$116.33
97014	$33.95		97166	$139.61

A Fee Schedule Excerpt

CPT CODE	2018 FEE		CPT CODE	2018 FEE
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Procedure Code

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Procedure Code

MAR

A Fee Schedule Excerpt

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CPT CODE	2018 FEE
97164	$55.84
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97166	$139.61

Procedure Code

MAR

When a medical service provider performs "untimed electrical muscle stimulation" (97014), the WC insurer is not required to pay more than $33.95.

Fee Schedule Usage Has Expanded Substantially

Fee Schedules Can Affect WC Ratemaking

- Medical service providers generally are reimbursed at or near the MAR in states with a fee schedule.

- When the MARs in a fee schedule are updated, medical payments tend to move in tandem.

- Fee schedule updates are thus benefit level changes – and in many state filings loss costs are explicitly adjusted.

How Does NCCI Analyze Fee Schedule Updates?

This basic procedure covers any type of fee schedule update:

- Determine the percentage change in MAR for each code with a MAR

- Calculate the weighted-average MAR change based on payments from the latest service year (SY)

- Transform weighted-average MAR change into estimated change in reimbursements (i.e., medical losses) paid using a 'price realization' factor

- Multiply the impact by the share of total WC benefit costs affected by the fee schedule

Fee Schedule Example

State X is updating its hospital outpatient fee schedule from a multiple of 2018 Medicare reimbursements to 2019 Medicare.

There are only three outpatient services in State X:

Code	Description	SY 2018 Paid
29405	Apply Short Leg Cast	$400,000
29999	Unlisted Complex Arthroscopy	$100,000
30400	Simple Nose Reconstruction	$500,000

Hypothetical example.

Step 1: Determine the % Change in MARs

Code	2018 MAR	2019 MAR	% Change in MAR
29405	$126	$128	+1.6%
29999	N/A	N/A	-
30400	$1,560	$1,680	+7.7%

Hypothetical example.

Codes without a MAR are assumed to be unaffected by fee schedule updates.

Step 2: Payment-Weight the % Changes

Code	SY 2018 Payments	Weight	% Change in MAR
29405	$400,000	40%	+1.6%
29999	$100,000	10%	-
30400	$500,000	50%	+7.7%
Total	**$1,000,000**		

Hypothetical example.
Payment data is from NCCI's Medical Data Call for the latest service year.

Step 2: Payment-Weight the % Changes

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29405	$400,000	40%	+1.6%
29999	$100,000	10%	-
30400	$500,000	50%	+7.7%
Total	**$1,000,000**		**+4.5%**

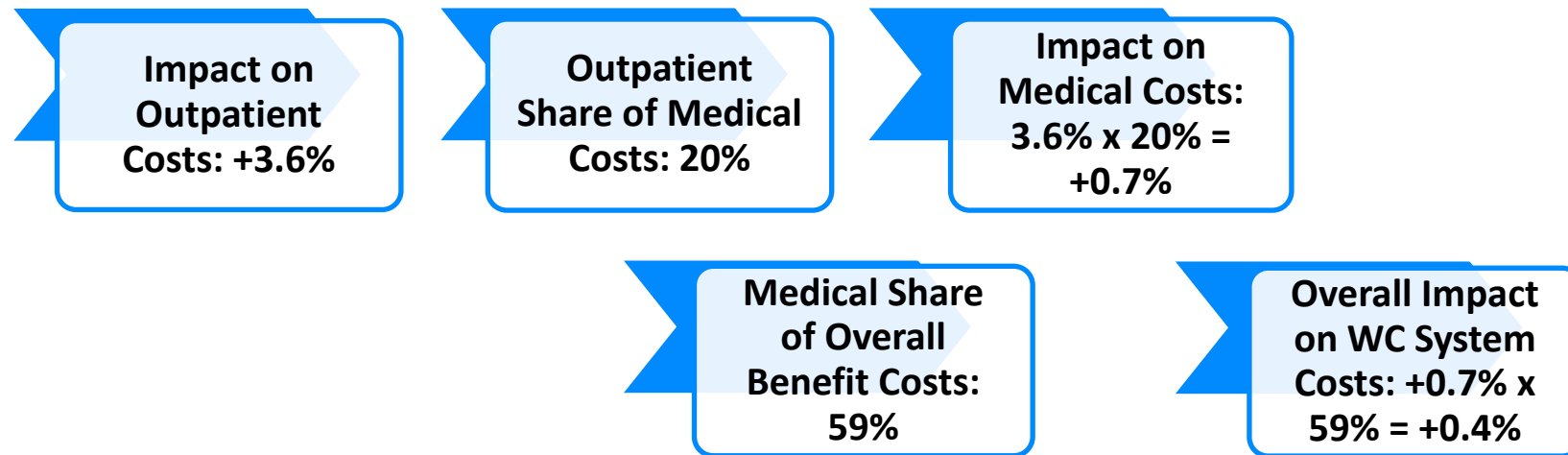Hypothetical example.

Payment data is from NCCI's Medical Data Call for the latest service year.

Step 3: Apply the Realization Factor

- Now, translate the average change in MAR to an expected change in medical payments (losses).

- Previous studies have suggested that **80%** of a change in MAR is realized as a change in price paid.

- **+4.5%** change in outpatient average MARs $\Rightarrow$ **+3.6%** change in hospital outpatient paid losses

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Step 4: Impact on Overall Loss Costs

Impact on Outpatient Costs: +3.6%

Outpatient Share of Medical Costs: 20%

Impact on Medical Costs: 3.6% x 20% = +0.7%

Medical Share of Overall Benefit Costs: 59%

Overall Impact on WC System Costs: +0.7% x 59% = +0.4%
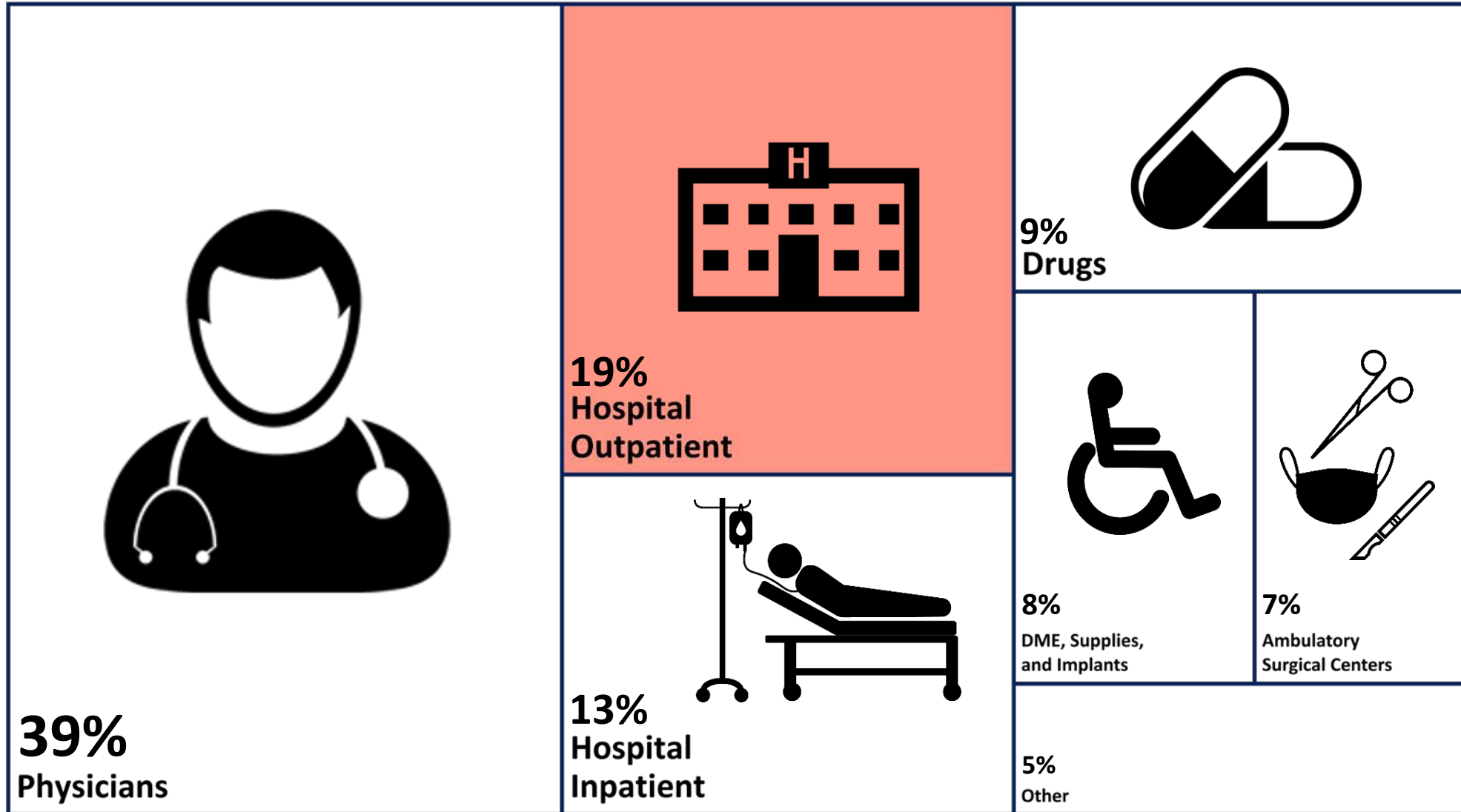
Hypothetical example.

Hospital Outpatient Fee Schedule Model

Research Goal

- Previous research on physician costs found the price realization factor for physician fee schedule changes is approximately **80%**

- In other words, for each 10% increase (decrease) in MAR for a service, reimbursements paid by insurers increased (decreased) by **8.0%**

- The research presented here extends our findings to hospital outpatient reimbursements

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Data

- The data source used in this study is NCCI's Medical Data Call*

- Data subject to the following limitations was used:
  - Outpatient services (or groups of services), with a MAR, provided between July 1, 2010 and December 31, 2018
  - NCCI states with an enforceable hospital outpatient fee schedule that was updated at least once during the study period
  - Screened for reporting errors and medical coding anomalies

- These transactions were aggregated into a total of 10,507 state, service quarter, and reimbursement code combinations

*For Texas, the data source is DWC Medical State Reporting Public Use Data File.

Data Sample

State	Service Quarter	Code	Description	Percent Change in Average Price from Prior Quarter	Percent Change in MAR from Prior Quarter
TX	2	0615	LEVEL 4 TYPE A EMERGENCY DEPARTMENT VISITS	-0.8%	0.0%
TX	3	0615	LEVEL 4 TYPE A EMERGENCY DEPARTMENT VISITS	-0.3%	0.0%
TX	4	0615	LEVEL 4 TYPE A EMERGENCY DEPARTMENT VISITS	+0.9%	0.0%
TX	5	0615	LEVEL 4 TYPE A EMERGENCY DEPARTMENT VISITS	-1.9%	-1.3%
GA	2	5114	LEVEL 4 MUSCULOSKELETAL PROCEDURES	+2.9%	0.0%
GA	3	5114	LEVEL 4 MUSCULOSKELETAL PROCEDURES	+9.9%	+10.7%
GA	4	5114	LEVEL 4 MUSCULOSKELETAL PROCEDURES	-3.4%	0.0%

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Price Changes Correspond to MAR Changes in Texas

Exogeneity Matters

- Two mechanisms for fee schedule updates to occur:
  - "Endogenous" updates
    - Fee schedules affect prices, <u>but</u>
    - Fee schedules are also updated in response to price levels
  - "Exogenous" updates
    - Fee schedules affect prices, <u>and</u>
    - Fee schedules are updated independently from price levels
- Hard to isolate causation from correlation for an endogenous fee schedule update!

Are Outpatient Fee Schedule Updates Exogenous?

- Most hospital outpatient fee schedule updates are exogenous
  - Fee schedules are updated automatically based on a fixed percentage of Medicare reimbursement rates.
  - Medicare outpatient rates are explicitly decoupled from general medical price inflation by the Affordable Care Act.

- We eliminated several states that did not meet this requirement for exogenous fee schedule updates.

Modeling Approach

- Modeling considerations:
  - Explanatory variable (change in the MAR) is exogenous
  - Emphasis on simplicity and interpretability of results
  - Autocorrelated longitudinal (time series) observations
  - Cross section of many relatively short time series

- A Panel Vector Autoregression (PVAR) with exogenous variables is a natural modeling choice

Benefits of Panel Vector Autoregression

Extension of ordinary least squares regression (OLS) for panel (i.e. longitudinal and cross-sectional) data

- "Vanilla" specification produces an easily interpretable linear model in the same format as OLS

- Adjusts *standard errors* for panel correlation structure

- Extendable to more complex specifications, such as
  - Dynamic interdependence: $Y_t = f(X_t, Y_{t-k})$ and $X_t = f(Y_t)$
  - Fixed effects: regression coefficients varies by panel member

Model Structure

Model structure:

$$\%\Delta P_{i,s,t} = \gamma\%\Delta P_{i,s,t-1} + \beta\%\Delta M_{i,s,t} + \alpha + u_{i,s,t}$$

Where:

- $\%\Delta P_{i,s,t}$ is the quarterly change in price for service i in state s during quarter t
- $\%\Delta M_{i,s,t}$ is the quarterly change in MAR for service i in state s during quarter t
- $\%\Delta M_{i,s,t}$ is assumed to be exogeneous
- The errors $u_{i,s,t}$ are assumed to be identically and normally distributed, but may be autocorrelated within a given service and state

Data Sample

State (s)	Service Quarter (t)	Code (i)	Description	Percent Change in Average Payment from Prior Quarter $(\%\Delta P_{i,s,t})$	Percent Change in MAR from Prior Quarter $(\%\Delta M_{i,s,t})$
TX	2	0615	LEVEL 4 TYPE A EMERGENCY DEPARTMENT VISITS	-0.8%	0.0%
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Model Results

Model structure:

$$\%\Delta P_{i,s,t} = \gamma\%\Delta P_{i,s,t-1} + \beta\%\Delta M_{i,s,t} + \alpha + u_{i,s,t}$$

Coefficient	Variable	Fitted Coefficient Value	Standard Error
γ	$\%\Delta P_{i,s,t-1}$	-0.1058	0.0187**
β	$\%\Delta M_{i,s,t}$	0.7501	0.0326**
α	$constant$	0.0013	0.0006**

** Statistically significant at the 1% confidence level

Hypothetical Example

Hypothetical example: Level 3 Musculoskeletal Procedures in State X increased in price by **+2%** *last* quarter, and the MAR *this* quarter increased **+5%**. Based on our model:

$$\%\Delta P_{i,s,t} = \gamma \%\Delta P_{i,s,t-1} + \beta \%\Delta M_{i,s,t} + \alpha + u_{i,s,t}$$

The change in price for <u>this</u> quarter is expected to be:

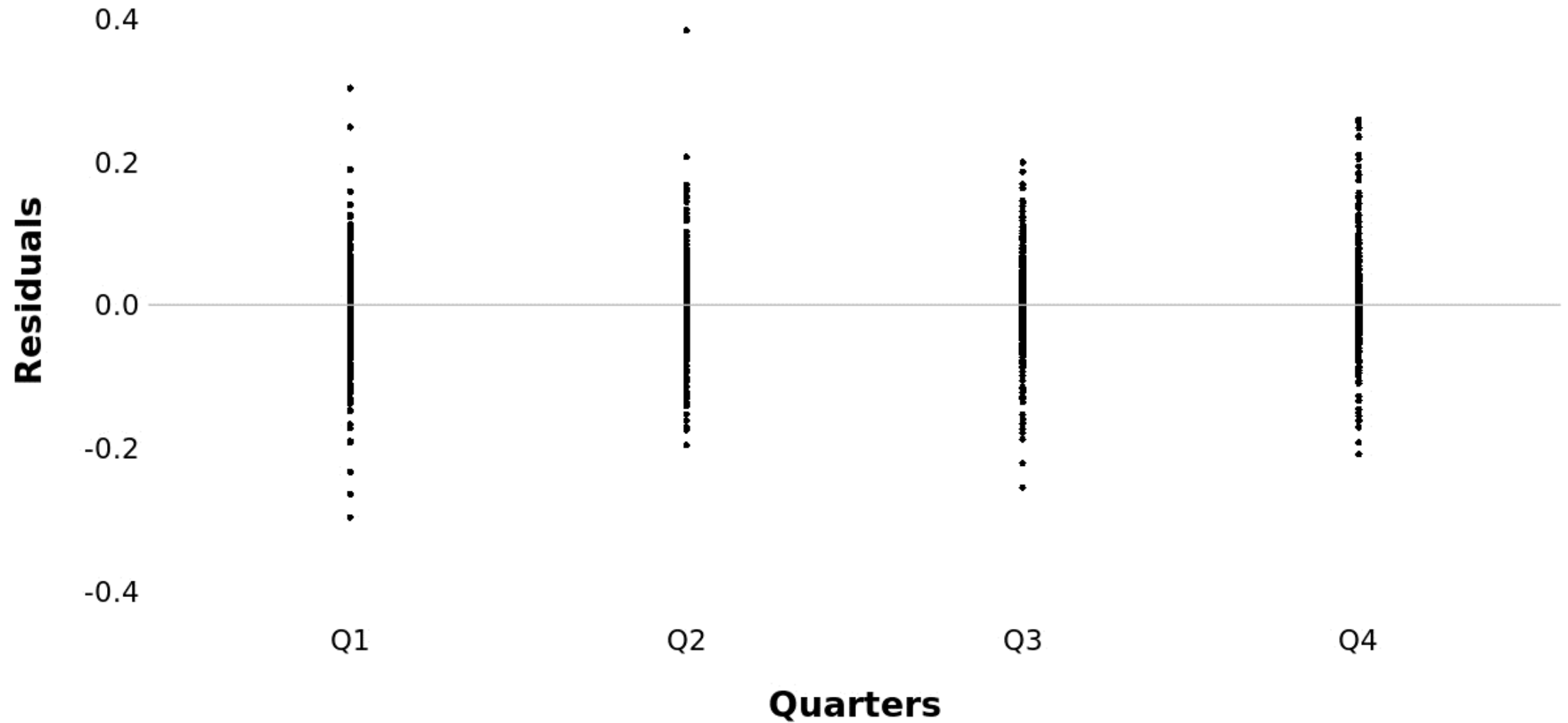$$+\mathbf{3.7}\% \ (= -.1058 \times \mathbf{2}\% + .7501 \times \mathbf{5}\% + .0013)$$

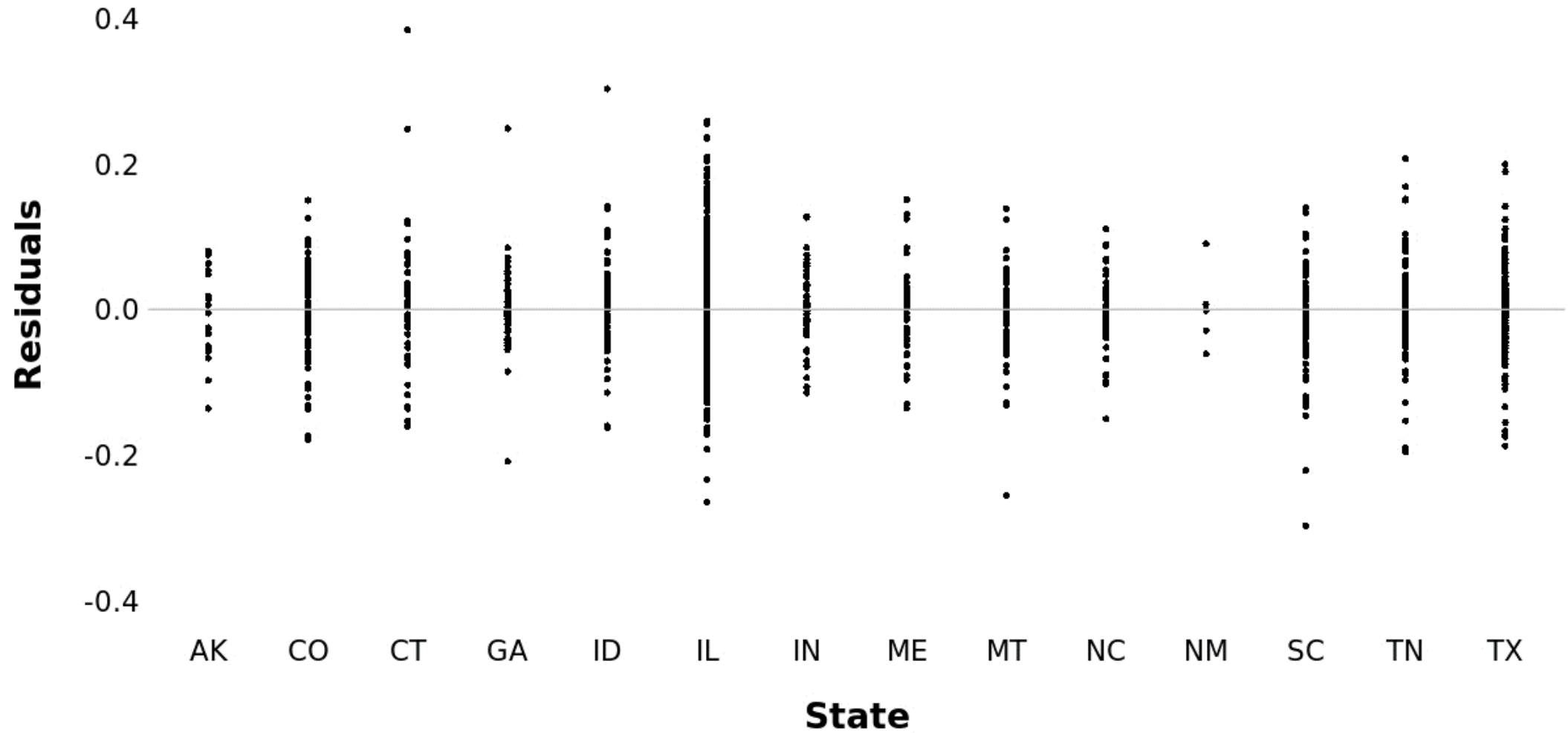# Model Testing and Performance

What About…?

- Model puts a premium on simplicity

- So, the model could be vulnerable to, for example:
  - Seasonality
  - Differences by state
  - Differences by payment volume
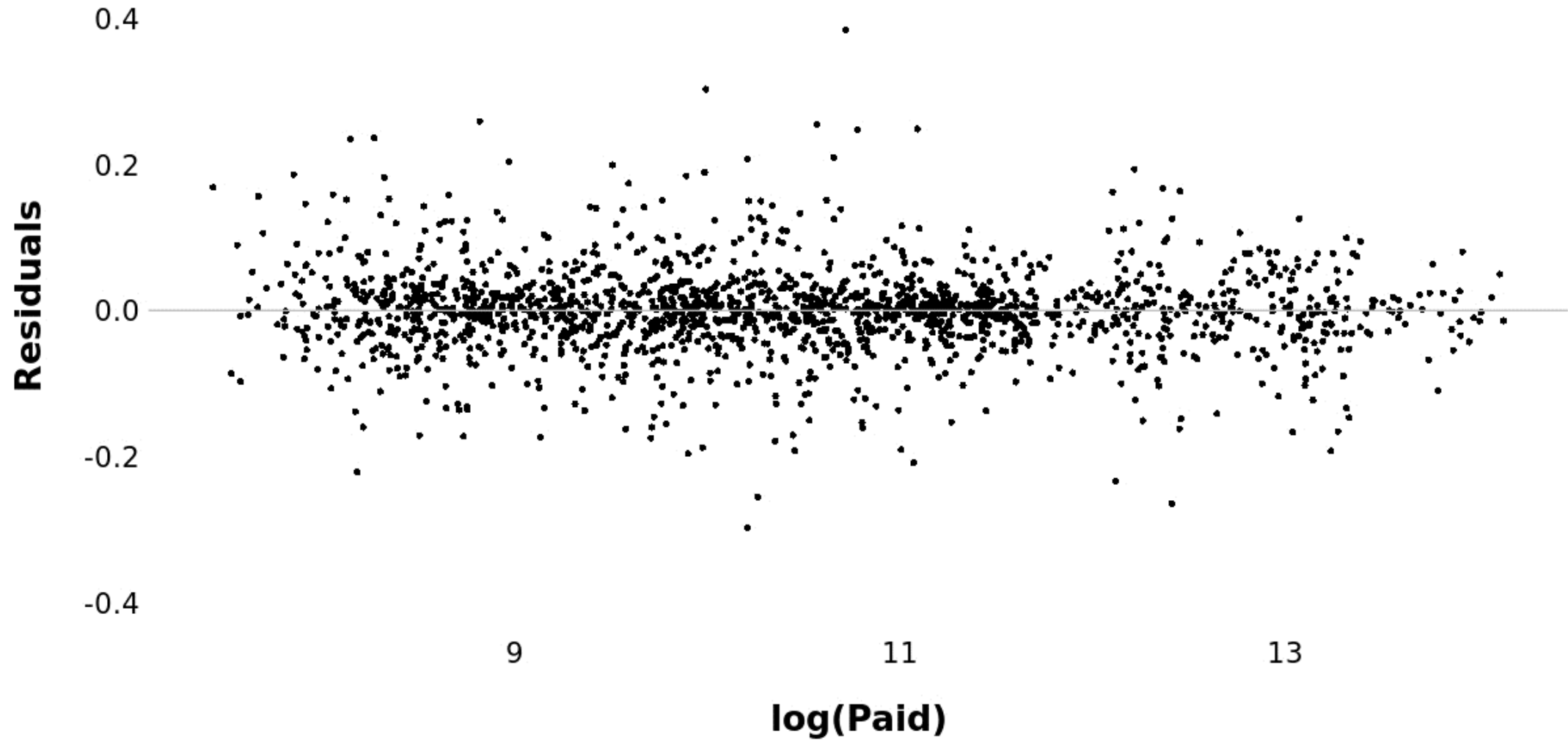 - Changing parameters over time
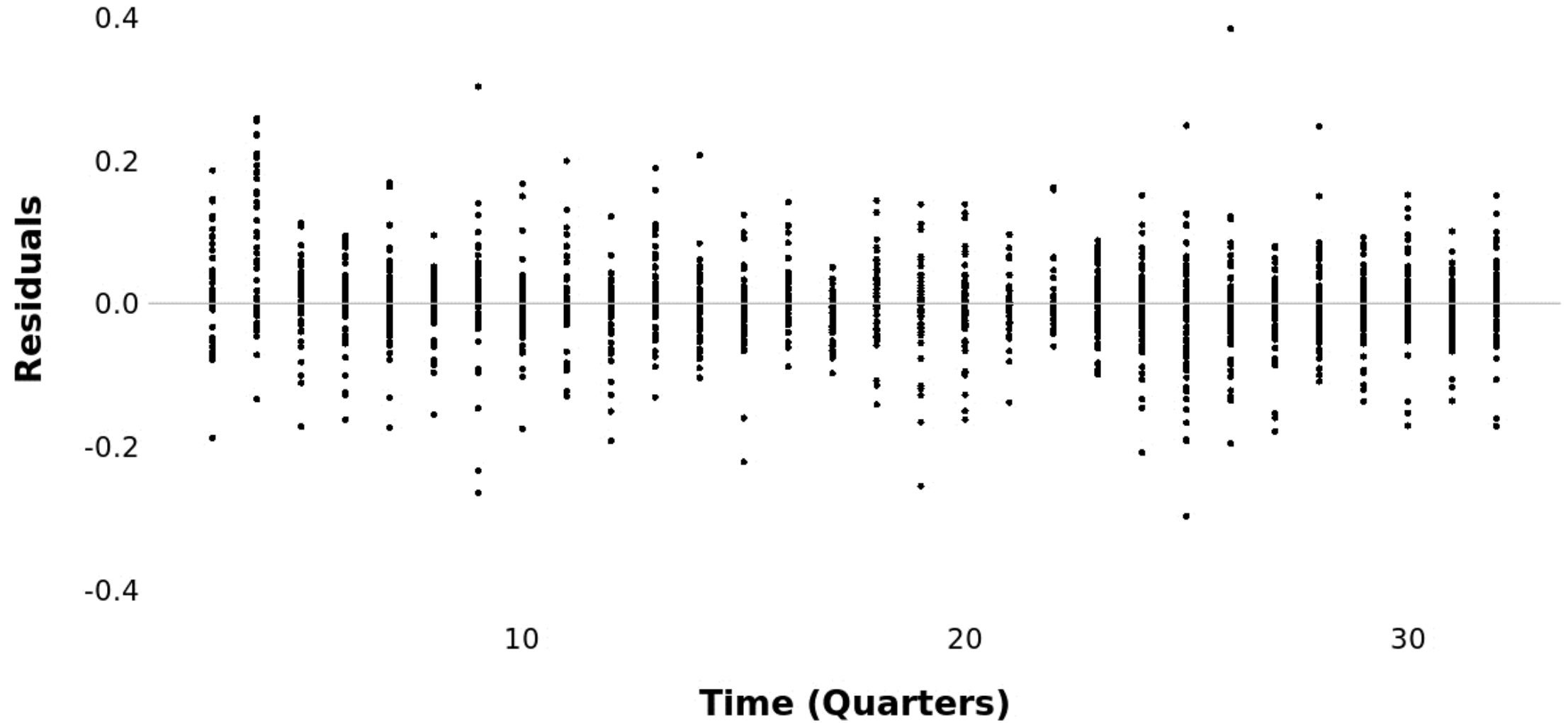 - Etc.

Residuals by Quarter

Residuals By State

Residuals by Payment Volume

Residuals Over Time

Out-of-Sample Testing

- Model was tested on out-of-sample holdout data

- Price per unit of service was estimated for each code/state/service quarter (all prices indexed to a starting value of 1.00 for comparability)

- Two points of comparison:

  - Is there a strong correlation between predicted and actual prices?

  - Does the proposed model outperform a model without fee schedule updates (i.e. MAR changes)?

Holdout Sample Testing – Actual v. Predicted

Holdout Sample Testing—Model Comparison

We calculated mean squared errors for price prediction for our model and two simpler versions:

- Price inflation only

- Price inflation and autocorrelation (lag)

Model Includes:	Mean Square Error
Inflation Only	0.80%
Inflation and Lag	0.79%
Inflation, Lag, and MAR Changes	0.41%

Conclusion

- Medical costs are the largest driver of WC losses

- Fee schedules are an important medical cost management tool

- NCCI modeled the response of hospital outpatient reimbursements to fee schedule changes

- Modeling work used a panel vector autoregression

- Modeling indicates that a 10% change in a WC outpatient fee schedule MAR changes prices paid by approximately **7.5%**