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Macroeconomic Trend Forecasting Model

Joint Meeting of
The Actuaries Club of the Southwest
and
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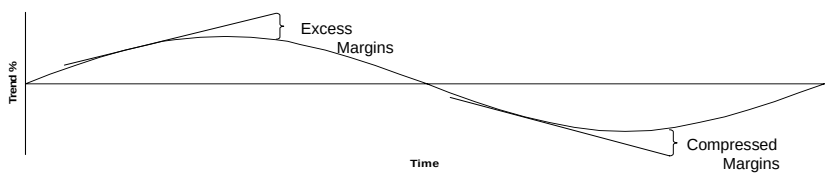
Background

- Typical regression-based models miss key inflection points in trend curve
- Significant contributor to past underwriting cycles
- Better understanding of detailed components and drivers of trend has helped
- Need to better predict inflection points in trend curve led to development of economic-based forecasting model keying on leading relationship between changes in general economy and changes in health care costs



Which variables to model?

Relationship between economic forces and health care trends

- Published studies have shown that changes in personal disposable income (PDI) lead health care trends by two to four years
  - CMS, Projections of National Health Expenditures: Methodology and Model Specifications, 2/21/2006
  - Forecasting Health Expenditures: Short, Medium and Long Term, Thomas E. Getzen, *Journal of Health Care Finance*, 12/7/1999
- Used National Health Expenditures (NHE) and the health care components of Personal Consumption Expenditures (PCE) as our measure of health care costs

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Which variables to model?

Relationship between economic forces and health care trends

- Employment changes and general economic conditions (GDP) also have a leading relationship with health care costs
- Our modeling based on combined PDI, GDP and Employment produced more accurate results than models based on any one of the single input variables

	MSE	Correlation
Combined Model	0.003%	n/a
PDI Model (3 yr. lag)	0.011%	39%
GDP Model (3 yr. lag)	0.010%	22%
Employment Model (3 yr. lag)	0.010%	44%

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Why a 3-Year (+/-) Lag?

- Significant time can pass between earnings growth and benefit changes
- Additional delays occur between decision to increase benefits and next renewal and open enrollment dates
- As benefit increases work through the system, demand for health care increases, placing upward pressure on costs

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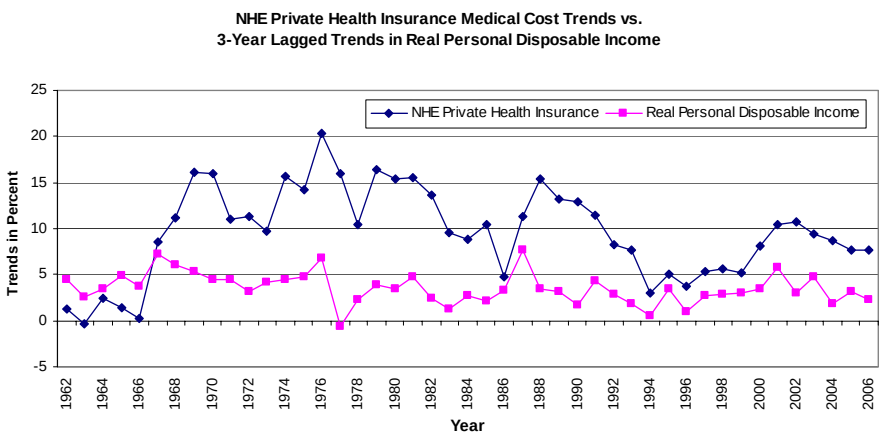
Historical Relationship between Lagged PDI and Health Care Costs



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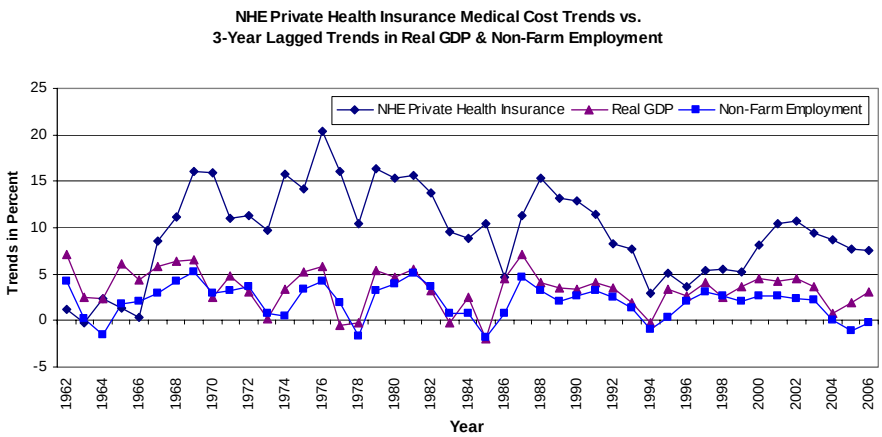
Historical Relationship between Lagged Real GDP, Non-Farm Employment and Health Care Costs



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Development of the Model

- Utilized vector auto-regression (VAR) statistical model
  - VAR is extension of Box-Jenkins class of time series models (autoregressive, moving average, ARIMA models) which perform better in forecasting compared to regression models
  - VAR effectively blends recent innovations in statistics with accepted economic theories
  - VAR models are relied on by the Federal Reserve to develop economic forecasts in support of monetary policy decisions
- Several variables were tested to arrive at real PDI, real GDP and non-farm employment as most predictive of NHE
- Primary goal of economic-based model is to project future direction of trend changes and anticipate inflection points, not to pinpoint trend magnitude

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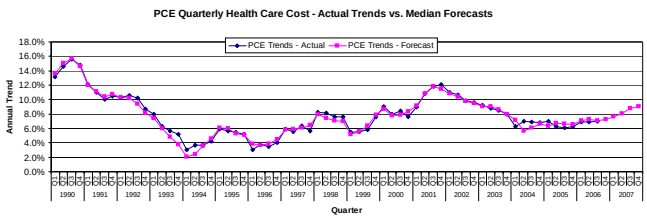
Results of Macroeconomic Forecasts



- Testing the model from 1990-2006 produces the following results:

Projection Period	Percent Directional Agreement	% of Forecasts within 50 bps	% of Forecasts within 100 bps	Std. Error Forecast vs. Actual
One Quarter	81.8%	68.7%	94.0%	0.51%
Quarters 1-4	90.5%	82.8%	98.4%	0.32%
Quarters 3-6	88.7%	79.0%	98.4%	0.32%
Quarters 5-8	93.3%	80.0%	98.3%	0.35%

- In the 2 years R&A has applied this model, directional accuracy one quarter ahead has been 100%

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Future Enhancements to Model

- Demographic adjustments to NHE / PCE
- Work / calendar day adjustments
- Isolate core unit cost changes (medical CPI) from utilization and mix of services
- Medicare / Medicaid populations (?)

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Necessary, But Not Sufficient

- Economic trend model is a supplemental tool to provide insight into pressures affecting future direction of trend
- It is an imperfect tool:
  - Based on government data – requires numerous adjustments and assumptions to get to a reasonable proxy to private commercial per capita costs
  - Economic relationships, while statistically meaningful and supported by anecdotal reasoning, cannot currently be supported by direct cause-and-effect relationships
- Any individual insurer's experience WILL differ from NHE/PCE results, due to differences in geography, demographics, products, contracting, etc.
  - Economic modeling is no replacement for detailed, component-driven trend analysis
- Recognizing these limitations, economic modeling can be a useful directional indicator for guiding future trend assumptions, and to date has proven more effective than simple regression-based forecasts

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