Using Time Series Analysis to Explain Prescription Drug Utilization Trends Among Beneficiaries with Private Insurance

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Express Scripts Overview

- Pharmacy benefit manager covering approximately 100 million members
- Respected and recognized
  - Combined behavioral science and clinical specialization to develop meaningful solutions to major healthcare challenges

Key corporate facts
- Revenue of $93 billion
- Market cap: more than $45 billion
- 30,000 employees
- Manage 1.4 billion prescriptions
- Trusted by 3,500 clients

At Express Scripts, we work to make the use of prescription drugs safer and more affordable
Today’s Agenda

- Problem Statement
- Time Series Data
  - Dependent
  - Explanatory
- Modeling Methodology
- Results
- Conclusions
- Discussion
Problem Statement:

- The rate of Per Member Per Year (PMPY) utilization is slowing down.
- In the past 6 years, Y/Y utilization growth has decreased in 50% of those years.
- Why would a population who
  A. has coverage;
  B. is experiencing a growing prevalence of obesity and diabetes and other chronic diseases; and
  C. has an increased selection of lower cost generic therapies not be increasing utilization of prescription drugs?
Recent Headlines

- “Health Care Cost Growth May Be Slowing Long-Term, New Studies Show” Forbes, May 7, 2013
- Health care spending growth is at a record low. Here's the catch. CNN. April 29, 2013
PMPY Utilization 1997-2012
Possible Explanations for Slowdown in Growth

- Economic conditions affecting household income and wealth
  - Housing crisis
  - Recession
- Benefit Design
  - Higher cost share for beneficiaries for premiums, copayments, and deductibles
  - Fewer office visits mean fewer prescriptions
- Changes in Promotion
  - Lower DTC spend due to loss of patent protection
- Demographics
Drivers of Utilization versus PMPY Growth
Possible Explanatory Variables?

Housing Price Index and Office Visits
Seas. Adj. House Price Index
Office Visits/100 Persons excl Well Baby
% Change in PMPY Utilization


-5.0% 0.0% 5.0% 10.0% 15.0% 20.0% 25.0%
Could DTC Spend be a factor?
Time Series Regression

- Controlling for auto-correlation
  - First order autoregressive term used
  - Limited number of observations (15 with 12 Degrees of Freedom)
- De-trending for stationarity
  - Differenced dependent variable and explanatory variable
  - Percent of Full-Time Employees in Unions utilized as time trend
  - Union membership highly co-linear with time trend but more significant
- Regime switches
  - Considered but not utilized
Final Explanatory Variables

[Graph showing trends in PMPY Growth, % of FT Employees in Unions, and Baby Boomers Turning 50 (Log) from 1997 to 2012.]

- PMPY Growth
- % of FT Employees in Unions
- Baby Boomers Turning 50 (Log)
Explanatory Variables

- Percentage of Full-Time Employees in Labor Unions (from Bureau of Labor Statistics)
  - Labor unions have traditionally negotiated for zero cost health care for their members
  - Non-labor employees in the same company tend to get benefits that closely match the union employees
- First difference of the log of the number of Baby Boomers turning 50 each year (99% of actual births to allow for deaths)
  - 50 is a “milestone” age in which chronic conditions begin to be diagnosed due to recommended screenings.
- One period lag of the dependent variable: first difference of PMPY utilization
Final Form of Model

First Difference in PMPY Rx/Percent of FT Employees in Unions
First Difference of Log of Baby Boomers Turning 50
DifBB50  PMPYDif  UnionFT
Actual Parameter Estimates

\[ \text{PMPYdif} = \text{difbb50 unionft} \]

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The AUTOREG Procedure

Maximum Likelihood Estimates

| Variable          | DF | Estimate | Std Error | t Value | Pr > |t| |
|-------------------|----|----------|-----------|---------|-------|---|
| Intercept         | 1  | -3.9598  | 0.9192    | -4.31   | 0.0012|
| difbb50           | 1  | 18.8865  | 3.2619    | 5.79    | 0.0001|
| UnionFT           | 1  | 0.3106   | 0.0656    | 4.73    | 0.0006|
| AR1               | 1  | 0.7474   | 0.1940    | 3.85    | 0.0027|

Autoregressive parameters assumed given

| Variable          | DF | Estimate | Std Error | t Value | Pr > |t| |
|-------------------|----|----------|-----------|---------|-------|---|
| Intercept         | 1  | -3.9598  | 0.9153    | -4.33   | 0.0012|
| difbb50           | 1  | 18.8865  | 3.2619    | 5.79    | 0.0001|
| UnionFT           | 1  | 0.3106   | 0.0654    | 4.75    | 0.0006|
Utilization Model Equation

\[ PMPY_y - PMPY_{y-1} = -3.9598 + 18.8865 \times (\log(BB50)_y - \log(BB50)_{y-1} + 0.3106 \times \text{UnionFT} + 0.7474 \times (PMPY_y - PMPY_{y-1})_{t-1} \]

PMPY = Rxs per Member per Year
BB50 = Number of Baby Boomers turning age 50
UnionFT = Percent of FT Employees in Unions
Demographic “Roller Coaster”

Births (1932-2011)

- Baby Boom (1946-1964)
- Baby Bust (1965-1974)
- 2007 Largest number of births

Births Log

0 500,000 1,000,000 1,500,000 2,000,000 2,500,000 3,000,000 3,500,000 4,000,000 4,500,000 5,000,000

Conclusions

- We believe the slowdown in growth of prescription drug utilization in the privately insured population can be explained by two major factors:
  - Demographic shift: the aging out of Baby Boomers into Medicare and the lack of similar numbers of Baby Bust generation to take their place.
  - General erosion of benefits as employees must assume a greater proportion of their health care costs.
    - Global competition
    - Shift to Service Economy from Manufacturing
Discussion

- Other explanatory variables might have given the same results except that obtaining annual consistent time series for the same period is difficult.

- Labor Unions were unique in their negotiating ability to negotiate zero cost healthcare and their declining popularity may indicate changing sentiments towards cost-sharing.

- A mini-baby-boom occurred in 2007 with the largest number of births on record. That cohort will reach age 50 in 2057!
References


Thank You