1. What is MMx Modeling
   1. Intro
   2. How promotions work
   3. Typical list of HCP and HCC channels along with one-line explanations (2 or 3 slides)
   4. Talk about sensitivity
   5. Organization of training
2. Data Extraction (Sarath)
   1. Talk about dependent vars NRx or NBS, TRx, Vials / shipped, Doses sold / shipped
   2. Talk about independent variables – promotions etc. MMix model picture may help.
   3. Data Lake, Database / Tables, Extraction of data (Belsomra)
3. Data Exploration (Senthil)
   1. Variable summary, understanding distribution and missing data
   2. Comparing spends vs promotional activities
   3. Trends of sales vs promotions
4. Data Transformations (Sarath)
   1. Adstocks 🡪 concepts, assumptions
   2. Variable Transformations for modeling 🡪 concepts with formula where needed
      1. Linear, Polynomial, Log, Sqrt, Power, S Curve, Spines, Others like Negative Binomial.
5. Correlation (Senthil / Sarath)
   1. Correlations and multi-collinearity
      1. Concepts, Issues with multi collinearity
      2. Belsomra example
6. Model – Part1 (Senthil)
   1. Koyck Structure with one variable (say Details)
      1. Model form (Yt = a\*Y(t-1) + b\*Dt + e)
      2. Derivation of short term vs. long term impacts
         1. Beta vs beta/(1-alpha)
         2. Merck’s practice & Expected values of alpha
      3. Show graph of Year 1 to Year N contributions
      4. Practical aspects – launch vs mature life cycle alphas
   2. Introduce OLS Model Structure (similar to Paul Allison)
      1. OLS Model Structure
      2. Talk about residuals & N(IID) assumptions
      3. Deviations from Distribution Assumptions
         1. Poisson Regression
         2. Negative Binomial Regression
         3. Data transformations help – In general estimates are forgiving to distributional changes
      4. Deviations from Independence Assumptions
         1. Multi collinearity
         2. Lagged variables independence violation on Residuals
            1. ARIMA
      5. Dealing with Multicollinearity
         1. Bias introduction in estimates
         2. Principal Components – Concepts, Code Usage (Princomp)
         3. Ridge regression
            1. Concepts
            2. Bias
            3. Code run
            4. Explain Output
         4. Step Models
      6. Dealing with Error Dependencies
         1. Robust standard errors
         2. Mixed Effects models with Correlation Structures (just some intro as this is an ocean and details for another day)
      7. Belsomra Example
         1. Standard OLS, Ridge, Step Model (G9 here)
7. Model – Part 2 (Senthil/ Sarath)
   1. Outlier detection and elimination
      1. Std. Dev, Cooks D, variable beta-hats
   2. Parametric, Semi-Parametric, Non-Parametric Models
      1. Spline through GAM
      2. Splines through Loess
   3. Discussion on shapes of response curves
      1. Show example output of shapes from practical data
      2. Why log transformation is not ideal
      3. Advantages of Polynomial and Power Curves
8. Model – Part 3 – Longitudinal (or Panel) Data Analysis (Senthil)
   1. Paul Allison Chapter 2 Run through with Nasonex Example (both theory and output)
   2. Talk about strong preference for Fixed Effects model
   3. Discussions from Panel Data analysis Classical Paper applied to Pharma
9. Computing ROIs (Sarath / Senthil)
   1. 3 year NPV vs PGM per dose
   2. Excel Outputs with Formula’s used.
10. Practice Sessions (Belsomra Data) (Senthil / Sarath)
    1. OLS, Robust std err – code pieces, outputs, questions
    2. Random Effects & Mixed Effects – code pieces, outputs
    3. Fixed effects and Hybrid Methods – code pieces
    4. Step Models – Code pieces
11. Brand Complete Walk Through (G9 Adult) (Sarath / Senthil)
    1. Data Extraction walk through (code, data table)
    2. Data Exploration walk through (univariate, correlation – Excel outputs)
    3. Modeling
       1. Code (SAS)
       2. Output (Excel)
    4. Presentation
       1. HCP
       2. HCC
12. A
13. A
14. A
15. A

References:

Fixed Effects Regression Methods Using SAS by Paul Allison Link:

<https://statisticalhorizons.com/wp-content/uploads/FixedEffects_PaulAllison.pdf>

Mizik and Jacobson Paper Link:

<https://www0.gsb.columbia.edu/mygsb/faculty/research/pubfiles/1079/Mizik_are_physicians_easy_marks.pdf>

Outlier Detection Materials:

Mixed Models: <https://support.sas.com/resources/papers/proceedings/proceedings/sugi29/189-29.pdf>

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Panel Data Analysis – Nasonex Example:

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Refer to all rtf files (step 1 to step 6) 🡪 This formed the basis of the Nasonex diagnostics folder.

Nasonex Fixed Effects Model Slides:

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