A Reference Class Forecasting Approach for Pharmaceutical Launches

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# KMK Consulting, Inc.

- **Business Analytics firm** Founded 2000
  - Staff of 80+ employees
  - Offices in Florham Park, NJ

- **Business Analytics / Commercial Operations support** for large, medium, small Pharma and BioTech

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<td>• Sales Analytic Support</td>
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### Information Management and Data Warehousing
- Private Cloud hosted in SAS70 certified type 2 secure data center.
- Data Warehouse Optimized for Analytics
- Information / Data Vendor Management

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Different types of “Casts”

• Forecast: A Statement or estimate of future events based on
  – Some “Analysis” of past and present data.
  – “Personal” Observation/Experience.
• Goalcast (or Goal): Stating that a particular observable and measureable outcome must be achieved within a certain time period, based on want.
• Hopecast: Stating that a particular outcome will occur based on hope.

Based on (human) internal expectations, pressures, or biases in a particular situation, it is not uncommon for one type of “cast” to look like another.
Reference Class Forecasting

• Introduced in 1979 by Daniel Kahneman and Amos Tversky
  – Based on Decisions made under uncertainty (Nobel Prize in Economics 2002).
  – Typical Forecasting takes an “Inside View” which tends to be over-optimistic and biased.
  – Reference Class takes the “Outside View“. “...frame the forecast problem so as to facilitate utilizing all the distributional information that is available.”

• Concept was further discussed in the Business Setting in 2003 by Dan Lovallo and Daniel Kahneman, and in 2008 by Bent Flyvbjerg.

Pre-Launch and Early Launch Forecasting Challenges

• Pre-Launch (Product will be launching soon.)
• Early-Launch (Product has a few months of Actual data.)
• Questions
  – What will the first year’s sales look like?
  – What will the next 5-10 year’s sales look like?
  – What is the Peak share?
  – Are we properly resourced?
Focus for Today (Reference Class Forecasting for Pre-Launch and Early Launch)

- Pre-Launch (Product will be launching soon.)
- Early-Launch (Product has a few months of Actual data.)
- Questions
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  - What is the Peak share?
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If the first year is way off, the next 5-10 and Peak share predictions are pretty useless.
IMS Health: Top Provider of Prescription Data

- Total Prescriptions (TRx’s)
- New Prescriptions (NRx’s)
- Extended Units (Pills, Vials, etc…)
- Dollars
- Brands, Generics, Markets, Product Classes
- Specialties
- National, Physician, Payer/Provider Group Levels, etc.
**Product Monthly Sales Example**

**Product Monthly TRx’s**

*Data Used for Example Only*

Not Actual Rx Data
Calendarization of Monthly Sales

• Each Month’s Sales have different number of
  – Days in Total
  – Weekdays
  – Holidays
  – Business Days (Normal, Light).

• Adjustments need to be made to Monthly data to make an “apples-to-apples” comparison.
Product Monthly Sales Example (Calendarized)

Product Monthly TRx’s*

* Data Used for Example Only
Not Actual Rx Data
Patient-Based Approach

Eligible Population

Sufferers

Prevalence

Seeks Treatment

Does Not Seek Treatment

Treats with Rx

Does not Treat with Rx

Market Share

Uses Product “Y”

Uses Another Product

Compliance/Persistency

Uses Product “Y”

Avg. Annual Days of Therapy

Cost per Day

Annual Revenue

Growth Rates per Year

PROS

➢ Basic Idea is easy to follow, seems intuitive
➢ Fits nicely in spreadsheets (Easy to update)

CONS

➢ Lots of assumptions
➢ Huge variability
➢ Less Reliable
A word about Growth Rates (Expecting x% growth each year)

- Linear Trends do not yield equal growth period-to-period unless growth is flat (i.e. 0).
  - Months 1, 2, 3, 4, 5 → 100, 200, 300, 400, 500 in Sales
  - Growth each period → 100%, 50%, 33%, 25%, etc...
  - Years 1, 2, 3, 4, 5 → 600, 630, 660, 690, 720 in Sales
  - Growth each period → 5.00%, 4.76%, 4.55%, 4.35%
- Expecting similar (positive) growth rates year to year requires
  - Positive exponential growth (upward bend from linear).
Analog Forecasting Approach in Pharma

• Usually refers to a particular brand or brands within the market that the product competes in.
• Product Y is the product of interest to forecast.
• Typically look at Product $X_1$’s and/or Product $X_2$’s Launch.
Reference Class (Pre-Launch/Early Launch)

- Similar conditions
- Product Launches into a market which has had safety concerns.
- Product Launches into a market where a product has been removed from the market.
- Product Launches into a market where the top product in the market has gone generic.
- Seriousness of the disease state (“Lifestyle” drug vs. Life-threatening condition).
- Increasing Market, Declining Market, Flat Market
- Heavy Direct to Consumer (DTC) TV Advertising Market
- Product is a combination product (i.e. mixture of at least two established compounds.)
- Product is a line extension (XR, SR, ER, LA, XL, etc...)
• Things to measure for a Pre-Launch Reference Class
  – What type of share did the (Reference Class) branded product launch attain?
  – Did that product mimic previous branded launches in that class?
  – What was the shape of this product’s TRx’s (uptake).
    • Linear? For how long?
    • Monotonic increasing concave?
    • Generalized Logistic? Bass Curve?
  – How did the competitors fare.
  – Did competitors do pre-emptive increased spending (samples, detailing, DTC).
Product Correlation Reference Class (Early Launch)

• For any early product launch “Y” (4+ months), first correlate these monthly observation with all the brand launches.
• For the brands with the highest correlations, trend out the expected path of product launch “Y”, using those correlated products.*

EXAMPLE (4 months of data)
• Your Product “Y” monthly TRx’s $y_1, y_2, y_3, y_4$
• Highly Correlated Product “X”, monthly TRx’s $x_1, x_2, ..., x_k$
• $\tilde{y}_j = \text{trend}(y_2:y_4, x_2:x_4, x_j)$ $\text{ j=5,..,k}$ (Months 2+ are “full months”)

Exclusions can be made on criteria that clearly falls outside the reference class (e.g. Product is not seasonal, or product does not plan to do TV advertising.)
IMSA Health provides data time aligned from launch for a large number of brands for their product IMS New Product Spectra™.

**IMS New Product Spectra**

Large database of Archived Brand Rx information from IMS Health which can be used as a Reference Class database source.

* Information provided by IMS Health
## Correlated Reference Class Products

### Highest Correlations with Product “Y”

| TRx’s (000’s) | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M |
| Product      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 |
| X1           | 8 | 15| 22| 29| 36| 42| 48| 54| 59| 65| 69| 74| 78| 82| 86| 90| 93| 96| 99| 101|104|106|109|
| X2           | 28| 55| 79|101|121|140|157|173|187|199|211|221|230|238|245|252|257|262|267|271|274|278|281|284|
| X3           | 21| 39| 56| 71| 84| 96|106|115|122|129|134|138|142|145|147|149|151|152|153|154|156|157|159|162|
| X4           | 36| 69|101|131|160|187|212|235|257|277|296|313|329|343|356|367|378|386|394|400|405|408|411|412|
| X5           | 17| 33| 50| 65| 80| 95|109|123|136|148|160|172|182|193|202|211|219|227|234|240|246|250|254|258|
| X6           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

* Data Used for Example Only
Not Actual Rx Data

**ALL OTHER HIGHLY CORRELATED BRANDS IN THE REFERENCE CLASS (TRANSLATED TO THE PRODUCT “Y” SCALE)**
## Correlated Reference Class Products
**Translated to the Product “Y” Scale**

### TRx’s (000’s)

| M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M |
| P | o | o | o | o | o | o | o | o | o | o | o | o | o | o | o | o | o | o | o |
| r | u | d | c | t | h | h | h | h | h | h | h | h | h | h | h | h | h | h | h |
| M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M | M |
| T | r | x |’s | (000’s) | | | | | | | | | | | | | | | | |

| Y | 2 | 8 | 16 | 27 | | | | | | | | | | | | | | | | |
| X1 | 35 | 43 | 51 | 59 | 66 | 73 | 80 | 86 | 92 | 97 | 102 | 107 | 111 | 115 | 119 | 122 | 125 | 128 | 130 | 132 |
| X2 | 34 | 42 | 49 | 55 | 61 | 66 | 70 | 75 | 81 | 84 | 87 | 89 | 91 | 93 | 95 | 96 | 97 | 99 | 100 | |
| X3 | 34 | 41 | 47 | 52 | 56 | 60 | 63 | 66 | 68 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 80 | |
| X4 | 35 | 43 | 50 | 58 | 64 | 70 | 76 | 81 | 86 | 90 | 94 | 97 | 100 | 103 | 105 | 107 | 109 | 110 | 111 | |
| X5 | 35 | 44 | 52 | 60 | 68 | 76 | 83 | 89 | 96 | 102 | 107 | 113 | 118 | 122 | 126 | 130 | 133 | 136 | 138 | 140 |
| X6 | ALL OTHER HIGHLY CORRELATED BRANDS IN THE REFERENCE CLASS (TRANSLATED TO THE PRODUCT “Y” SCALE) | | | | | | | | | | | | | | | | | | | | |

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Example of Correlation Reference Class

Product X5 had a high DTC-TV Spend in Year 1.

X1-X5 $\in$ “Correlation” Reference Class

* Data Used for Example Only
Not Actual Rx Data
Example of Correlation Reference Class

While the number of actual monthly obs. is very small, Linear trend falls far outside the Reference Class.

X1-X5 ∈ “Correlation” Reference Class

* Data Used for Example Only
Not Actual Rx Data
Correlation Reference Class

- As more points become available the Reference class upper and lower trajectories become a bit tighter.
- Usually performs better than curve fitting (linear, log, log-linear, power functions) and time-series models.
- Outperforms Patient-Based Approach.
Promotional “Audits”

• There is also third party (estimated) information on Brand Spending
  – Sales Force Spending
    • Contacts, Details
    • Sampling
  – Direct to Consumer Spending
    • Advertising Dollars
• Data Providers: IMS Health, Encuity Research (SDI data)
Use of Promotional Audit Data

- Sales Force Resourcing
  - What was the detailing effort as a function of their overall sales?
- Direct to Consumer TV Advertising.
  - Did any of the particular brands have a strong DTC-TV effort.
  - Did they have 100% DTC share of voice?
Impacts of Under and Over Forecasting

• Over-Forecasting
  – Brand and sales teams feel they’re underperforming
  – Constant feeling of urgency (Lots of fire-drills).
  – Sales Goals are not met. Sales Associates have lower payout on their Incentive Plan.
  – Danger of people doing just enough to look busy.
  – Possible over-supply of product. Idle staff at manufacturing plants expecting high demand.

• Under-Forecasting
  – Brand and sales teams feel very confident.
  – Tendency to pull back effort.
  – Sales Goals are exceeded. Associates possibly getting “over-paid”.
  – Possible product shortages due to poorly forecasted demand.
  – Overtime hours at manufacturing plants.
Reference Classes for Key Events

• Large DTC-TV campaigns.
• Generic Erosion (Percent erosion months 1-6).
• Product or Class impacts to key label changes
  – Warnings, Precautions
  – New Indications.
• Positive/Negative study results.
Common Critique of the Reference Class or even simple Product Analog Approach

“Those Products have nothing to do with us.”

“I used to work on that Brand Analog you’re using. I can tell you from first-hand experience that we did things very differently back then.”

“The environment is completely different today. You can’t apply previous results for any product.”

“We have a much stronger team today and that collective experience is a factor you’re not considering.”

“You can’t compare our company to those other company launches. They’re not known for this disease state.”

“Digital media was not as advanced as it is today. On the TV side, more households have cable. There are a lot more patients getting information about these products.”
Summary

- Reference Class Forecasting has been shown in many settings to be much more accurate than other “Inside View” Approaches.
- However its general adoption is not as common as one would expect.
- Gaining experience with reference class approaches that work makes one a much better forecaster (though not everyone might be excited to hear your “Outside View”).