

“La semplicità è la sofisticatezza
finale”



Agenda

- A quick look at the role of empirical generalisation and replication
- Innovative prescribers
 - Who are they

What is an Emp Gen?

- A relationship between two or more variables which is observable across a range of conditions
 - Boyle's Law describes the relationship between pressure and volume of a gas
 - Moore's Law predicts that the number of transistors on an integrated circuit doubles every 2 years
 - Lots in science - few in social science
 - Benford's Law to predict tax evaders
 - Durkheim and the lower suicide rates of catholics compared to protestants
 - Height and weight of children

Replication

- Crucial to development of knowledge
- Arts vs Craft vs Science
- Predictability of results under different conditions leads to generalisability
 - Boyle vs cold fusion

Heights and weights of children

- Eveleth and Tanner Database
 - 200 data sets
 - 40 countries
 - 20 years
- $h = 53 \ln w - 53 \pm 2$
 - boys and girls up to 13
 - girls 14+
 - Indo-Euro vs Afro-Asian boys only

The Dirichlet

Purchase Incidence Assumptions

- Steady as-if-random buying probabilities ('Poisson').
- Smooth distribution of light, medium and heavy buyers ('Gamma').

Brand Choice Assumptions

- A portfolio with steady probabilities ('Multinomial').
- Individuals' buying probabilities follow smooth distributions ('Beta').

Brand choice is independent of purchase incidence

Marketing Illustration

- Double Jeopardy predicted by Dirichlet
 - Slight Extension
 - Toothpaste and Coffee in US
 - Extension over time and place
 - Toothpaste in UK, US, Japan, 1967-90
 - Radical Extensions
 - Durables, Industrial Contracting, Store Patronage, Attitudes, Doctors' Prescribing, Foreign Exchange Purchases, Collaborative Purchasing, Blood Donation, Charitable Giving.

An 'original' finding

Coffee in the USA

	Market Share	% buying		Av. purchase frequency	
		O	D	O	D
Maxwell House	19	24	22	3.6	3.9
Tasters Choice	14	22	21	2.8	2.9
Nescafé	8	13	13	2.9	2.8
Maxim	3	6	6	2.6	2.6

A differentiated replication

Are Sole Buyers Valuable Buyers?

	Average frequency of buying brand		Sole buyers Average frequency	
	O	D	O	D
Robinson's	1.8	1.8	1.7	1.6
Quosh	1.8	1.8	1.9	1.6
Kia-Ora	1.6	1.8	1.4	1.5
R. Barley	1.6	1.7	1.5	1.5

- Sole buyers normally buy a brand at the same or slightly lower rate than an average 'multi-brand' buyer.
- Sole buyers are not valuable marketing targets

A radical differentiated replication

Prozac In 12 weeks	Market Share (%)	Penetration (%)		Average Prescription Frequency	
		O	T	O	T
1997	21	67	66	3.8	3.8
1996	19	66	64	3.6	3.7
1995	17	62	58	3.3	3.5
1994	16	59	54	3.0	3.2
1993	15	50	47	2.9	3.1
1992	11	40	38	2.7	2.9
1991	8	30	27	2.4	2.6
1990	5	18	18	2.5	2.5
1989	1	6	4	1.8	2.4

Innovator Behavior

(Some of) What we Know

- Coleman Katz and Menzel (1957)!!
 - 1 new drug which high socially integrated doctors prescribed 3-4 months earlier than low SI doctors.
- Van den Bulte and Lilien (2001), Manchanda et al (2008), Liu and Gupta (2012) Iyengar et al (2011, 2015) have all utilised social integration in studies of pharmaceutical innovation

Clever, sophisticated and complex

1. The full conditional distribution for β_i is given as

$$p(\beta_i | \beta_0, \gamma, V_\beta, y_{it}, x_{it}) \propto l(\beta_i) * \exp((\beta_i - \beta_0) * V_\beta^{-1} * (\beta_i - \beta_0)'),$$

where $l(\beta_i) = \text{Pr}_{iT} \prod_{t=1}^{T-1} (1 - \text{Pr}_{it})$.

$$\min \left\{ \frac{p(\beta_i^c | \bar{\beta}, V_\beta, y_{it}, x_{it})}{p(\beta_i^{(n-1)} | \bar{\beta}, V_\beta, y_{it}, x_{it})}, 1 \right\},$$

There are three other similarly complex functions in the model

Simple approach

(Some of) What we Know

- Taylor 1977!
 - 11 f.m.c.g. (grocery) categories across a year
 - Compared early and late adopters of new brands
 - Simple relationship between product class usage and innovative behaviour

Innovator Behavior

Data

- Continuous buyers over the 52 weeks before and the year of launch
 - a) Statins
 - b) ARBs
 - c) Cox-2
 - d) SSRIs
 - e) ED
 - f) Osteoporosis

Innovator Behavior

Our Approach

- In this research we adopt a simple approach
 - Measure mean rate of prescribing (any drug in the category) 12 month before launch
 - Compare the mean rate for innovators and non innovators
- *Heavy prescribers of each category in the year before a product launch are more likely to prescribe the new drug in its first year on the market than are light prescribers.*

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Results

Prescribing Ratios

	Brand	Ratio of R(i)/R(n i)	n	i	One tailed Mann- Whitney p- value	One tailed Kolmogorov- Smirnov p- value
Statins	Zocor	2.3	115	35	0.00	0.02
	Lescol	2.0	170	19	0.00	0.01
	Crestor	1.8	304	157	0.00	0.00
	Lipostat	1.7	145	35	0.01	0.07
	Lipitor	1.7	269	152	0.00	0.00
	Lipobay	1.6	269	73	0.01	0.02

For the Statin Category

Innovator Behavior

Results

Variations in $R(i)/R(ni)$ by Category and Time Period*

	3-Month	6-month	9-month	12-month
Statins	2.00	1.91	1.92	1.84
E. Dysfunction	1.22	1.44	1.32	1.44
Depression	1.44	1.41	1.46	1.42
Cox-2 Inhibitors	1.25	1.22	1.37	1.40
Angiotensin RB	1.42	1.40	1.36	1.37
Osteoporosis	1.55	1.45	1.35	1.34
All	1.47	1.46	1.46	1.46

*Geometric Means

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Results

Cox Proportional Hazard Model Results

Drug	Mean Prior Rx Rate	Exp(B)	One tailed <i>p</i> -value <i>Exp(B)</i>	Two tailed <i>p</i> - value change in -2LL	Two tailed <i>p</i> - value interaction with time
Zocor	3	1.119	0.00	0.00	0.91
Lescol	5	1.111	0.00	0.00	0.67
Crestor	18	1.025	0.00	0.00	0.83
Lipostat	4	1.041	0.00	0.04	0.38
Lipitor	8	1.030	0.00	0.00	0.74
Lipobay	8	1.044	0.00	0.00	0.05

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Results

Prescribing Ratios

	Ratio of R(i)/R(ni)	n	i	One tailed Mann- Whitney p- value	One tailed Kolmogorov -Smirnov p- value
Mean	1.46*	244	64	0.04	0.09

* Geometric Mean

For all 36 drugs

Innovator Behavior

All 36 drugs

Results

Cox Proportional Hazard Model Results

Drug	Mean Prior Rx Rate	Exp(B)	One tailed p-value Exp(B)	Two tailed p-value change in -2LL	Two tailed p- value interaction with time
Mean	19.6	1.045*	0.05	0.10	0.55

* Geometric Mean

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Conclusions

- We find confirmation for CK&M and Taylor – heavy buyers are more likely to innovate than lighter buyers.
- We extend previous work in terms of quantifying the difference between $W(i)$ and W .
- Implications for innovation research: look at rate of buying!

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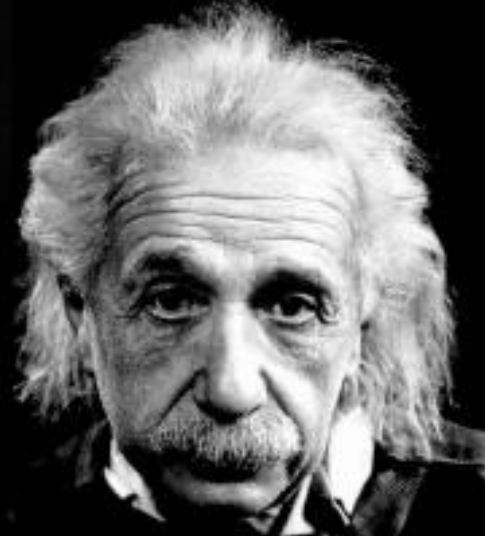
- CK&M still holds 60 years on
- We extend number of drugs examined from 4 to 40
 - Pharmaceuticals in a different country and radically different situation
- Taylor holds in radically different setting



simplicity is the ultimate sophistication

“Everything should be made
as simple as possible,
but not simpler.”

Albert Einstein



“The height of sophistication is simplicity”

Clare Booth Luce -1931

