

## CLASS SCHEDULE

[Each class will have two sessions, First session is from 7-8.20 PM. Short break of 10 minutes and then next session from 8.30-9.50PM]

| Week# |          | Session | Class Schedule           | Read [R] Submit[S]                                     | Session | Class Schedule          | Read [R] Submit[S]               |
|-------|----------|---------|--------------------------|--|---------|-------------------------|----------------------------------|
| 1     |          |         |                          |  |         | Introduction            | None                             |
| 2     | Jan 24   | 1       | Introduction             |  | 2       | New Product Process     | [R] HBS 592011-PDF-ENG           |
| 3     | Jan 31   | 1       | Needs to Design1         | [R] Notes on Teams                                     | 2       | Needs to Design2        | [R] Notes on Teams               |
| 4     | Feb 7    | 1       | Uncovering Needs         | [R] Notes on Teams                                     | 2       | Team Exercise           |                                  |
| 5     | Feb 14   | 1       | Market Sizing 1          | [R] HBS Note 505062-PDF-ENG                            | 2       | Market Sizing 2         | [R] HBS Note 894007-PDF-ENG      |
| 6     | Feb 21   | 1       | Concept Testing          | [R] HBS Note 590063-PDF-ENG<br>[S] Submit Assignment 1 | 2       | Conjoint Analysis       | [R] HBS Note 590059 –PDF-ENG     |
| 7     | Feb 28   | 1       | Simulated Test Marketing | [R] HBS Note 592088-PDF-ENG                            | 2       | Nestle Contadina Case   | [R] HBS Case HBS: 595035-PDF-ENG |
| 8     | March 7  | 1       | Channel Decisions        | [R] Notes on Teams<br>[S] Submit Assignment 2          | 2       | Pricing Decisions       |                                  |
| 9     | March 14 | 1       | HOLIDAY                  |  |         |                         |                                  |
| 10    | March 21 | 1       | Advertising Decisions    | [R] HBS Note 599087-PDF-ENG                            | 2       | Product Launch          | [R] HBS Note 598061-PDF-ENG      |
| 11    | March 28 | 1       | Introducing Brands       | [R] HBS Note 8140-PDF-ENG<br>[S] Submit Assignment 3   | 2       | Brand Equity            | [R] HBS Note 8140-PDF-ENG        |
| 12    | April 4  | 1       | Brand Extensions         | [R] HBS Note 8140-PDF-ENG                              | 2       | Brand Social Media      | [R] HBS Note R1603B-PDF-ENG      |
| 13    | April 11 | 1       | Brand Positioning        | [R] HBS Note 8197-PDF-ENG<br>[S] Submit Assignment 4   | 2       | Exam Review             | [R] Notes on Teams               |
| 14    | April 18 | 1       | Project review           |  | 2       | Product /Brand Mistakes | [R] HBS Note 594127-PDF-ENG      |
| 15    | April 25 | 1       | <b>Exam</b>              | <b>7 PM - 8.20 PM</b>                                  | 2       | Walt Disney Studio Case | HBS Case 516105-PDF-ENG          |
| 16    | May 2    | 1       | Presentation Day         |  | 2       | Presentation Day        |                                  |

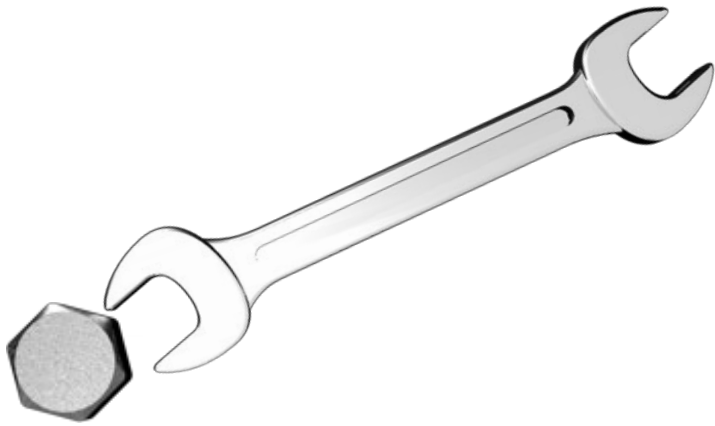
# Market Sizing 1

Prof Narayan Janakiraman

# New Product Proliferation

An 18-Year Comparison of Consumer Packaged  
Goods Product Launches

| Number of Product Launches    | 1980 | 1998 |
|-------------------------------|------|------|
| Cereals                       | 34   | 192  |
| Ice cream, Frozen yogurt      | 57   | 556  |
| Spices, Extracts, Seasonings  | 61   | 403  |
| Deodorizers, Air refresheners | 53   | 372  |
| Paper towels, Napkins         | 11   | 126  |
| Milk, Yogurt drinks           | 26   | 255  |
| Coffee                        | 11   | 384  |
| Beer, Ale                     | 25   | 187  |



**New  
Markets**

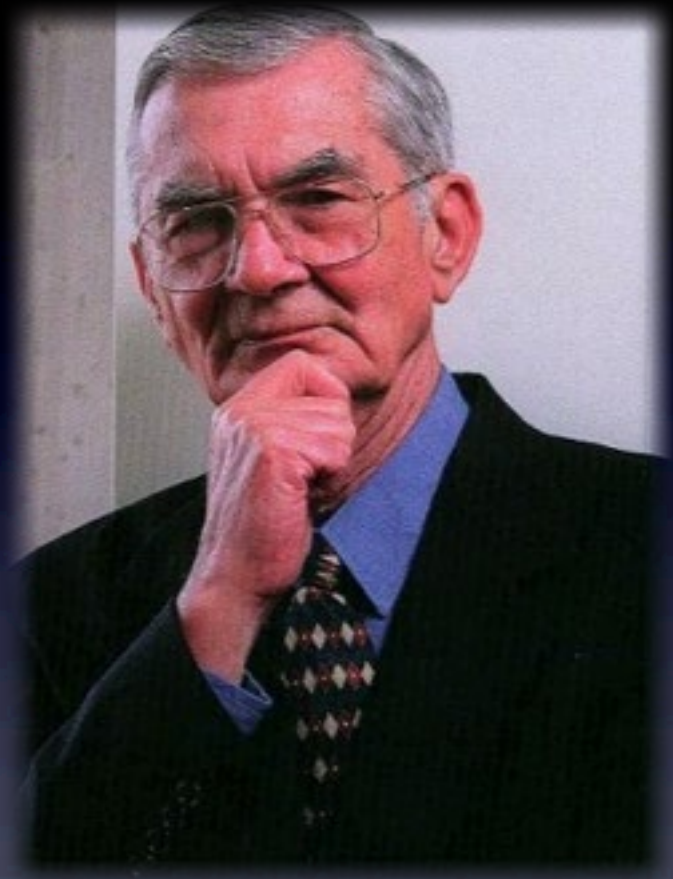
## Bass Diffusion Model

**Existing  
Products**

**New  
Products**

**Time Series  
Regression**

**Existing  
Markets**

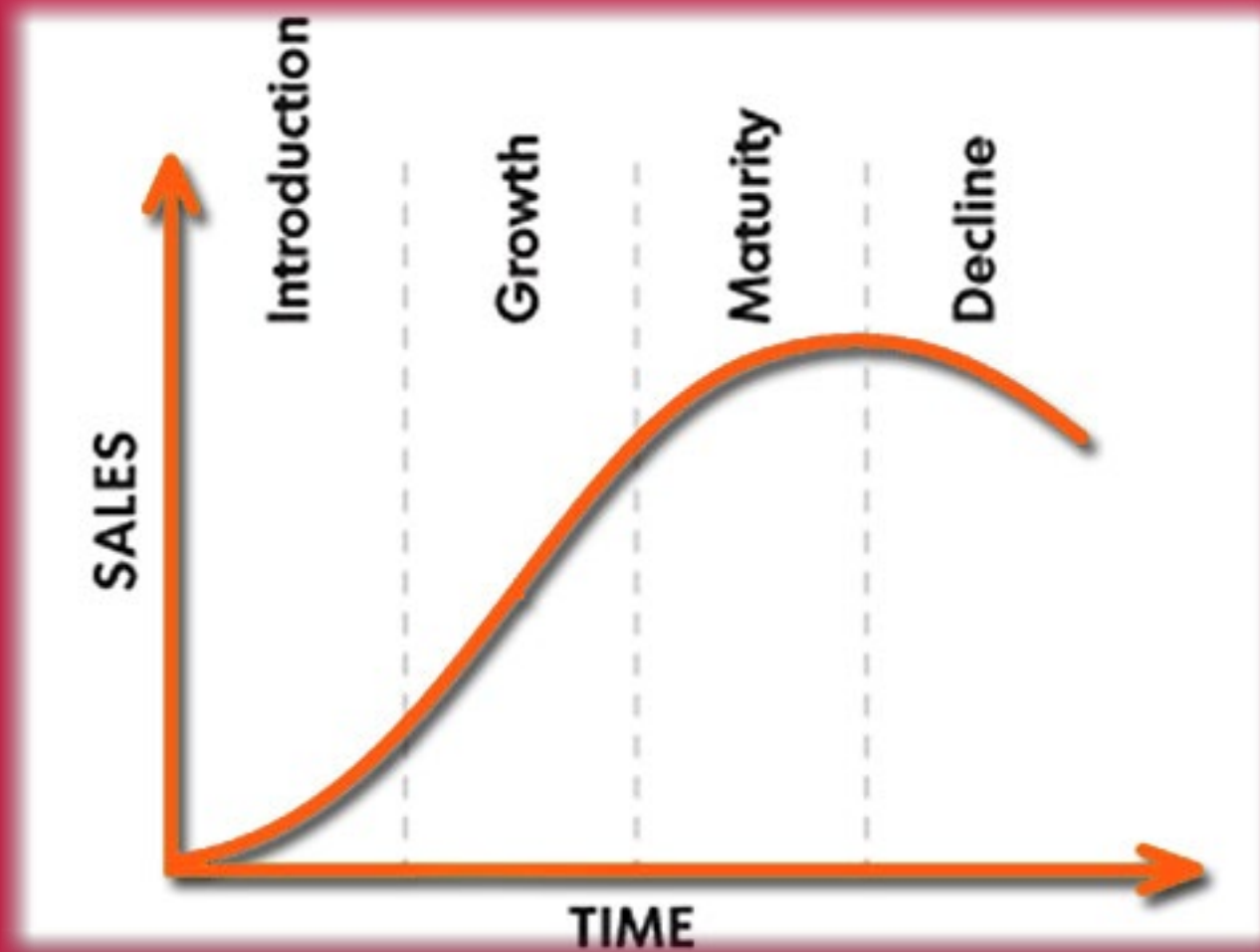


Frank Bass

1926-2006

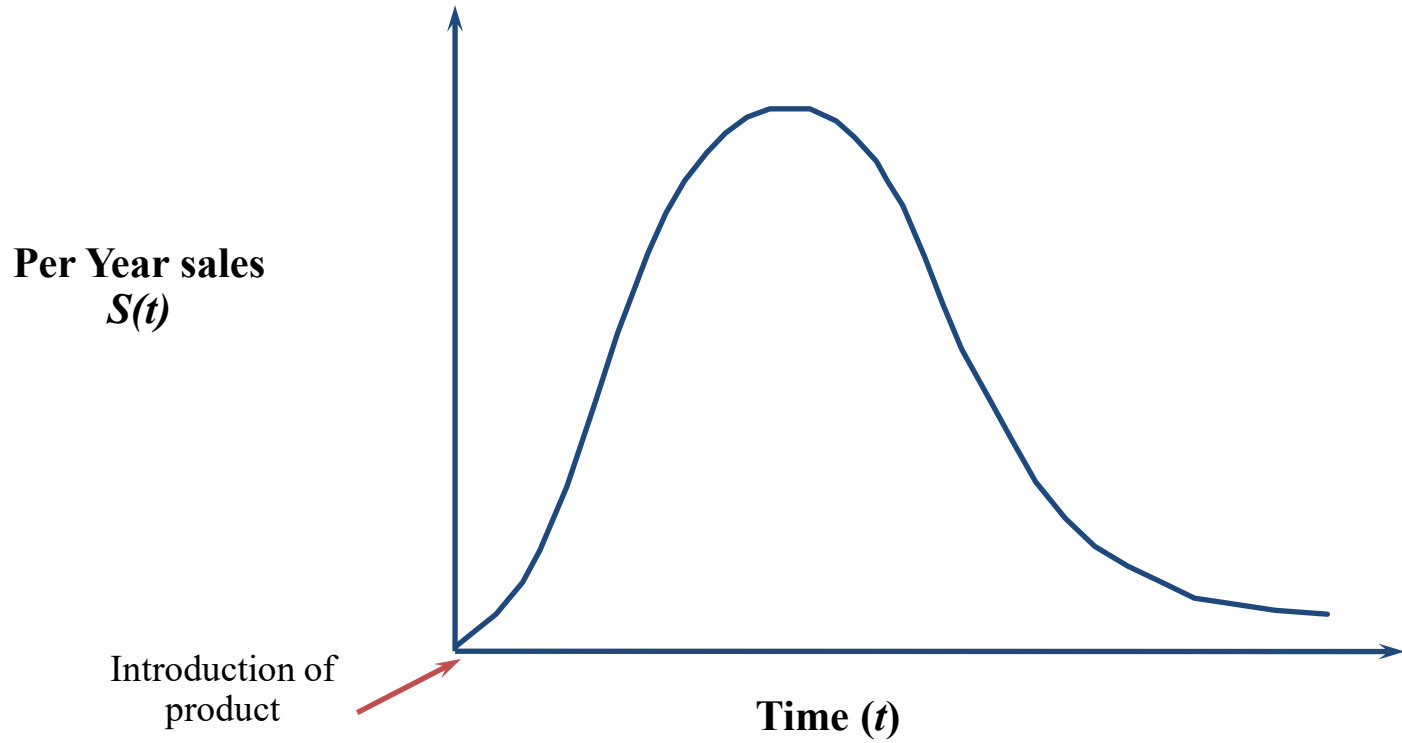
# Basics

What is this? and why is it important?



# SALES

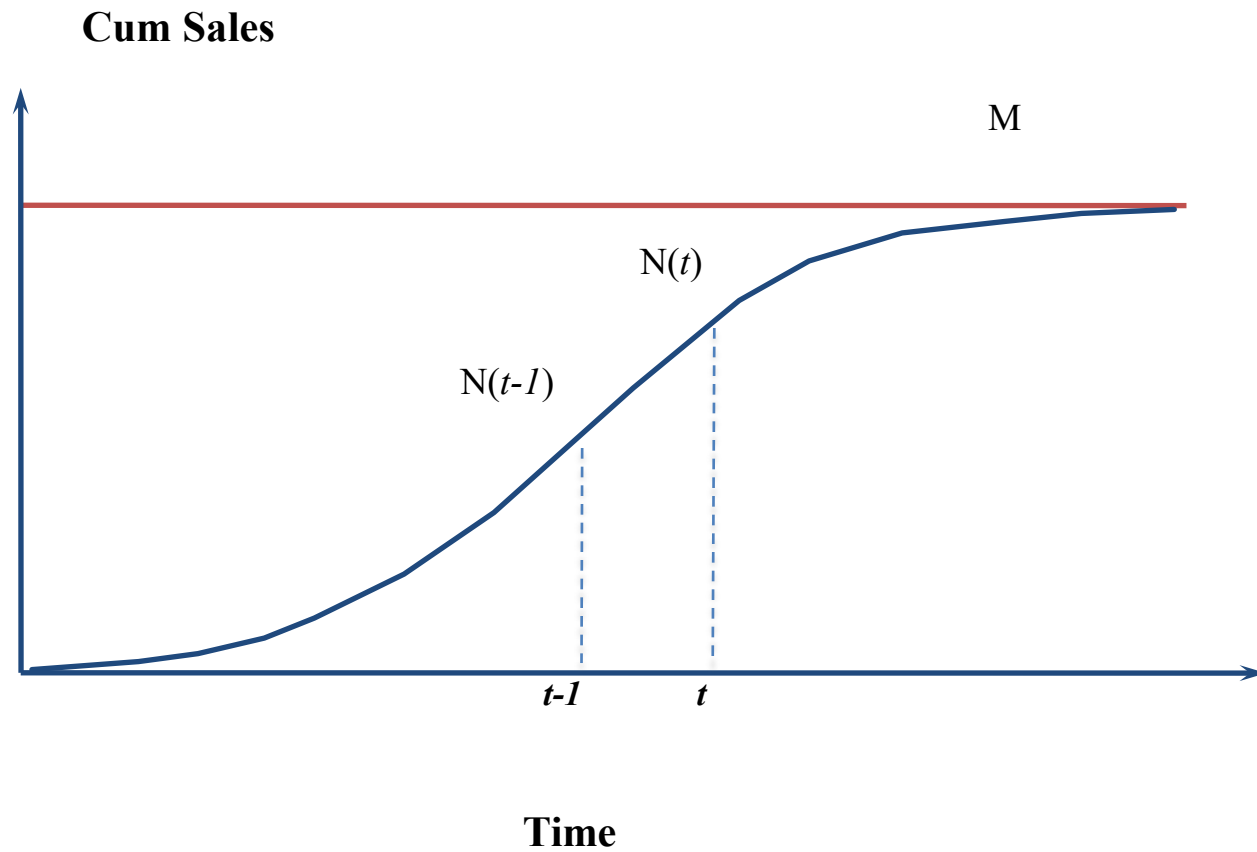
## Bell Shaped Curve





# Cumulative SALES

## S Shaped Curve



SALES = Probability (1)

\*

Remaining  
Consumers(2)



# 1. Probability

Effect of Advertising



p

Effect of Word of Mouth



q

# 1. Probability

Effect of Advertising



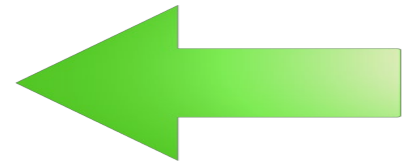
Effect of Word of Mouth



$$p + q * N_{t-1} / M \uparrow$$

## 2. Remaining Consumers

| YEAR     | Sales | Consumers Left  |
|----------|-------|-----------------|
| <b>1</b> | $S_1$ | $M$             |
| <b>2</b> | $S_2$ | $M - S_1$       |
| <b>3</b> | $S_3$ | $M - S_1 - S_2$ |





# SALES

=

Probability

$$\left[ p + q * N_{t-1} / M \right]$$

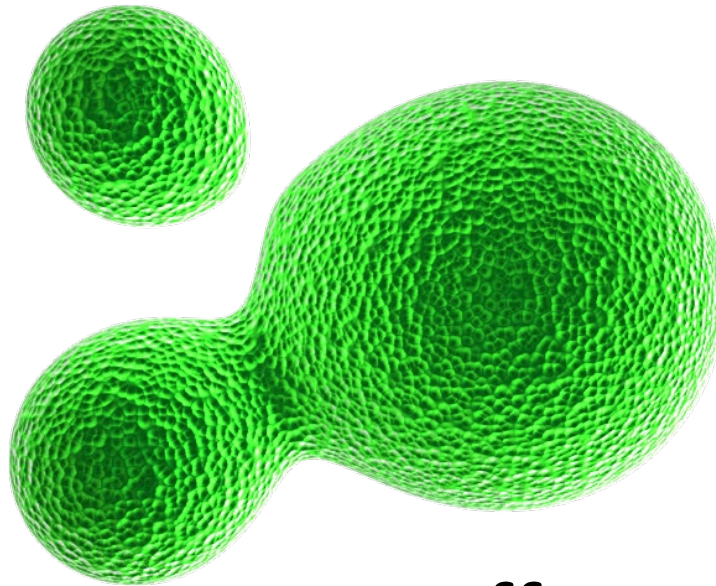
X

$$\left[ M - N_{t-1} \right]$$

Remaining Consumers

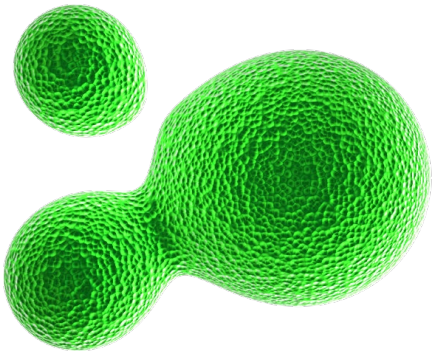


M – Market Potential



p – Effect of Advertising

q – Effect of Word of Mouth



# An example

$M = 30$  million

$p = 0.0112$

$q = 0.5$



# Year 1

$$\begin{aligned} S_1 &= (\text{Prob}) * (\text{Remaining Consumers}) \\ &= [p + q (N_0/M)] * [M - N_0] \\ &= [p + q (0)] * [M - 0] \\ &= [p] * M \\ &= 0.0112 * 30 = 0.336 = 336,000 \text{ consumers} \end{aligned}$$

# Year 2

$$\begin{aligned} S_2 &= (\text{Prob}) * (\text{Remaining Consumers}) \\ &= [p + q (N_1/M)] * [M - N_1] \\ &= [0.0112 + 0.5 * (0.336/30)] * [30 - 0.336] \\ &= 0.498 = 498,000 \text{ consumers} \end{aligned}$$

*Note that 498,000 = 332,237 innovators + 165,763 imitator*

Year 3,4,5....

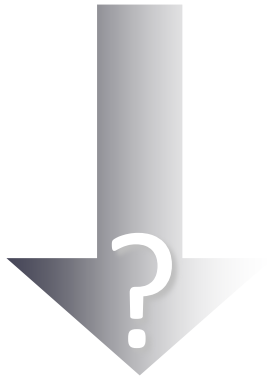
?

$p = 0.01$

$q = 0.5$

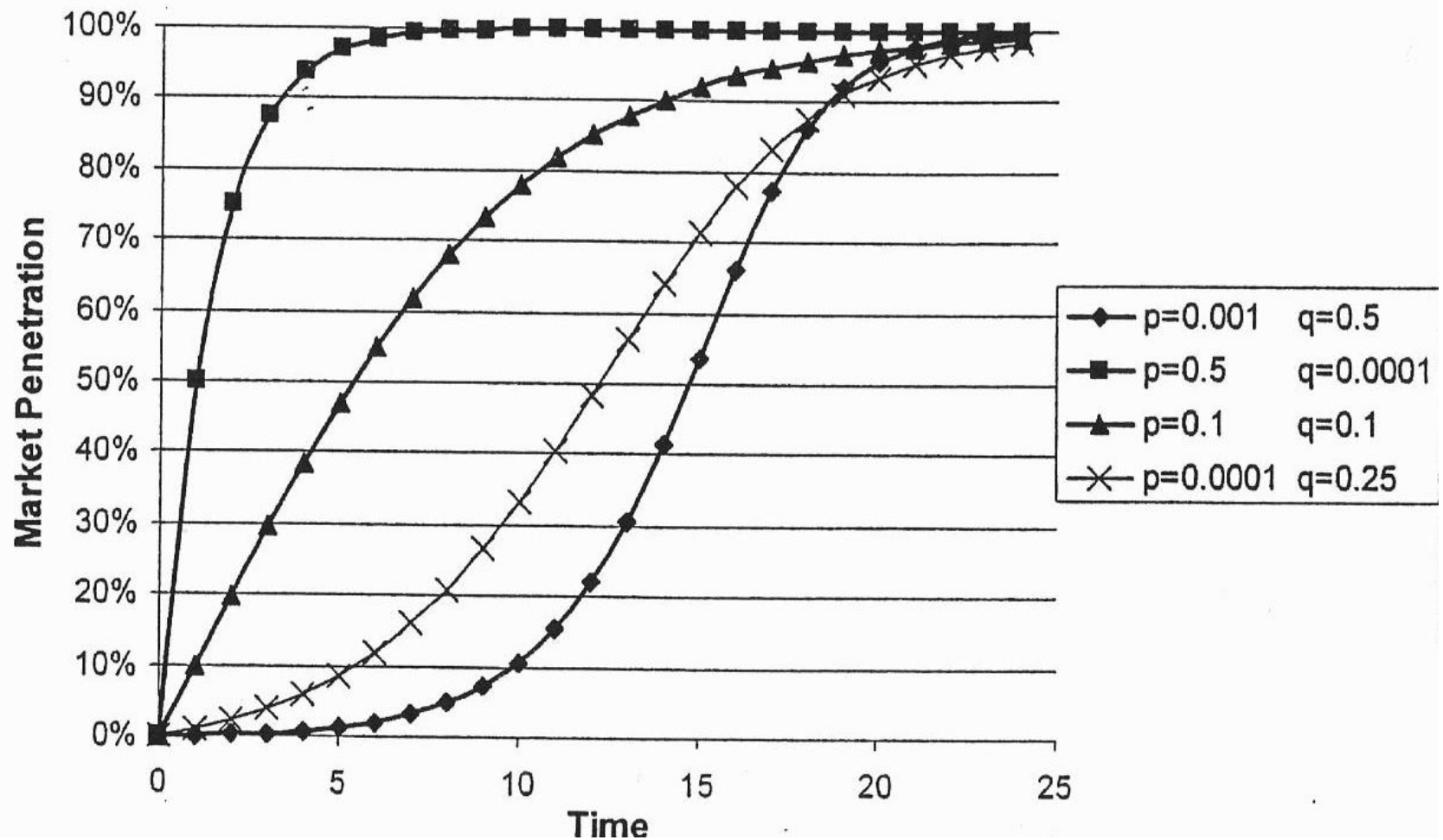


$p$  increases



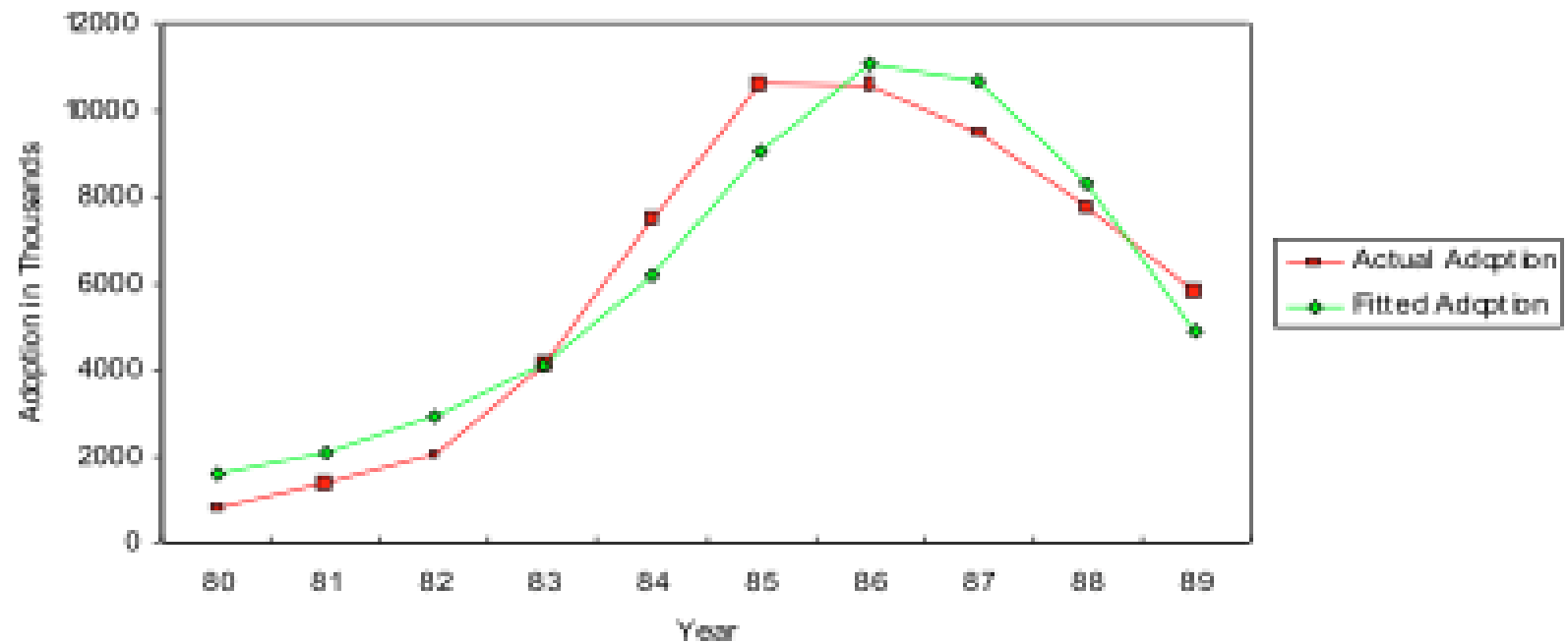
$q$  decreases

**Figure A1** Bass Models with Various Levels of Innovation ( $p$ ) and Imitation ( $q$ )

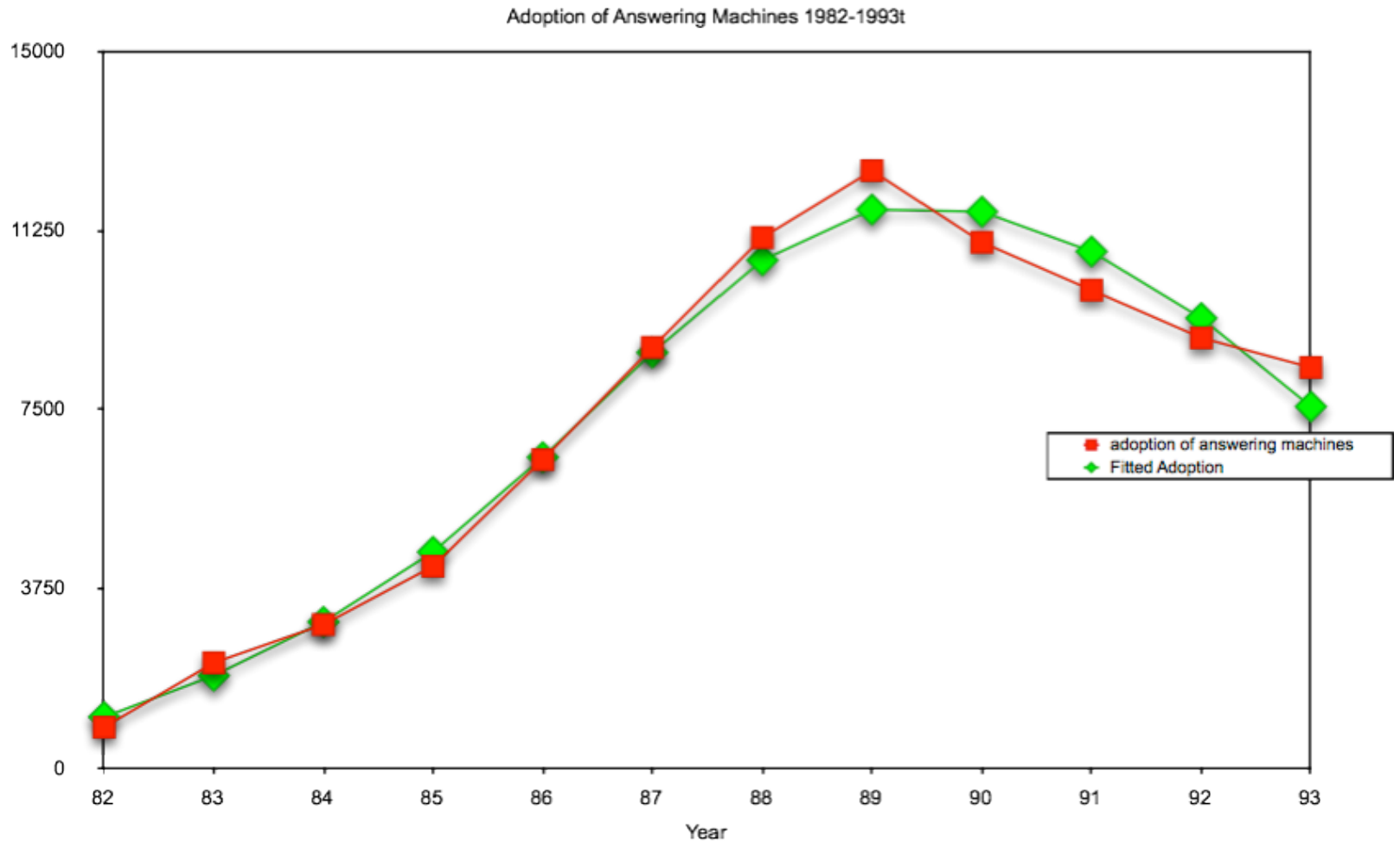


# Adoption of VCR's

Actual and Fitted Adoption VCR's  
1980-1989



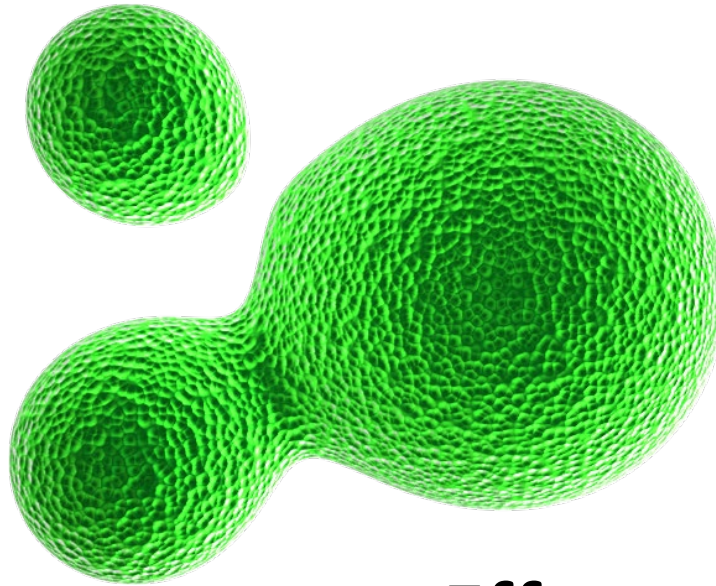
# Answering machines



# Determining the Bass Diffusion Model

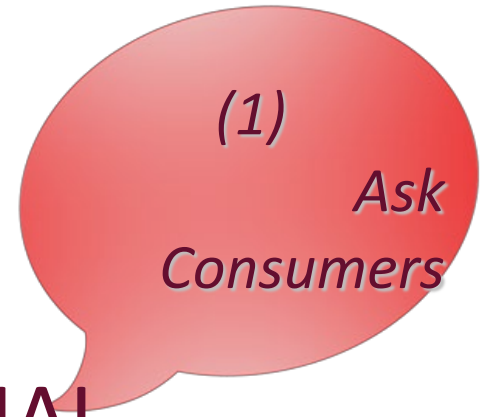
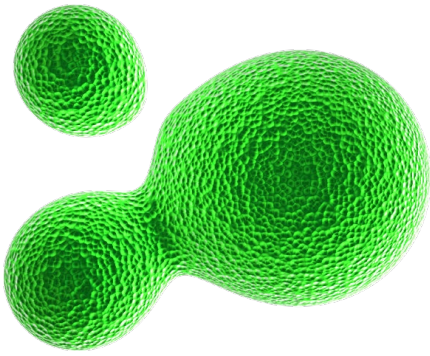


M – Market Potential



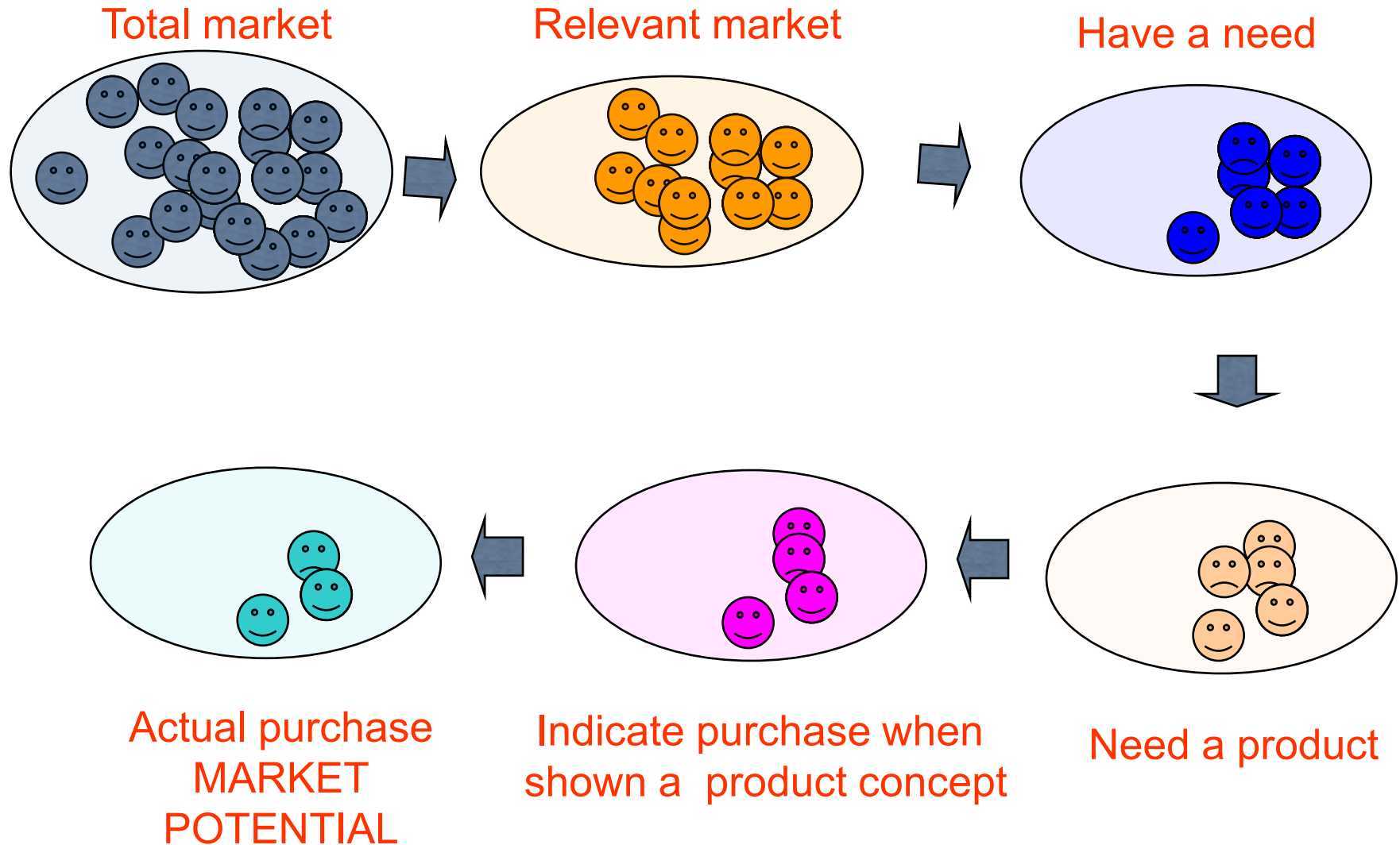
p – Effect of Advertising

q – Effect of Word of Mouth



# MARKET POTENTIAL


For each segment we should be able to get...



## Example...

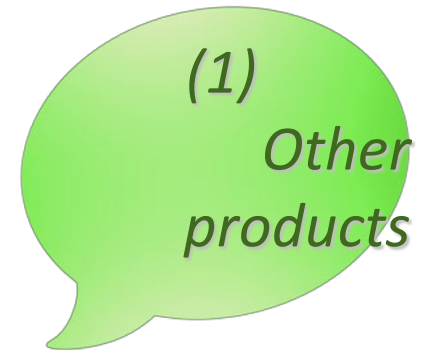
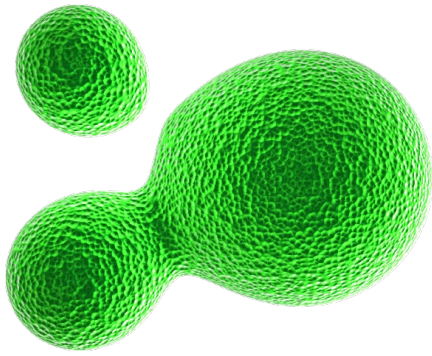
|  |     |             |
|--|-----|-------------|
| 1 Total Market                           |     | 300.00 mill |
|  |     | ↓           |
| 2 Relevant Market<br>(Women, aged 20-40) | 13% | 37.50 mill  |
|  |     | ↓           |
| 3 Have a need                            | 25% | 9.38 mill   |
|  |     | ↓           |
| 4 Likely to buy product                  | 25% | 2.34 mill   |
|  |     | ↓           |
| 5 Indicate will buy<br>for concept       | 25% | 0.59        |
|  |     | ↓           |
| 6 Actually buy                           | 25% | 0.15 mill   |





(2)  
*Ask Experts*

MARKET POTENTIAL



Estimating “p” &  
“q”

# “p” and “q” for existing products

| PRODUCT            | Innovation<br>parameter “p” | Imitation parameter<br>“q” |
|--------------------|-----------------------------|----------------------------|
| B & W TV           | 0.108                       | 0.231                      |
| Color TV           | 0.059                       | 0.146                      |
| Room AC            | 0.006                       | 0.185                      |
| Clothes Dryer      | 0.009                       | 0.143                      |
| Ultrasound Imaging | 0.0001                      | 0.534                      |
| Cell phones        | 0.008                       | 0.421                      |
| CD Player          | 0.055                       | 0.378                      |
| Steam Iron         | 0.031                       | 0.128                      |
| Microwave Oven     | 0.002                       | 0.357                      |
| Home PC            | 0.121                       | 0.281                      |

Estimating “p” &  
“q”

(2)  
*Three data  
points*



# Three data points

$$S_t = [p + q (N_{t-1}/M)] * [M - N_{(t-1)}]$$

$$S_t = a + bN_{(t-1)} - cN_{(t-1)}^2$$

Solve for a,b, c

$$p = a/M$$

$$q = -Mc$$

“M”

(1)  
*Ask  
Consumers*

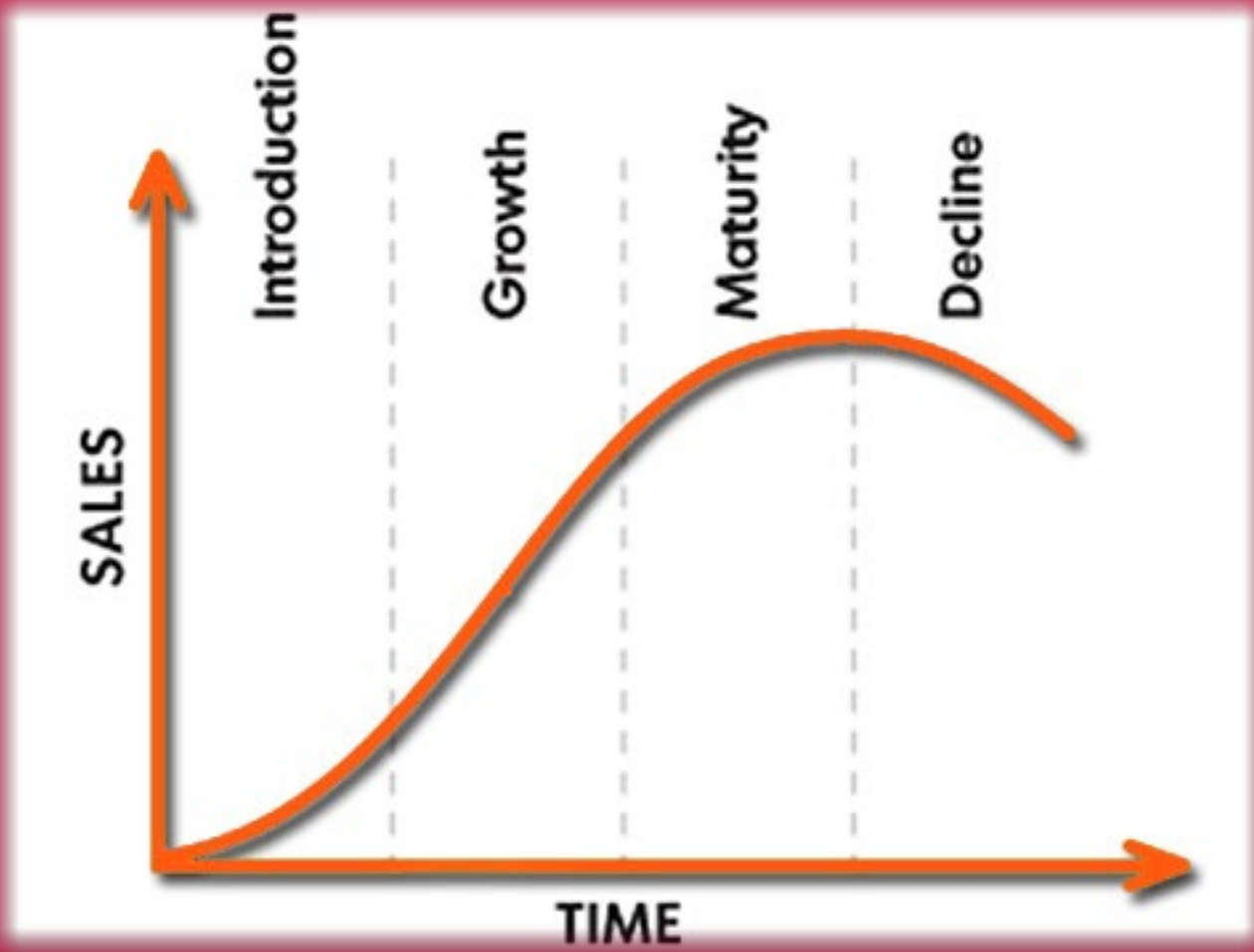
(2)  
*Ask Experts*

“p & q”

(1)  
*Other  
products*

(2)  
*Three data  
points*

# Product Life Cycle



# Product Diffusion

“p”  Effect of Advertising  
Innovation Rate

“q”  Effect of WOM  
Imitation Rate

DIFFUSION RATES

An example ...



# I. Market Potential

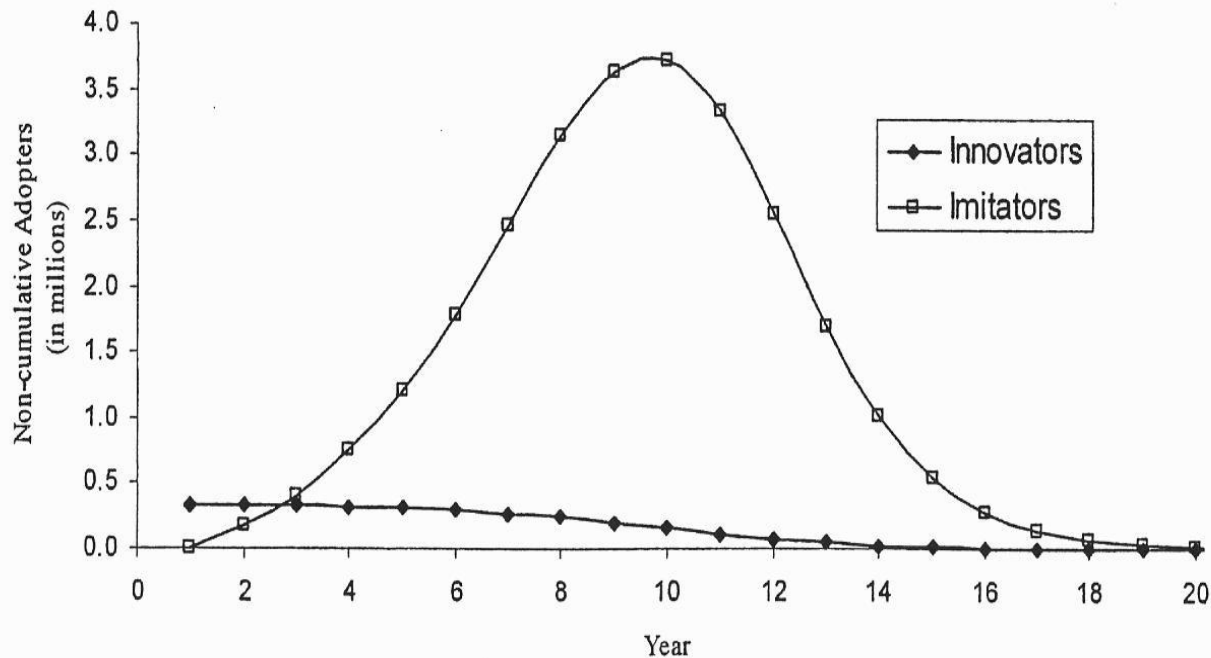
## Subscription Price

| Radio Price | \$12       | \$10              | \$8        | \$5        | \$2        |
|-------------|------------|-------------------|------------|------------|------------|
| \$400       | 23,682,641 | 27,404,662        | 27,484,190 | 27,590,767 | 27,714,837 |
| \$300       | 24,781,778 | 28,526,070        | 28,685,126 | 28,898,280 | 29,146,420 |
| \$250       | 26,552,125 | 30,698,835        | 31,225,323 | 31,840,895 | 32,637,794 |
| \$200       | 31,470,304 | 36,515,712        | 37,829,543 | 40,490,651 | 42,806,598 |
| \$150       | 35,626,570 | 580,232,54,026,74 | 44,098,158 | 49,110,119 | 52,965,846 |
| \$100       | 45,726,942 | 54,026,759        | 58,682,464 | 68,262,745 | 77,771,435 |

## 2. Estimation of $p$ & $q$

| Product            | $p$     | $q$   |
|--------------------|---------|-------|
| Portable CD player | 0.00605 | 0.66  |
| Automobile radio   | 0.0161  | 0.41  |
| Cellular phone     | 0.008   | 0.421 |

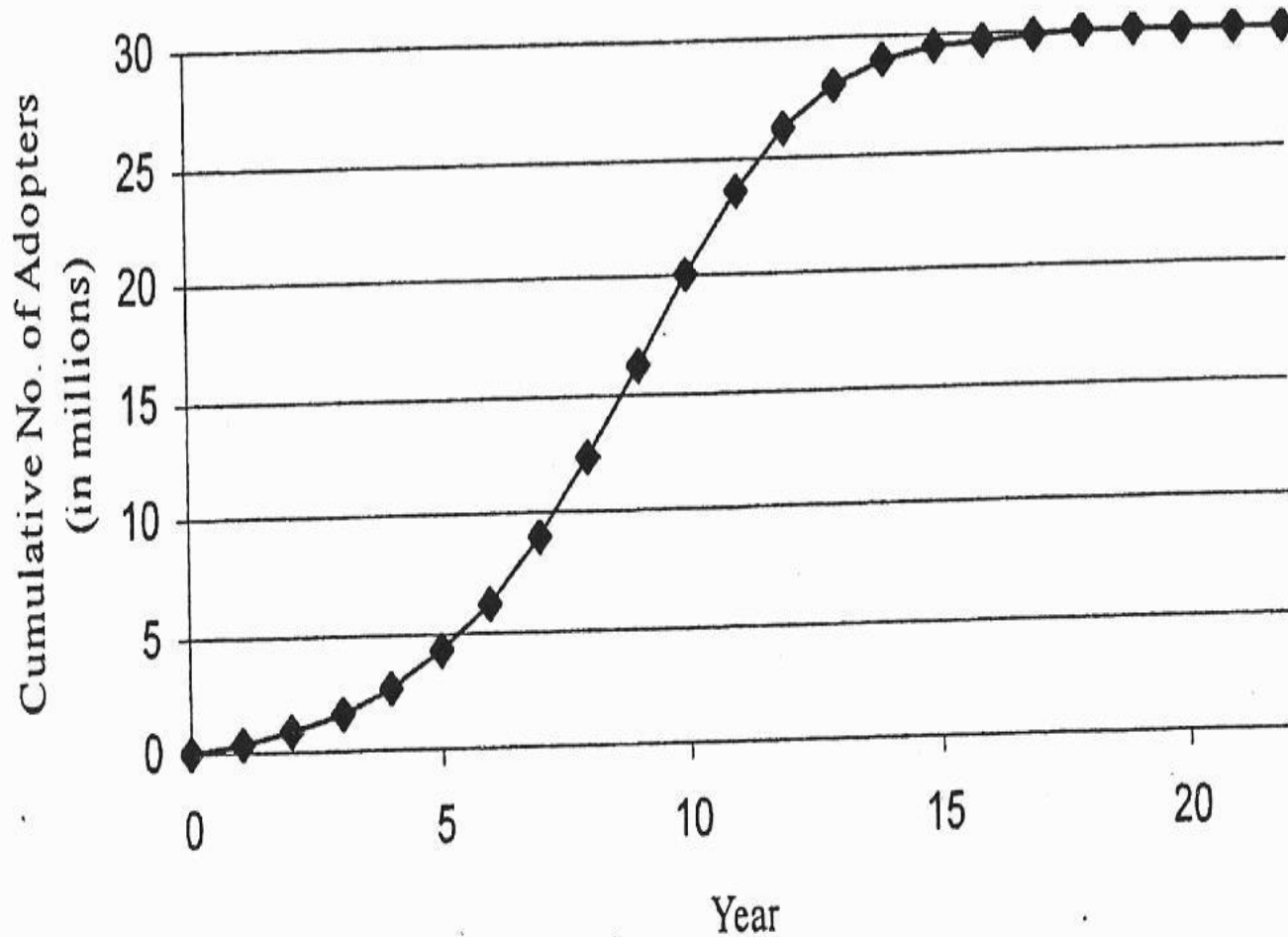
# Effect of p and q – Satellite Radio



Source: Casewriter.



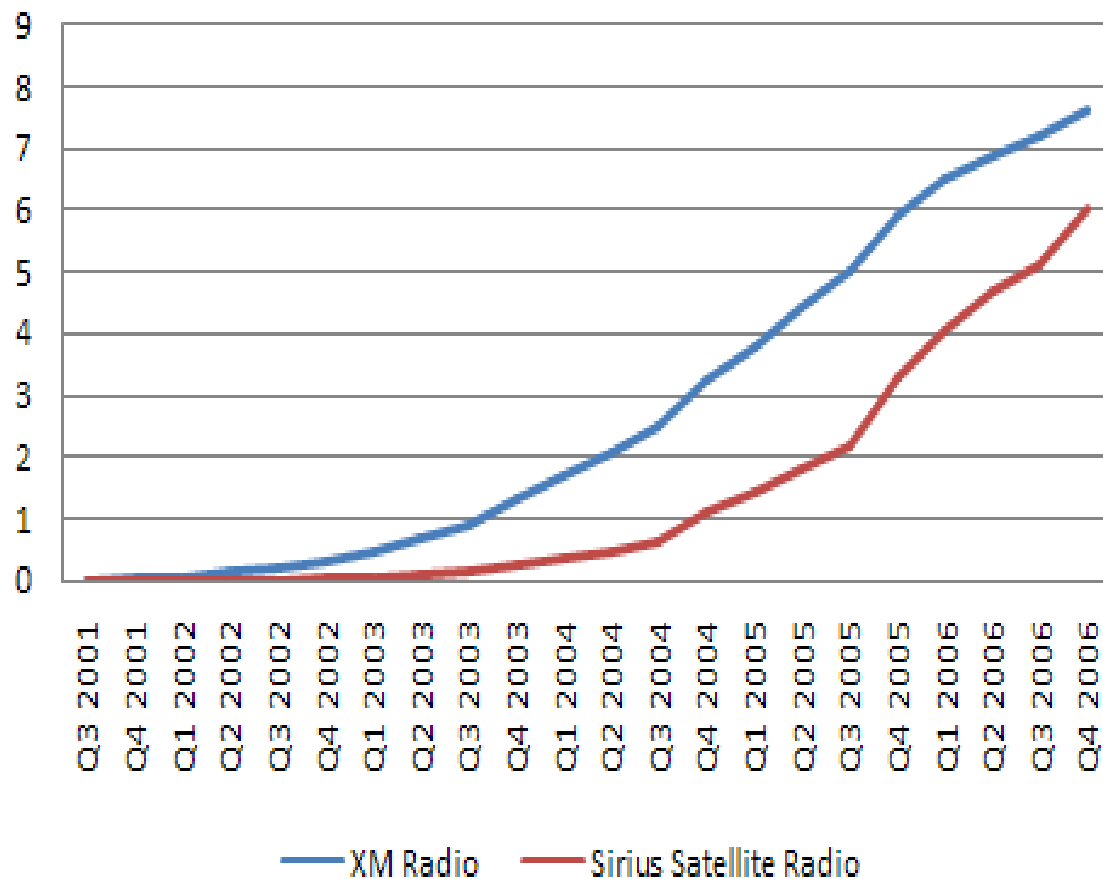
Figure E1 Demand Forecast for Satellite Radio Based on the Bass Model





Why the slow start and rapid acceleration?

# Actual sales of XM & Sirius



| Years | No. of XM subscrib |
|-------|--------------------|
| 2001  | 27,733             |
| 2002  | 347,159            |
| 2003  | 1,360,228          |
| 2004  | 3,229,124          |
| 2005  | 5,932,957          |
| 2006  | 7,185,000          |

E x t e n d i n g

the Bass Diffusion Model



Binary (consumer adopts or not)

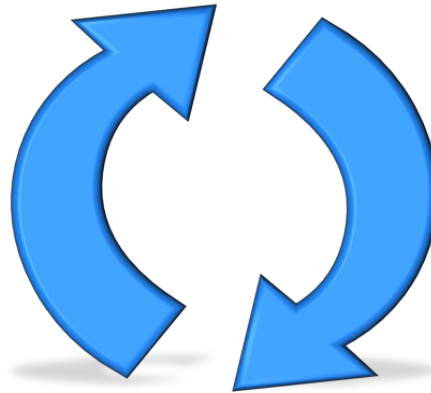
Constant potential i.e. no repeat purchase

Eventually, all will buy

WOM independent of adoption time

Independent of substitutes

No effect of marketing strategies



1. Varying market potential

2. Incorporation of marketing variables

Coefficient of innovation ( $p$ ) as a function of advertising

$$p(t) = a + b * Advertising$$

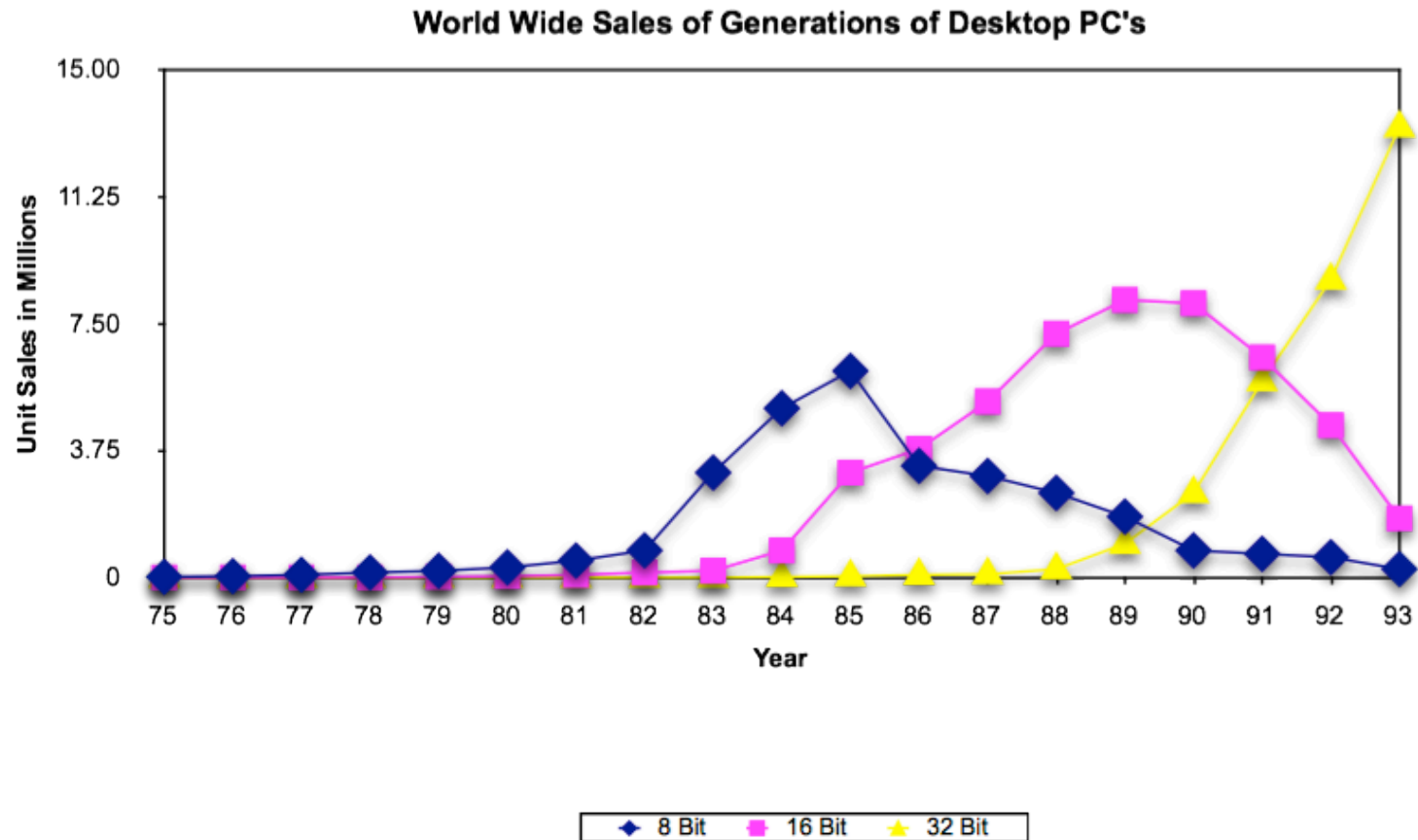
Effects of price and detailing.

3. Incorporating repeat purchases

4. Multi-stage diffusion process

Awareness □□ Interest □□ Adoption □□ Word of mouth

# Generations of PC's



# Rules of Diffusion Forecasting



(I) Hazy



(2) Time is of essence



(3) Garbage in, Garbage out

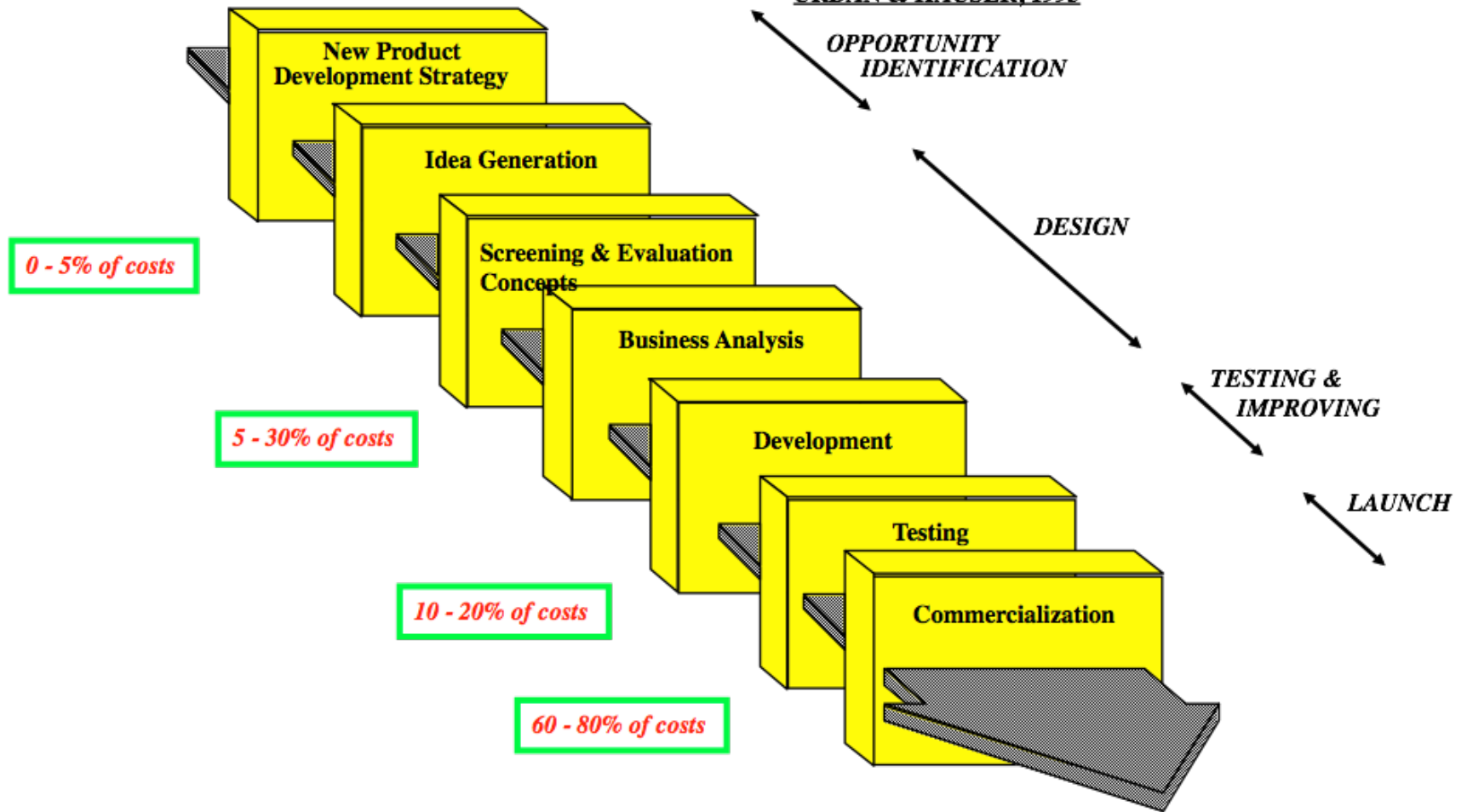


(4) “p” and “q” from other countries

Where does it fit in the  
product development  
process?

Booz-Allen & Hamilton, 1982

URBAN & HAUSER, 1993



# Market Sizing 1

Prof Narayan Janakiraman

# Forecasting - Quantitative Methods

- **Time Series Models:**

- Assumes information needed to generate a forecast is contained in a time series of data
- Assumes the future will follow same patterns as the past

- **Causal Models or Associative Models**

- Explores cause-and-effect relationships
- Uses leading indicators to predict the future
- E.g. housing starts and appliance sales



# Time Series Models

Forecaster looks for data patterns as

- Data = historic pattern + random variation

Historic pattern to be forecasted:

- Level (long-term average) – data fluctuates around a constant mean
- Trend – data exhibits an increasing or decreasing pattern
- Seasonality – any pattern that regularly repeats itself and is of a constant length
- Cycle – patterns created by economic fluctuations

Random Variation cannot be predicted

# Causal Models

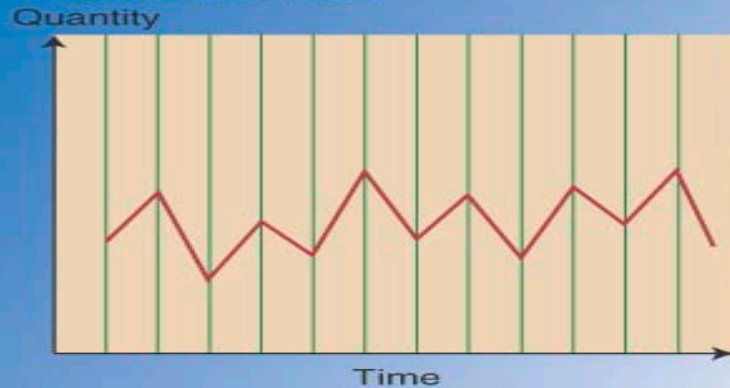
- Causal models establish a cause-and-effect relationship between dependent variable to be forecast (Y) and independent variables ( $x_i$ )
- A common tool of causal modeling is multiple linear regression:

$$Y = a + b_1x_1 + b_2x_2 + \dots + b_kx_k$$

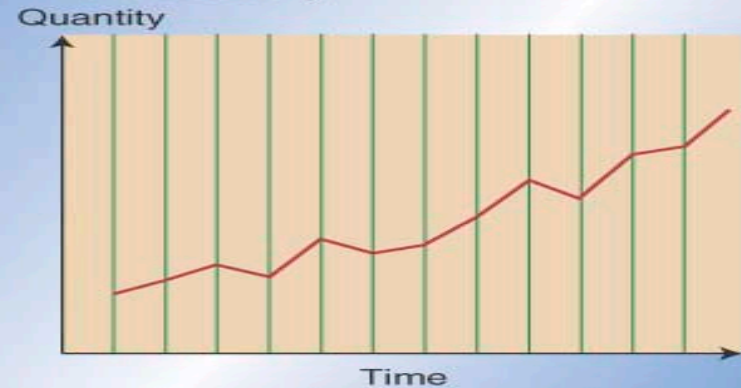
- Often, leading indicators can be included to help predict changes in future demand e.g. housing starts

# Time Series Patterns

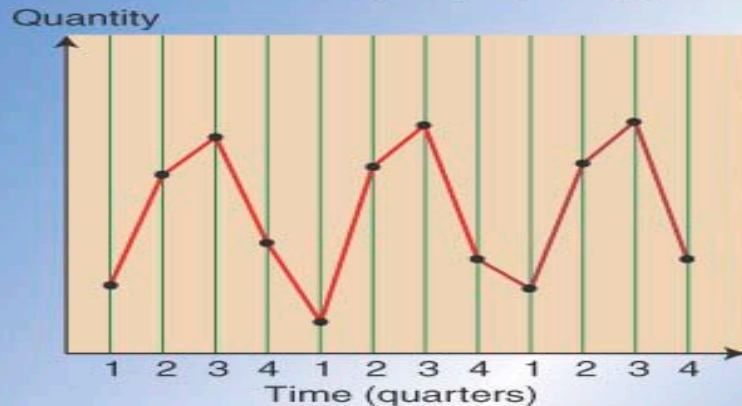
**(a) Level or Horizontal Pattern:**  
Data follows a horizontal pattern around the mean



**(b) Trend Pattern:**  
Data is progressively increasing (shown) or decreasing



**(c) Seasonal Pattern:**  
Data exhibits a regularly repeating pattern



**(d) Cycle:**  
Data increases or decreases over time



# Time Series Models

- Naive:  $F_{t+1} = A_t$ 
  - The forecast is equal to the actual value observed during the last period – good for level patterns
- Simple Mean:  $F_{t+1} = \sum A_t / n$ 
  - The average of all available data - good for level patterns
- Moving Average:  $F_{t+1} = \sum A_t / n$ 
  - The average value over a set time period  
(e.g.: the last four weeks)
  - Each new forecast drops the oldest data point & adds a new observation
  - More responsive to a trend but still lags behind actual data

# Time Series - Problem & Solution

| Period | Actual | 2-Period     | 4-Period     |
|--------|--------|--------------|--------------|
| 1      | 300    |              |              |
| 2      | 315    |              |              |
| 3      | 290    |              |              |
| 4      | 345    |              |              |
| 5      | 320    |              |              |
| 6      | 360    |              |              |
| 7      | 375    | <b>340.0</b> | <b>328.8</b> |
| 8      |        | <b>367.5</b> | <b>350.0</b> |

# Time Series Model 1

Weighted Moving Average:

$$F_{t+1} = \sum C_t A_t$$

- All weights must add to 100% or 1.00  
e.g.  $C_t$  .5,  $C_{t-1}$  .3,  $C_{t-2}$  .2 (weights add to 1.0)
- Allows emphasizing one period over others; above indicates more weight on recent data ( $C_t=.5$ )
- Differs from the simple moving average that weighs all periods equally - more responsive to trends

# Time Series Problem

- Determine forecast for periods 7 & 8
- **2-period** moving average
- **4-period** moving average
- **2-period** weighted moving average with t-1 weighted 0.6 and t-2 weighted 0.4
- **Exponential smoothing** with  $\alpha=0.2$  and the period 6 forecast being 375

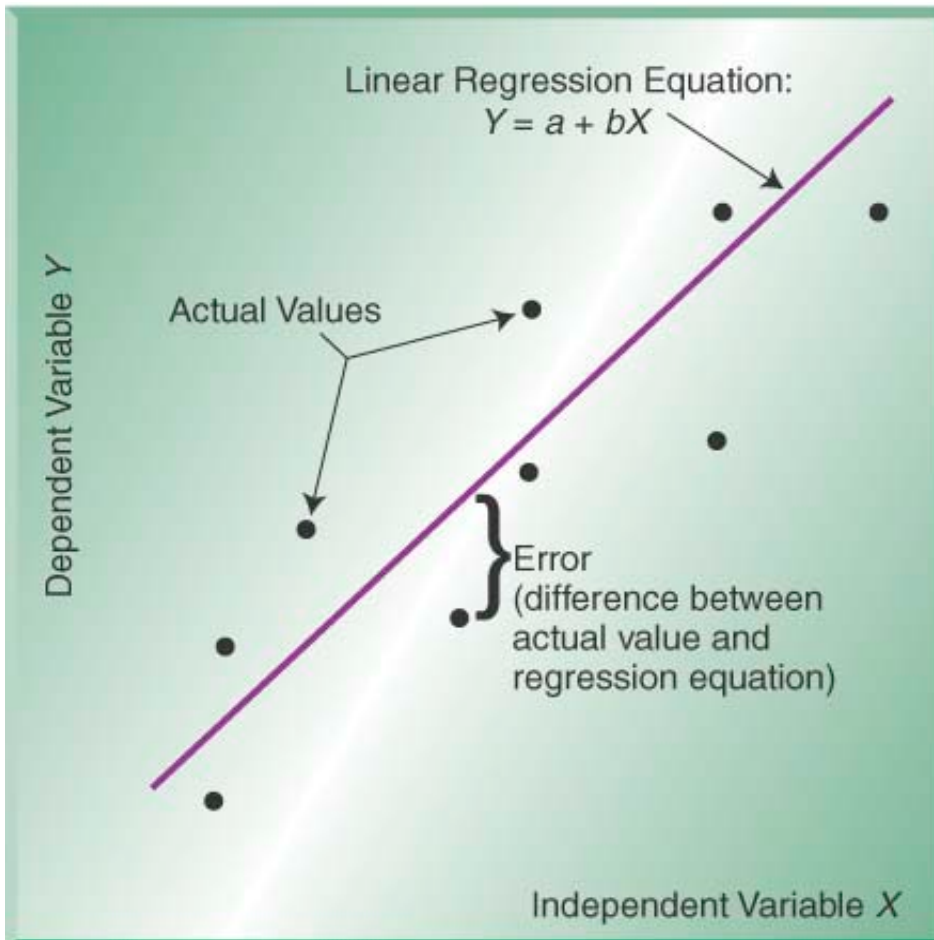
| Period | Actual |
|--------|--------|
| 1      | 300    |
| 2      | 315    |
| 3      | 290    |
| 4      | 345    |
| 5      | 320    |
| 6      | 360    |
| 7      | 375    |
| 8      |        |

# Time Series Problem Solution

| Period | Actual | 2-Period | 4-Period | 2-Per.Wgted. |
|--------|--------|----------|----------|--------------|
| 1      | 300    |          |          |              |
| 2      | 315    |          |          |              |
| 3      | 290    |          |          |              |
| 4      | 345    |          |          |              |
| 5      | 320    |          |          |              |
| 6      | 360    | 340.0    | 328.8    | 344.0        |
| 7      | 375    | 367.5    | 350.0    | 369.0        |
| 8      |        |          |          |              |



# Linear Regression



- Identify dependent (**y**) and independent (**x**) variables
- Solve for the slope of the line
$$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n\bar{X}^2}$$
- Solve for the y intercept
$$a = \bar{Y} - b\bar{X}$$
- Develop your equation for the trend line

$$Y = a + bX$$

**Linear Regression Problem:** A maker of golf shirts has been tracking the relationship between sales and advertising dollars. Use linear regression to find out what sales might be if the company invested \$53,000 in advertising next year.

|     | Sales \$<br>(Y) | Adv.\$<br>(X) | XY    | X <sup>2</sup> | Y <sup>2</sup> |
|-----|-----------------|---------------|-------|----------------|----------------|
| 1   | 130             | 32            | 4160  | 2304           | 16,900         |
| 2   | 151             | 52            | 7852  | 2704           | 22,801         |
| 3   | 150             | 50            | 7500  | 2500           | 22,500         |
| 4   | 158             | 55            | 8690  | 3025           | 24964          |
| 5   | <b>153.85</b>   | 53            |       |                |                |
| Tot | 589             | 189           | 28202 | 9253           | 87165          |
| Avg | <b>147.25</b>   | <b>47.25</b>  |       |                |                |

$$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n\bar{X}^2}$$

$$b = \frac{28202 - 4(47.25)(147.25)}{9253 - 4(47.25)^2} = 1.15$$

$$a = \bar{Y} - b\bar{X} = 147.25 - 1.15(47.25)$$

$$a = 92.9$$

$$Y = a + bX = 92.9 + 1.15X$$

$$Y = 92.9 + 1.15(53) = 153.85$$

# Selecting the Right Forecasting Model

The amount & type of available data

- Some methods require more data than others

Degree of accuracy required

- Increasing accuracy means more data

Length of forecast horizon

- Different models for 3 month vs. 10 years

Presence of data patterns

- Lagging will occur when a forecasting model meant for a level pattern is applied with a trend