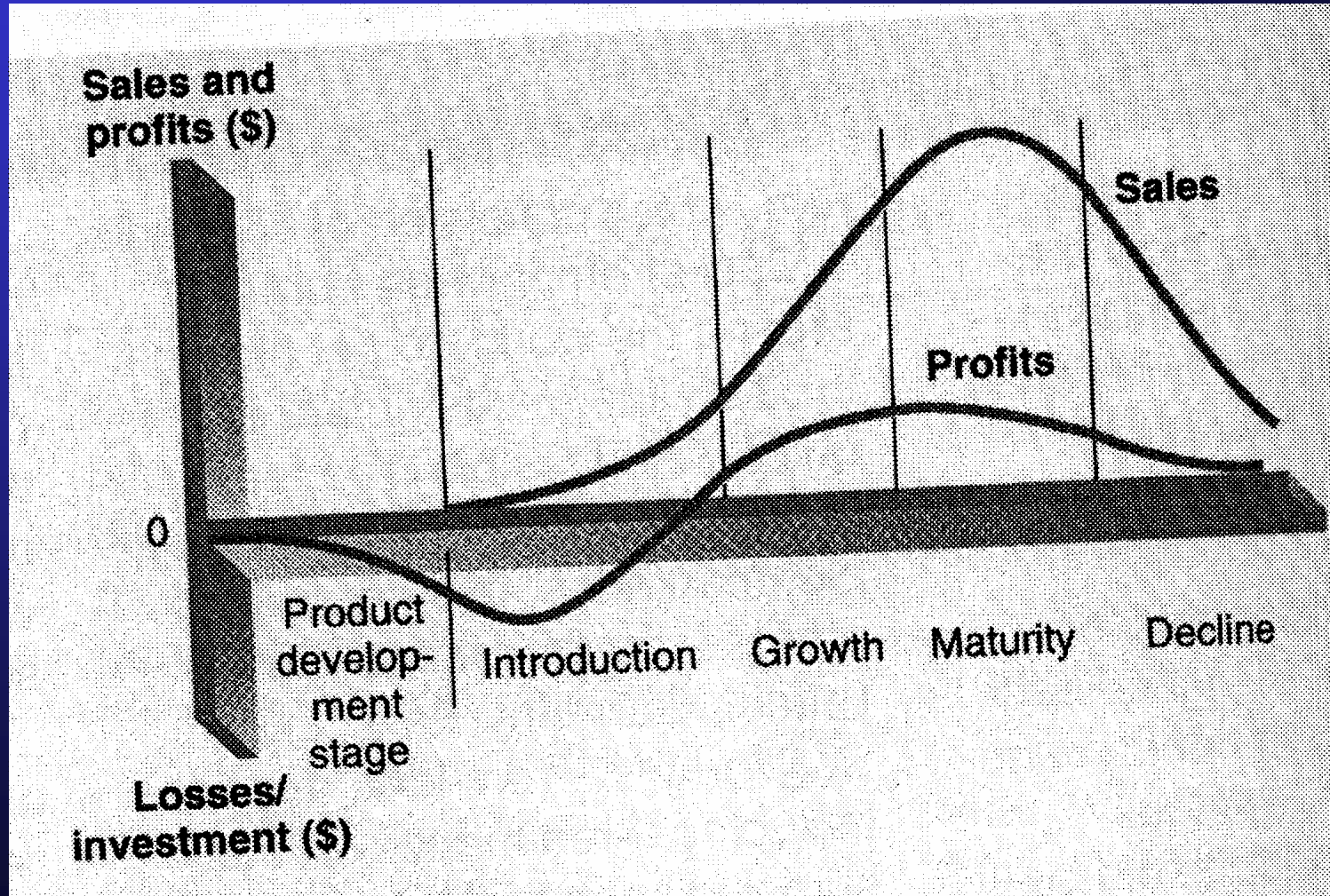
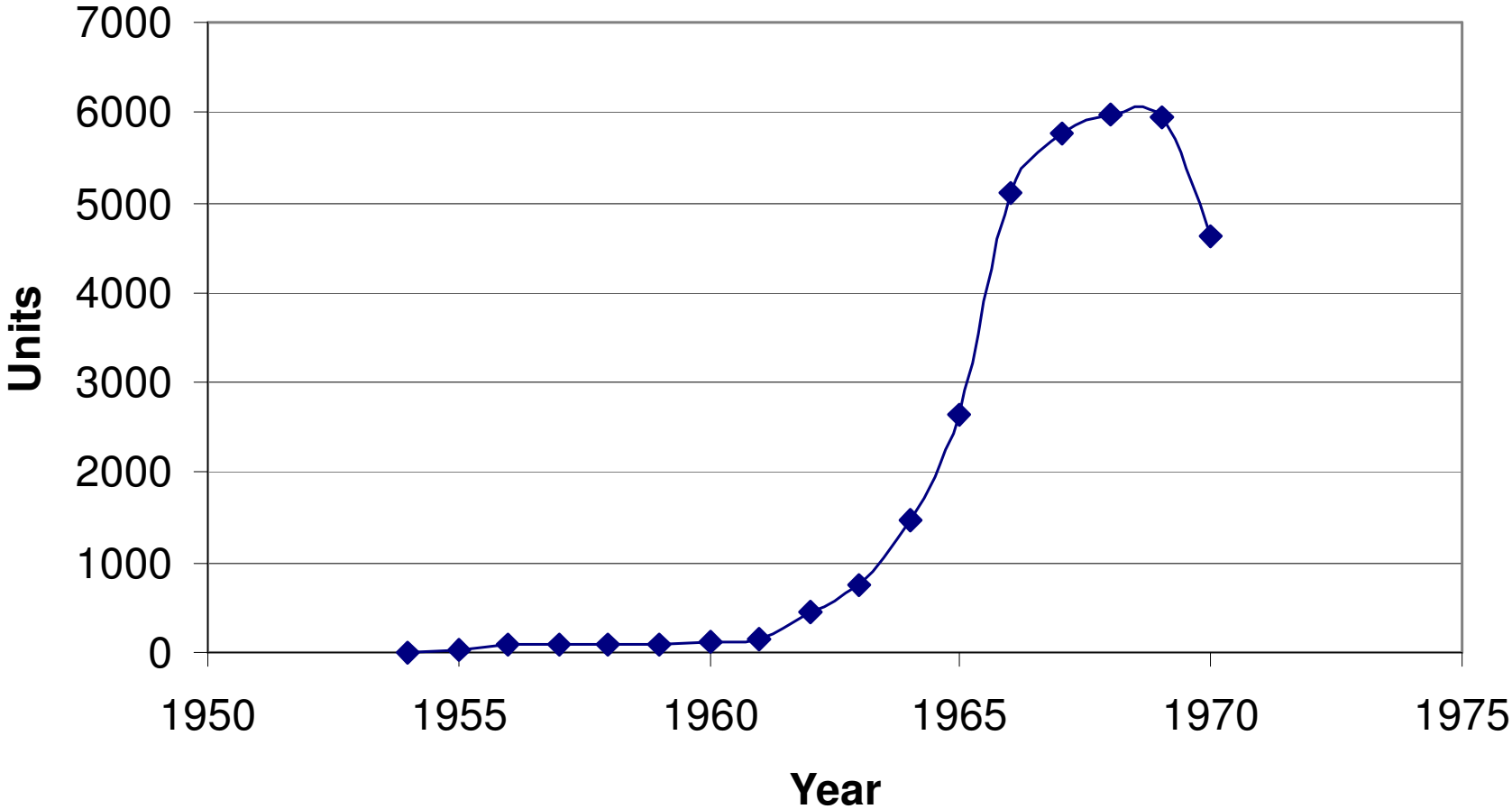


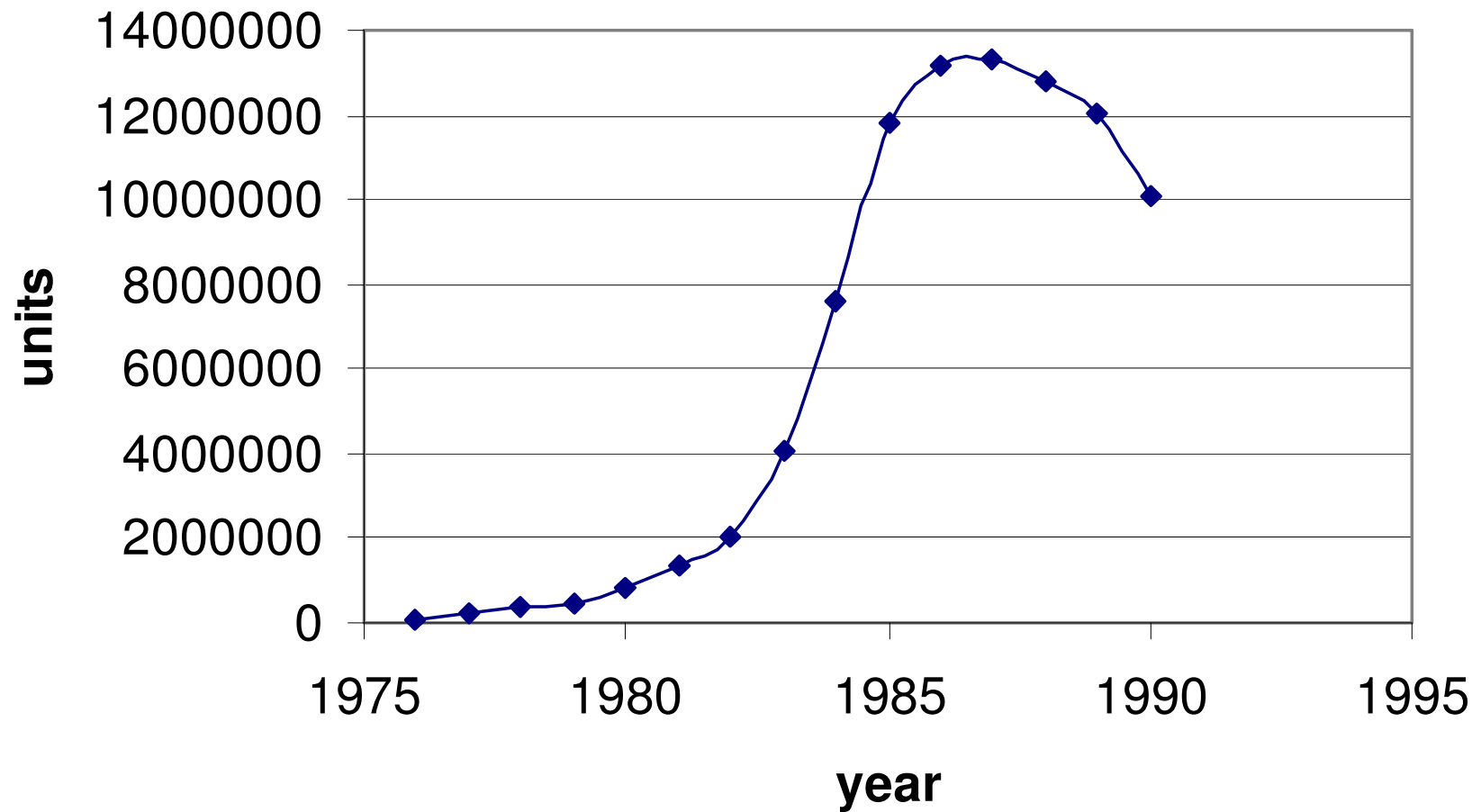
# Product Life Cycle



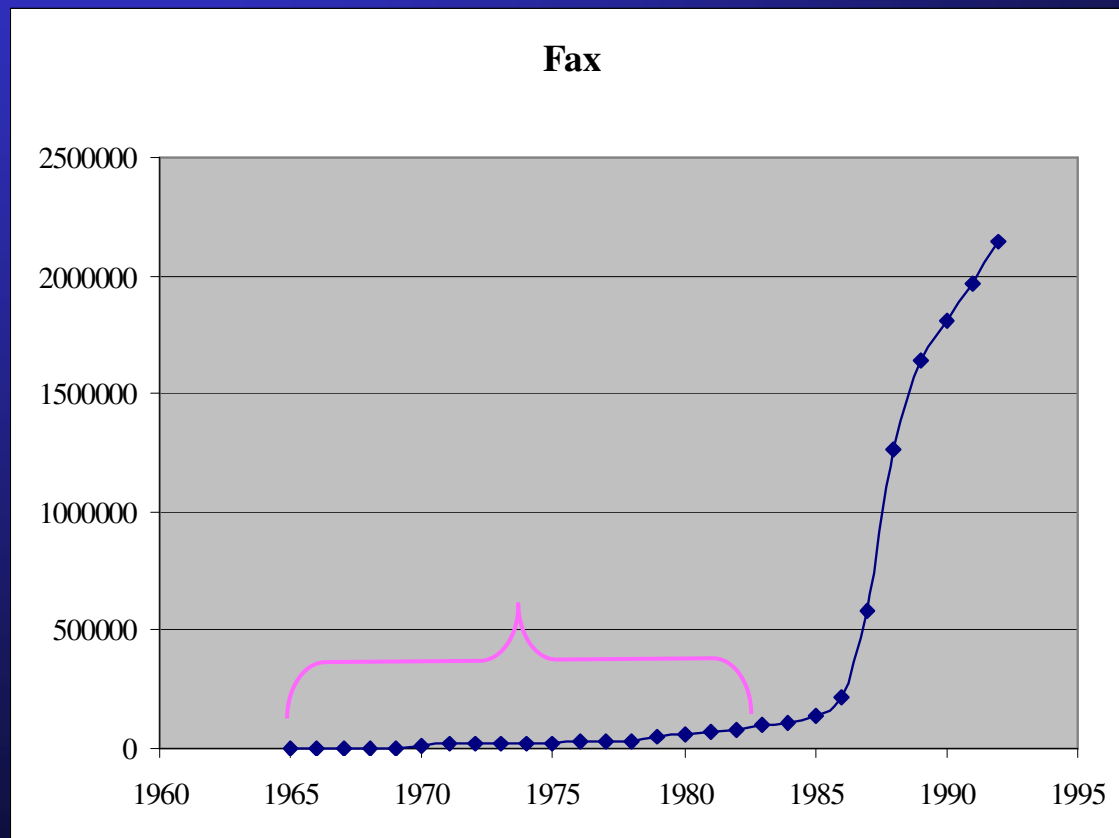
# Penetration of Color TV to the US



## VCR penetration to the US



# Fax Machines - Do not forget the Take off

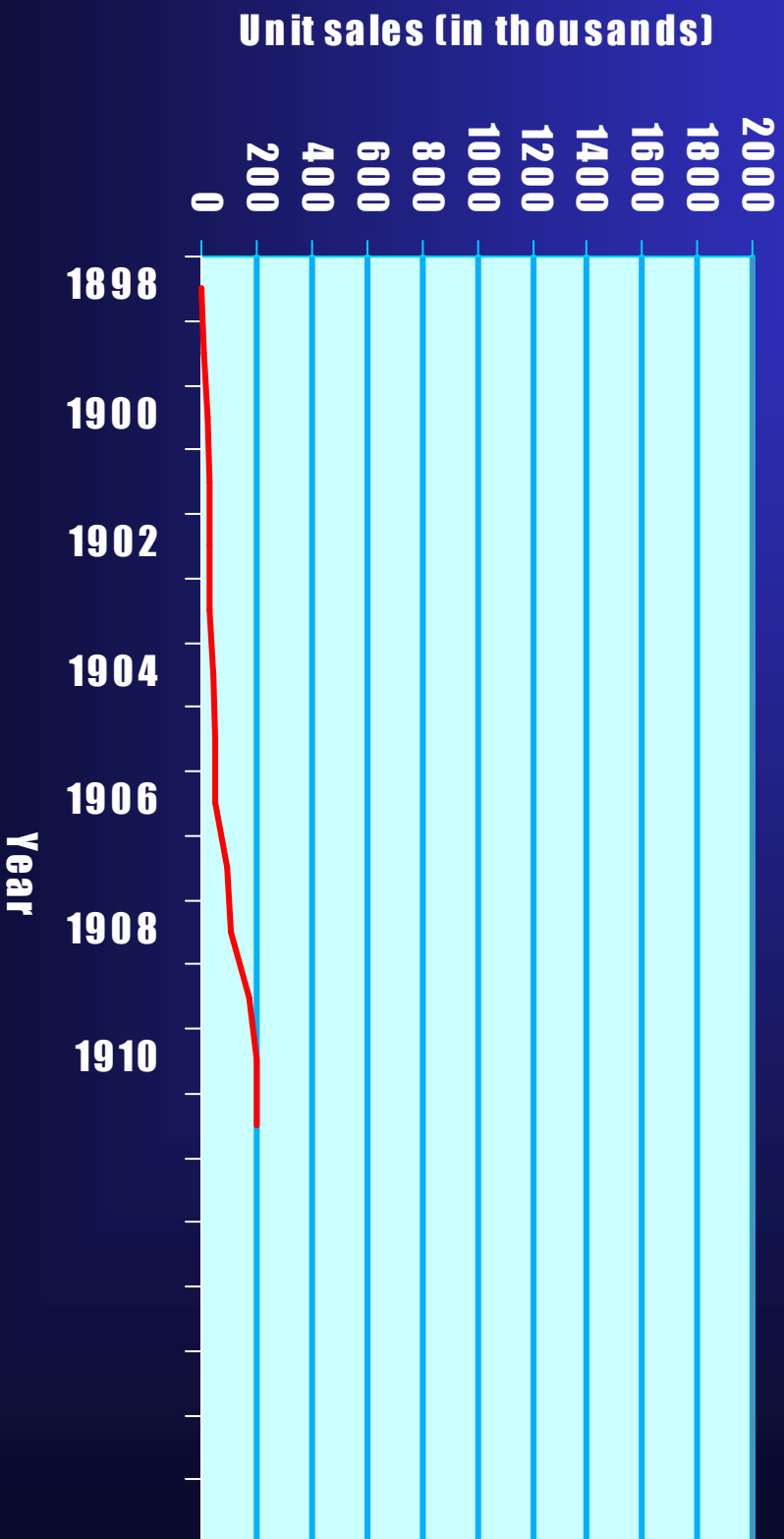


# Will It Ever Fly ? Modeling the Takeoff of Really New Consumer Durables

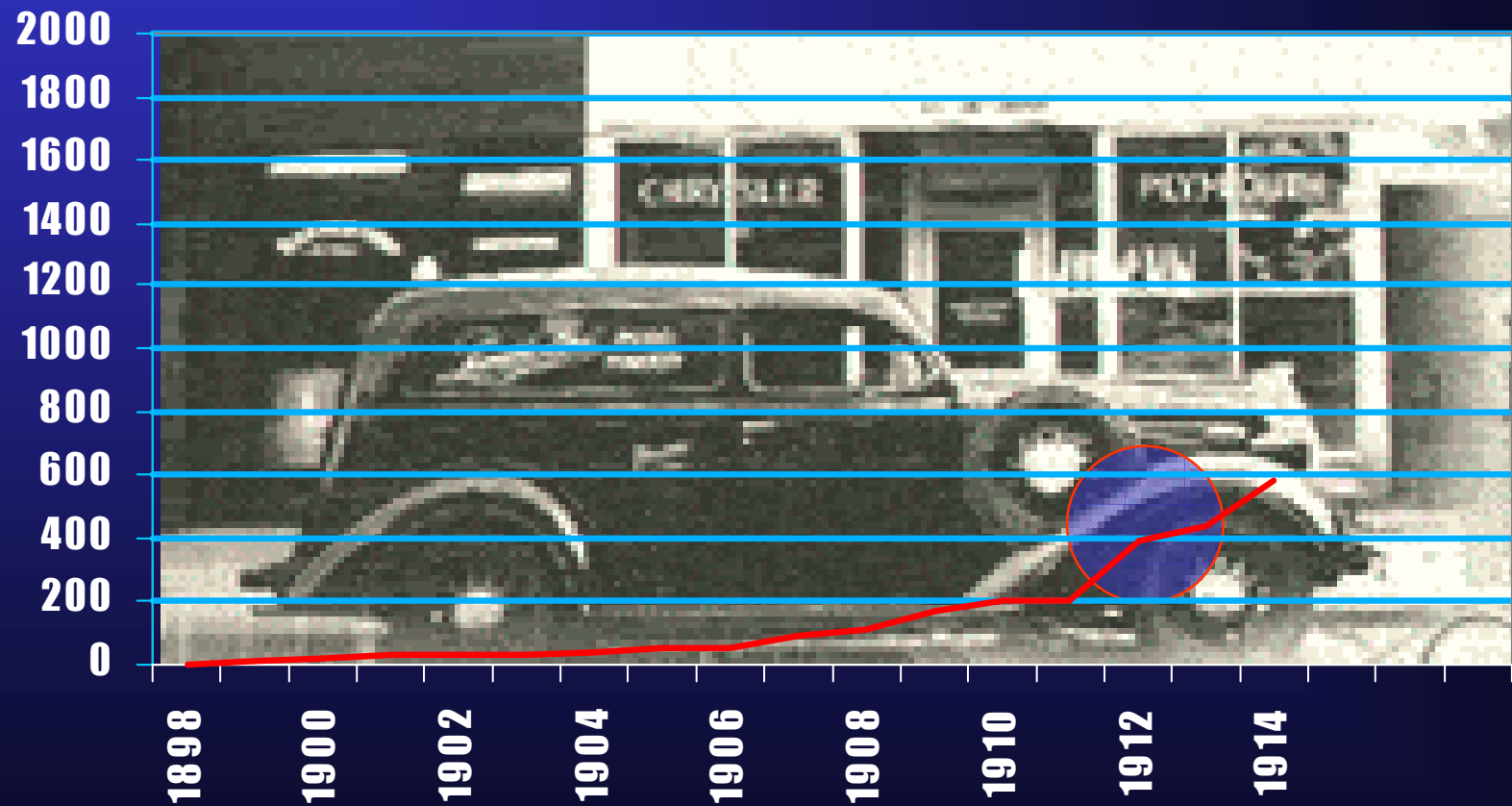
Peter N., Golder and Gerard J. Tellis (1997),  
*Marketing Sciences*, Vol.16, No.3 p.256-270

**Presented by Javier Pozas**

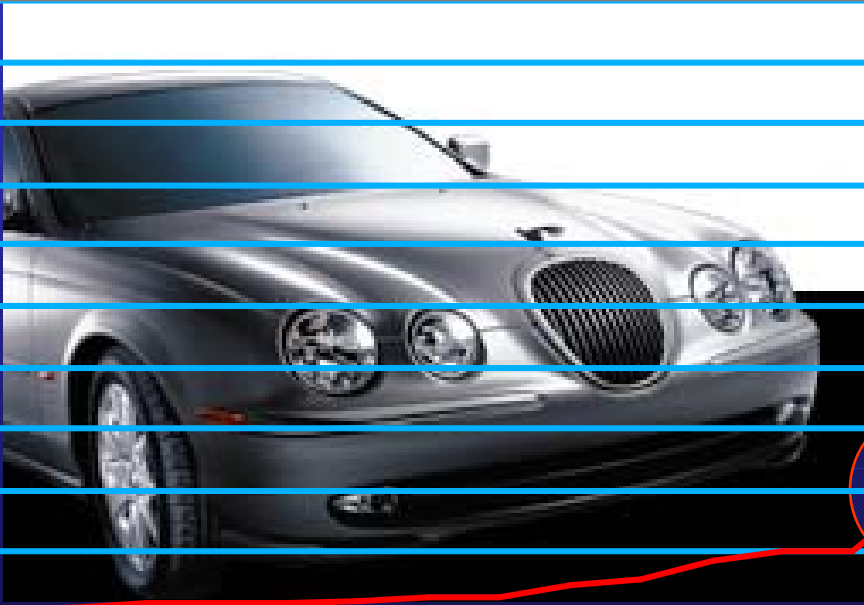
# Automobile



# Automobile



# Autom



# Automobile



# Takeoff Definitions

**Conceptual definition:** the point of transition from the introductory stage to the growth stage of the product life cycle (for most new products, the start of the growth stage is dramatic and clear).

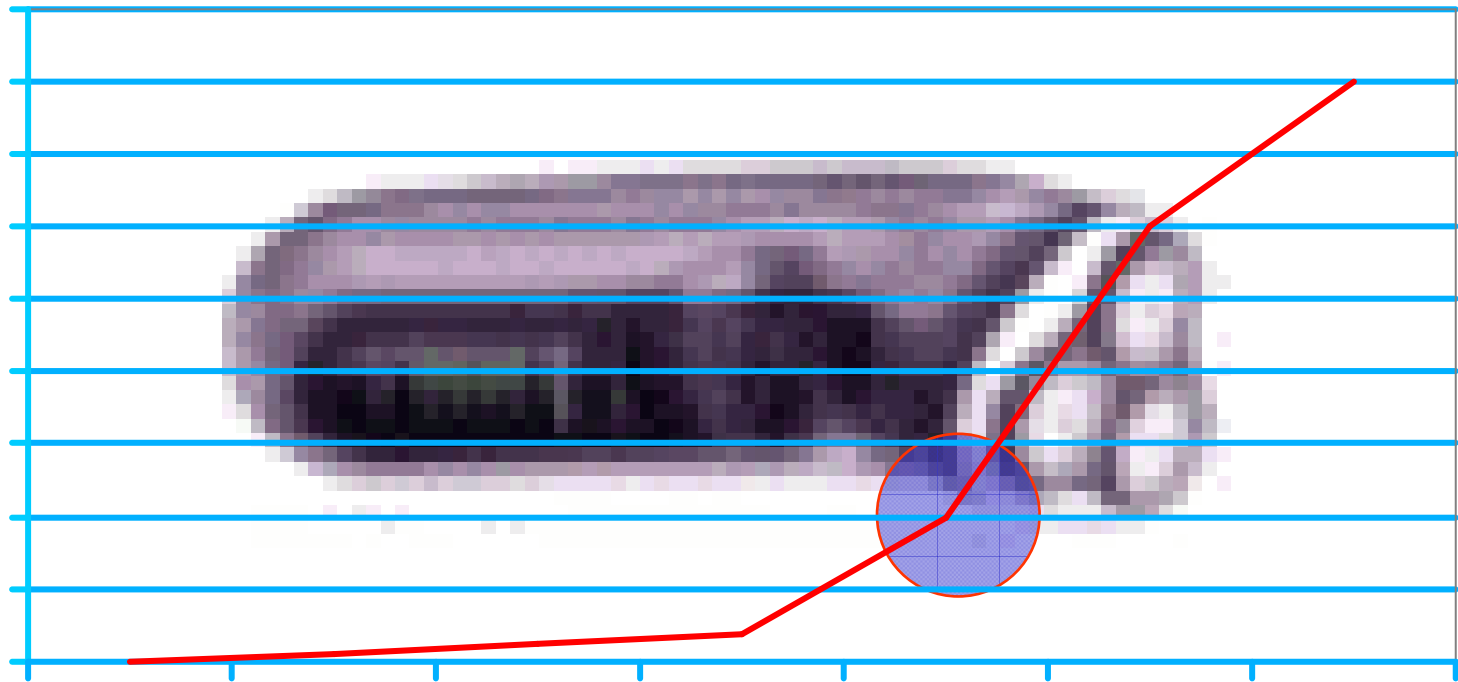
**Operational definition:** the first year in which an individual category's growth rate relative to base sales crosses a threshold

**Threshold for takeoff:** the plot of percentage sales growth relative to a base level of sales, common across all categories.

**Product's Relative growth rate:** the plot of its annual growth in sales relative to its base sales for that year.

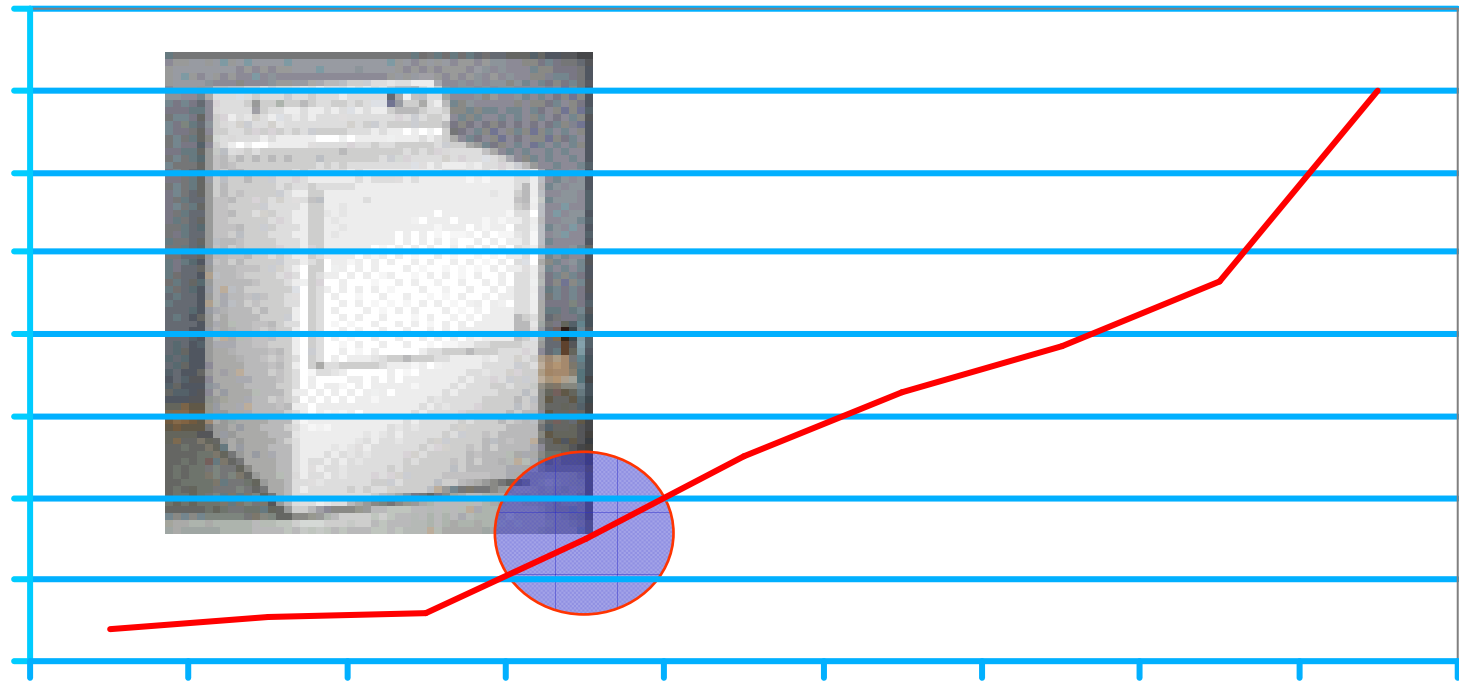


# Electric Shaver

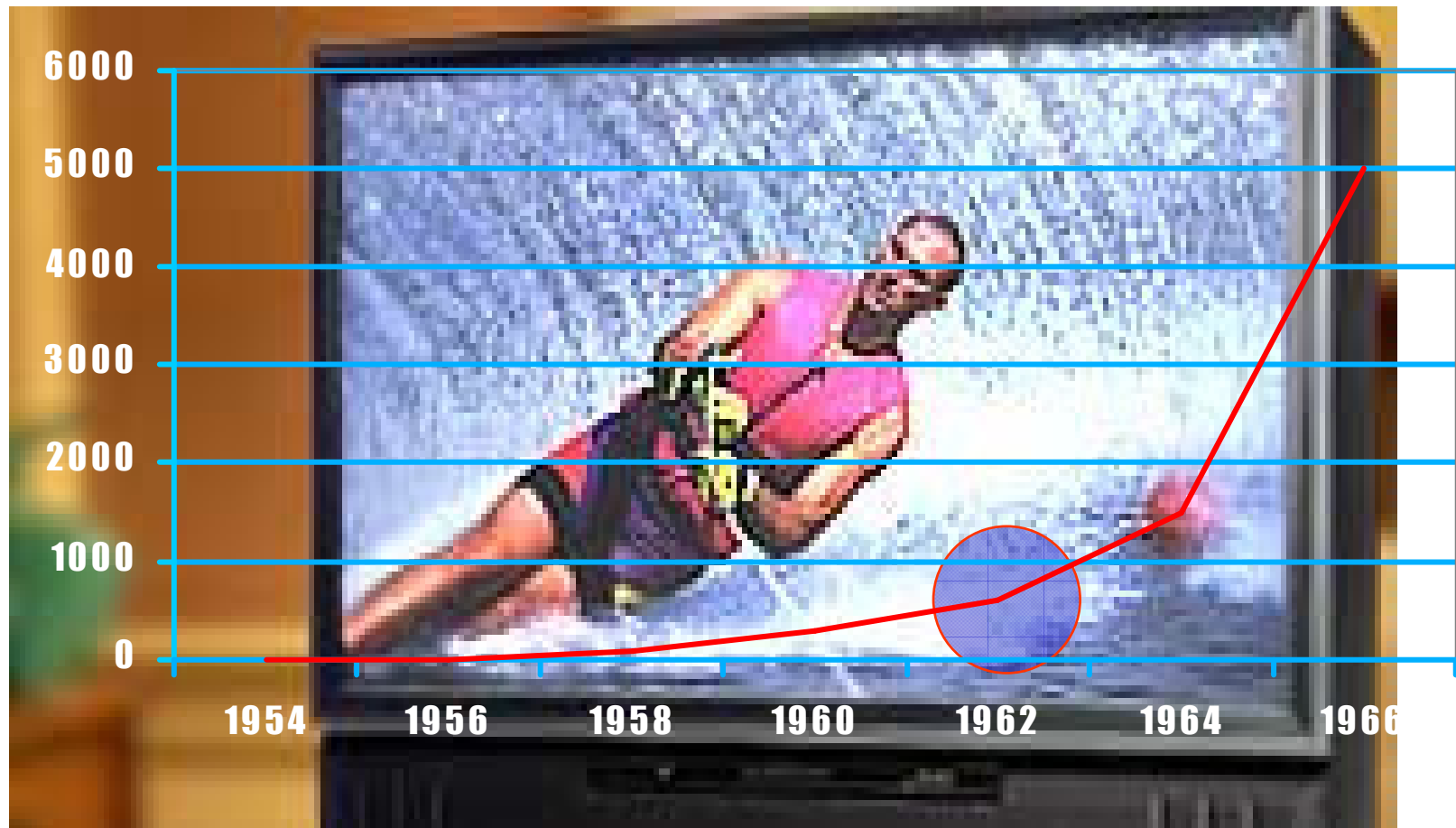




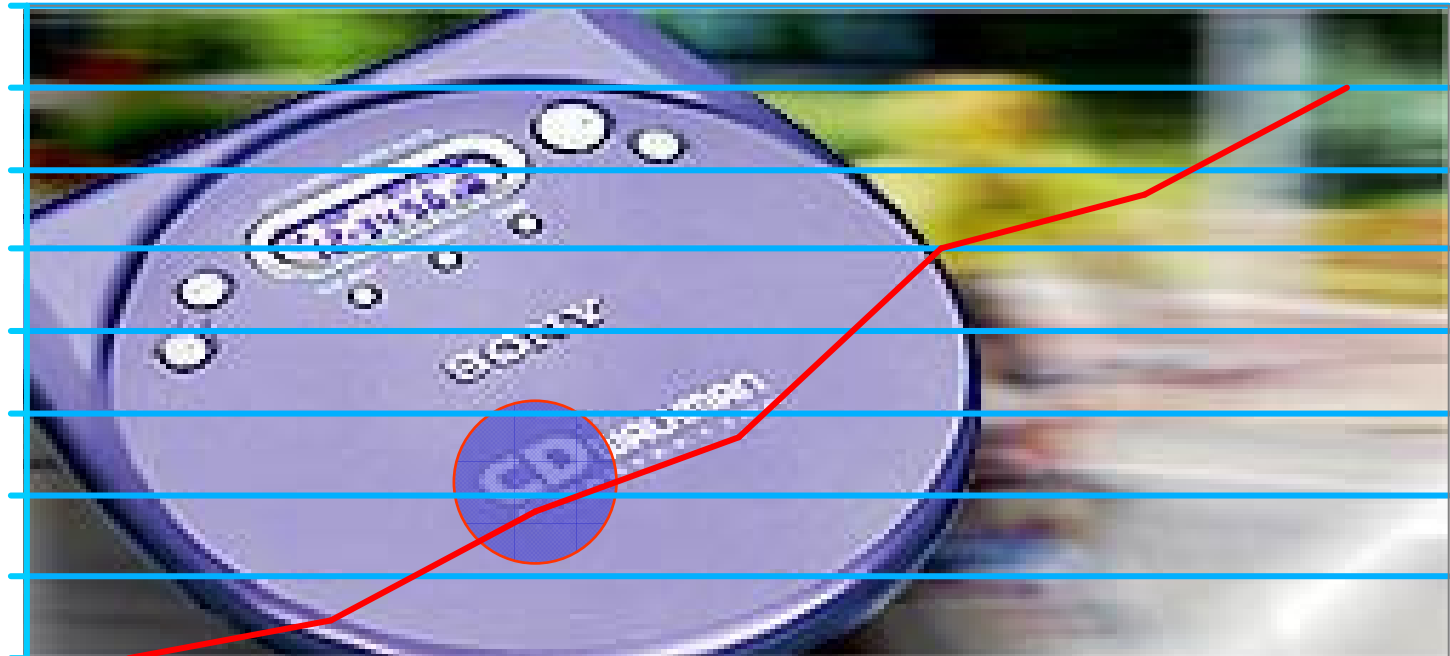
# Clothes Dryer



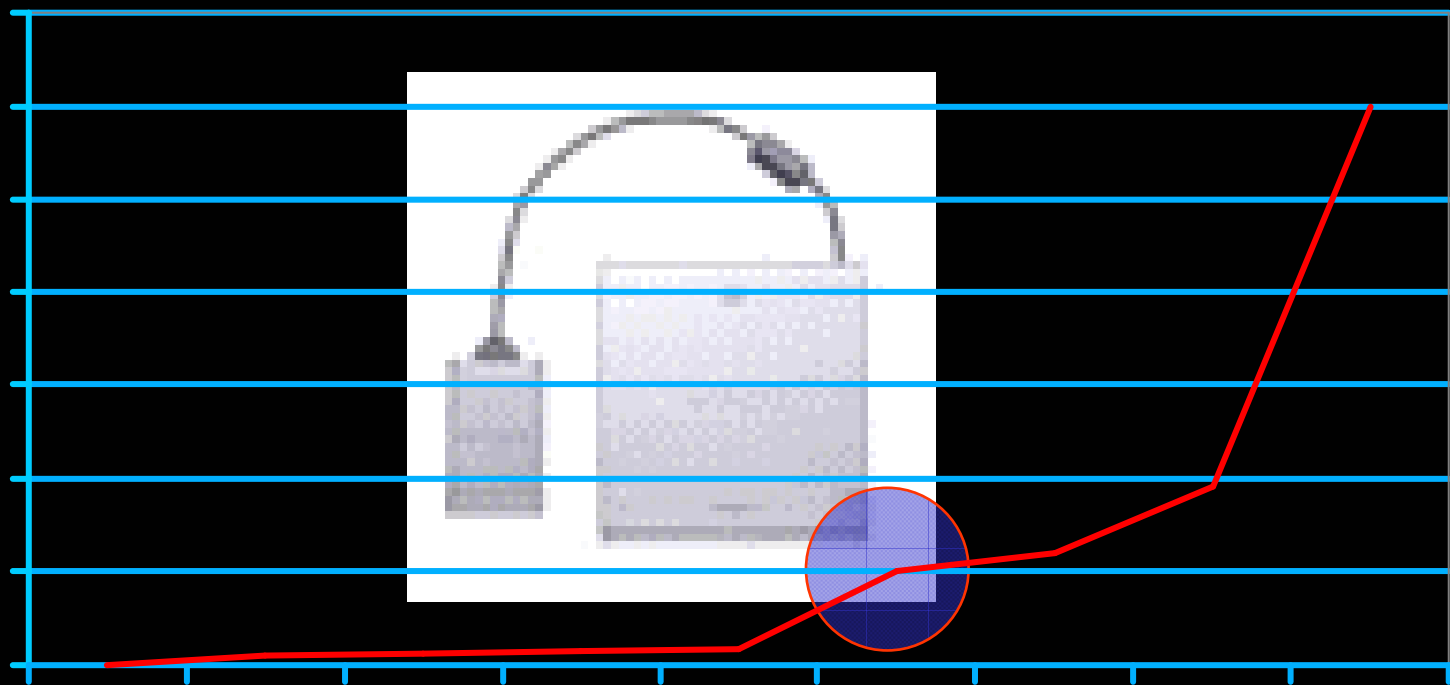
# Color Television



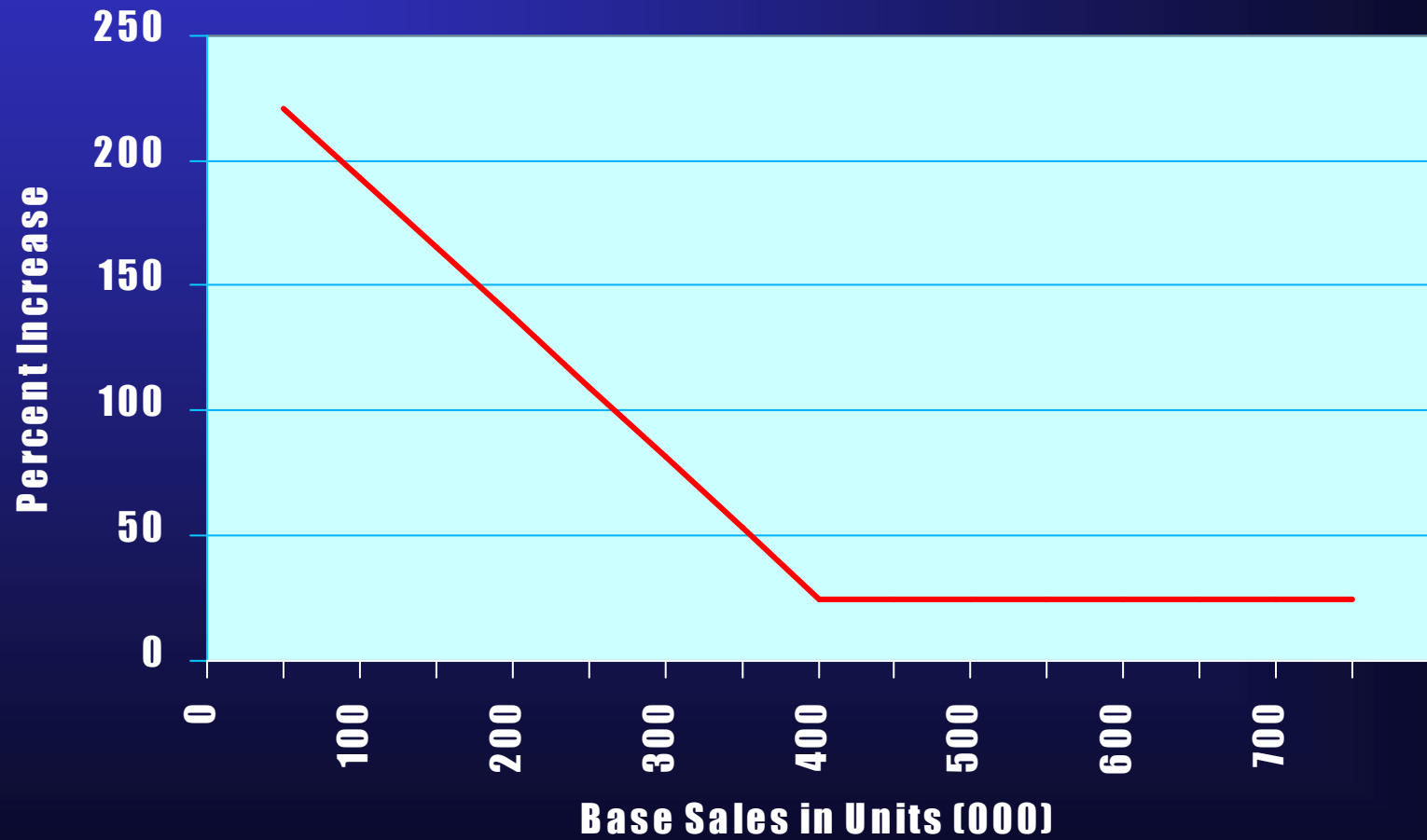
# CD Player



# CD-ROM



# Threshold for Takeoff



## The Interpretation of a Concept Test's Results

- Definitely will buy 15%
- Probably will buy 45%
- Might/might not buy 20%
- Probably not buy 10%
- Definitely not buy 9%

To go or not to go?

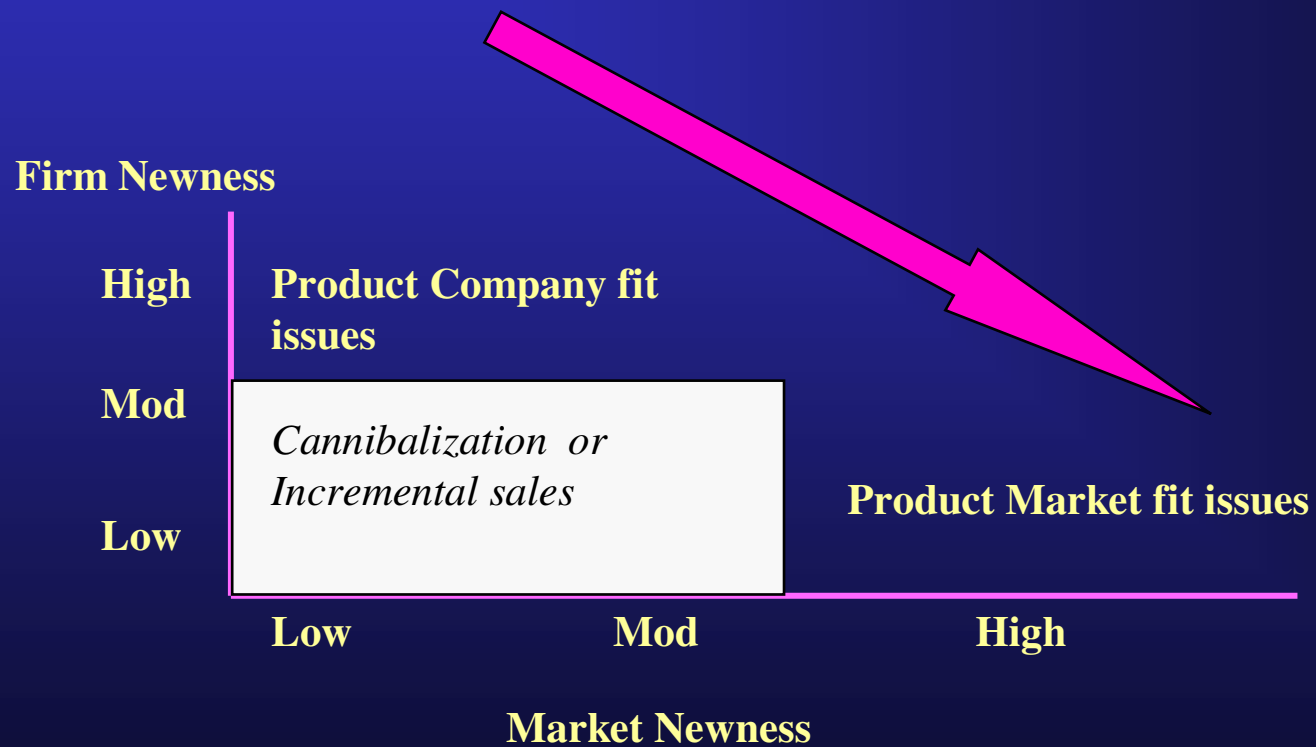
## Relationships Between Intent and Actual Purchase (Tauber, 1981)

<b>Stated intention</b>	<b>Became aware of the product</b>	<b>Tried given aware</b>	<b>Repeat given trial</b>
<b>Definitely buy</b>	71	31	52
<b>Probably</b>	60	16	43
<b>Might/might not</b>	54	17	56
<b>Probably not</b>	52	8	50
<b>Definitely not</b>	38	10	40

# Newness Maps

(Goldenberg, Lehmann and Mazursky, 2001)

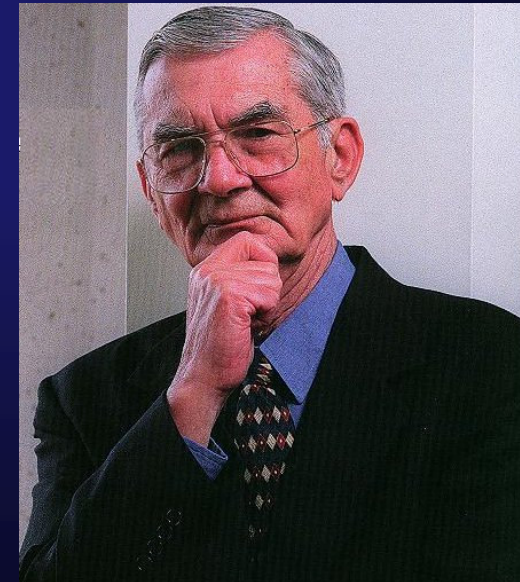
*Newness to the World = Firm Newness + Market Newness*



# Bass Model

The Bass diffusion model developed by Professor Frank Bass in 1969, is one of the fundamental models to describe, and sometimes predict, first purchases for consumer durable products.

This model is particularly useful for modeling the evolution of demand for “Really New Products”, whose sales curves over time follow a familiar product life cycle - an S shaped growth curve followed by stabilization and then decline.



# The Bass Model (1969)

innovation effect

imitation effect

$$n(t) = p(M - N(t)) + q\left(\frac{N(t)}{M}\right)(M - N(t)) = \left(p + q\frac{N(t)}{M}\right)(M - N(t))$$

Where:  $n(t)$  = numbers of adopters at time  $t$ ,  $M$  = market potential,  $N(t)$  = cumulative number of adopters,  $p$  = coefficient of innovation,  $q$  = coefficient of imitation (word of mouth effect)

$$\frac{dN}{dt} = n(t)$$

# The Solution of the Differential Equation - The properties of the Diffusion

$$N(t) = M \left[ \frac{1 - e^{-(p+q)t}}{1 + \frac{q}{p} e^{-(p+q)t}} \right]$$

$N(t)$  - Cumulative sales by time  $t$  after introduction (or “take off”)

$M$  - Ultimate Market Potential (in units)

$p$  - Coefficient of innovation

$q$  - Coefficient of imitation (WOM effect)

Other important properties can be obtained easily:

• **The sales rate:**

$$n(t) = N'(t)$$

• **The timing of the peak  $t^*$ :**

$$t^* = \left[ \frac{1}{p+q} \right] \ln \left( \frac{p}{q} \right)$$

• **The peak sales rate:**

$$n(t^*) = \frac{M}{4q} (p+q)^2$$

• **The peak cumulative sales:**

$$N(t^*) = M \left[ 0.5 - \frac{p}{2q} \right]$$

# Estimating the Bass Model

The Bass model can be estimated by using a simple regression.

Use the approximation:  $n(t) = N'(t) \approx N(t) - N(t-1)$

Thus, the model can be rewritten:  $n(t) = pM + (q-p)N(t-1) - \frac{q}{M}[N(t-1)]^2$

Or:  $n(t) = a + bN(t-1) - c[N(t-1)]^2$

a, b, and c can be estimated by running ordinary least squares regression, using the cumulative sales as dependent variables, the lagged sales and the squared lagged sales as the independent variables.

After estimating a, b, c the bass parameters can be derived:

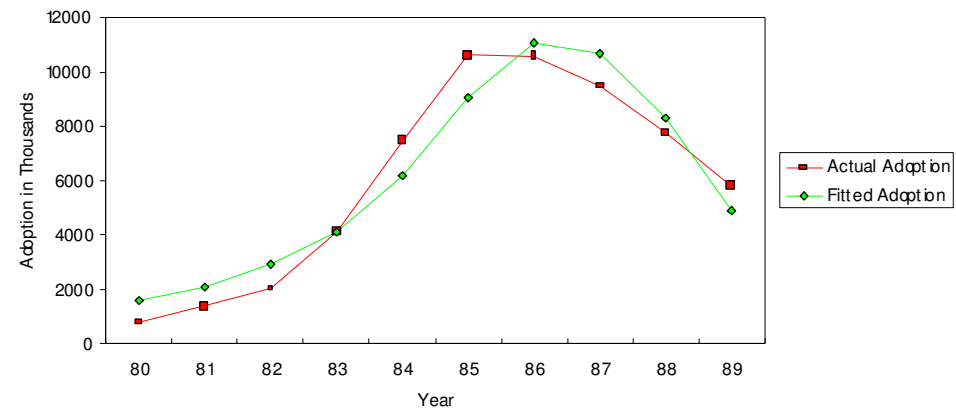
$$p = \frac{a}{M}$$
$$M = \frac{-b \pm \sqrt{b^2 - 4ac}}{2c}$$
$$q = p + b$$

*Caution: In order to produce reasonably accurate data one needs to have at least 10-12 years of data.*

# Fit

## Adoption of VCR's

Actual and Fitted Adoption VCR's  
1980-1989



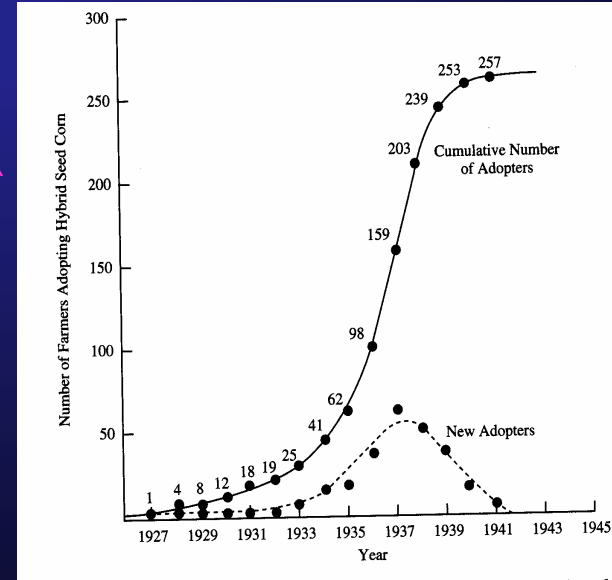
# Exercise in Bass Model

Use the data below on the cumulative sales of cellular subscribers (source: CTIA, 1996 - estimated numbers) to estimate the growth of cellular subscribers to year 2000, use the Bass diffusion model. According to your estimations: What is the market potential? When do you expect the peak to occur?

Repeat your calculation but this time use data only up to 1993. Compare  $p$  and  $q$  and your estimation to the former estimations. What are your conclusions?

Year	Cumulative Number of Cellular Subscribers (millions)
1983	0.01
1984	0.13
1985	0.33
1986	0.68
1987	1.23
1988	2.07
1989	3.51
1990	5.28
1991	7.56
1992	11.03
1993	16.01
1994	24.13
1995	33.79
1996	45.41

The question:  
How can we tie individual level behavior to the  
aggregate level data managers often face ?



# Diffusion of Innovation - First steps with CA

0 - a potential buyer

1 - an adopter

$p$  - probability to adopt due to external effects

$q$  - probability to adopt due to an interaction with one adopter

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0



0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0
1	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0
0	0	1	0	0	1	0	0
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0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

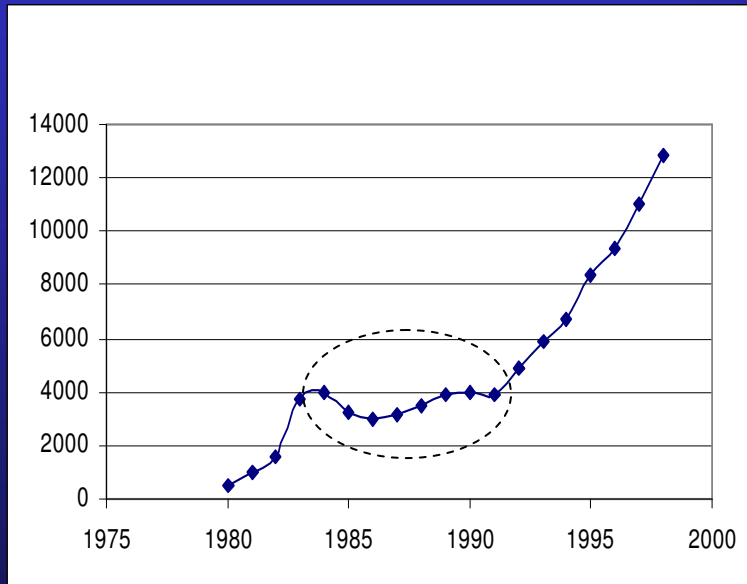


1	1	1	1	1	1	1	1
1	1	1	1	0	0	1	1
1	1	1	1	1	1	1	1
1	0	1	1	0	1	1	1
1	1	1	1	1	1	1	1
0	0	1	1	0	1	1	1
1	1	1	1	1	1	1	0
1	1	1	1	1	1	1	0

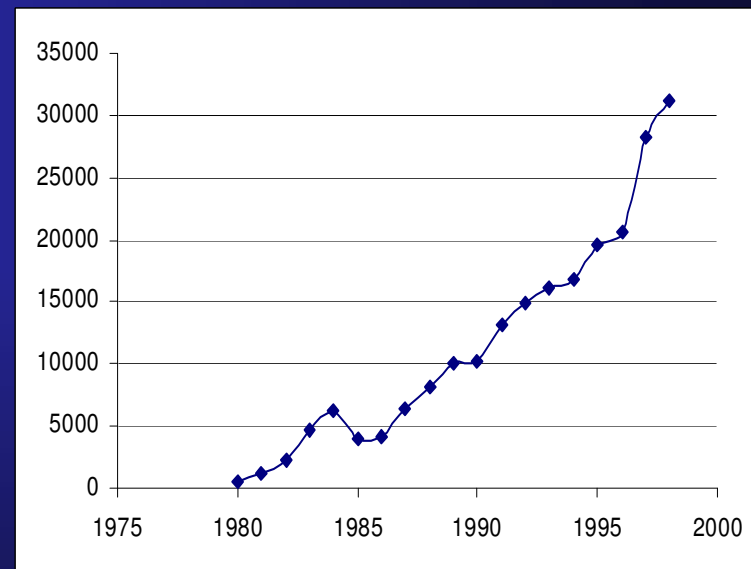
$$\text{Individual Probability of Adoption} = PA = 1 - (1-p)(1-q)^k$$

# Saddle's Ubiquity

## Saddle in Personal Computers



## Saddle in Cordless Phones

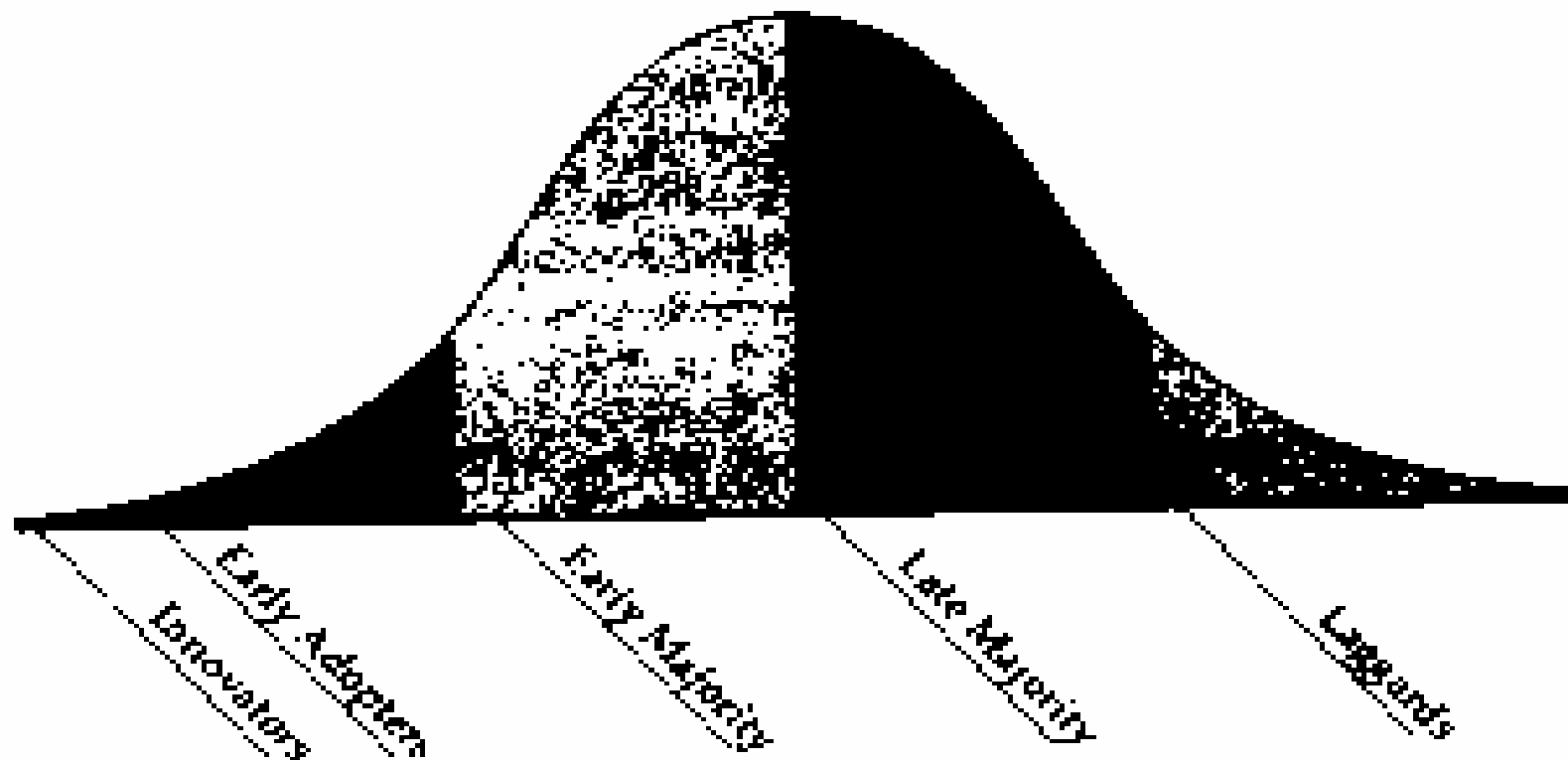


# Different types of adopters

12

CROSSING THE CHASM

Technology Adoption Life Cycle

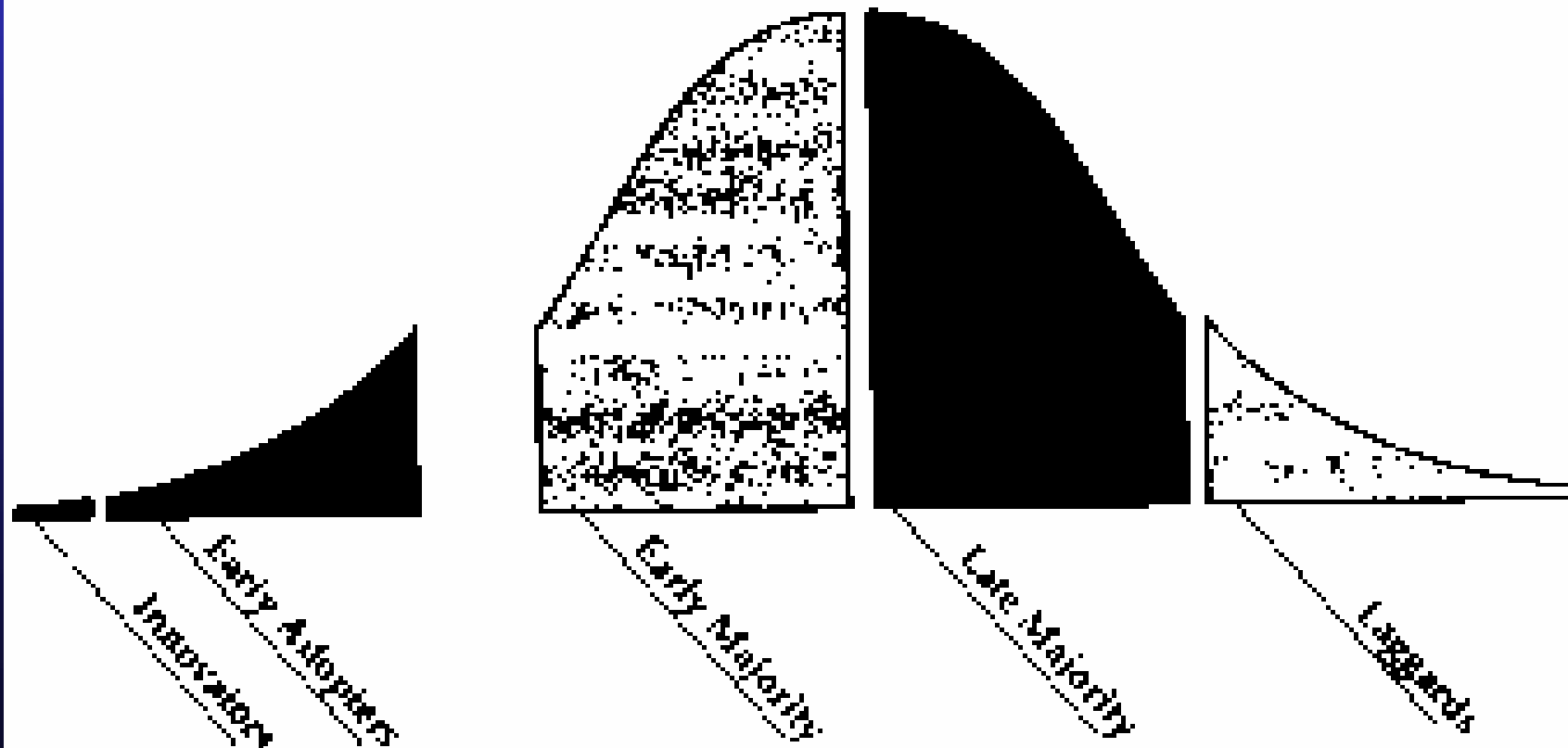


# The Chasm

*High-Tech Marketing Illusion*

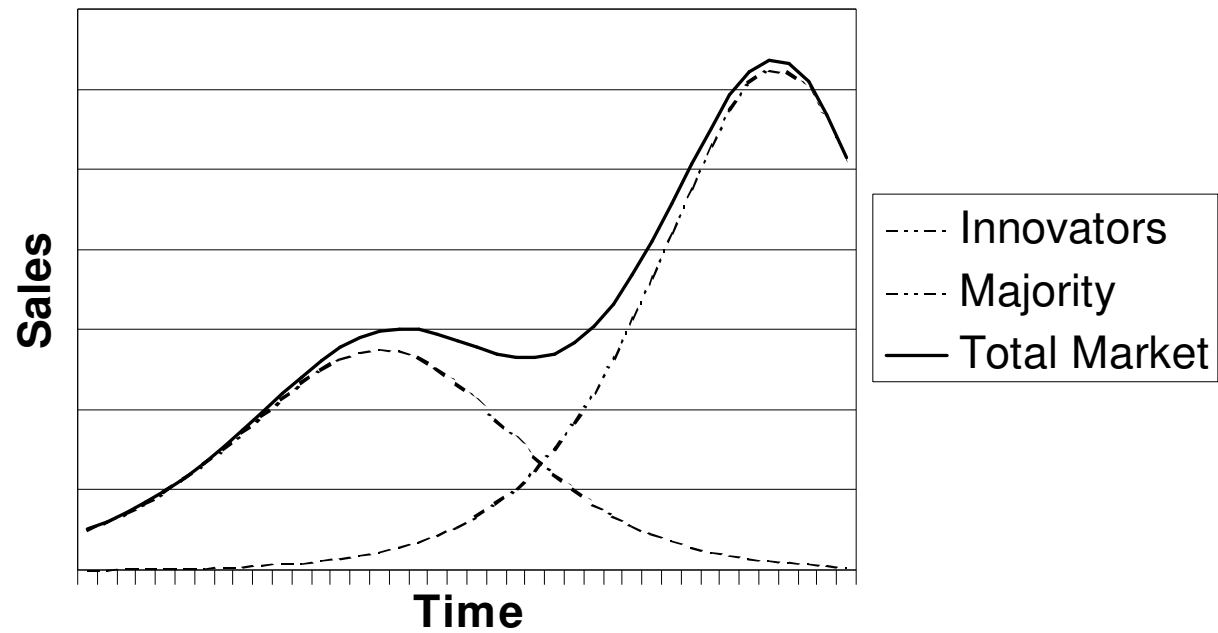
17

## **The Revised Technology Adoption Life Cycle**



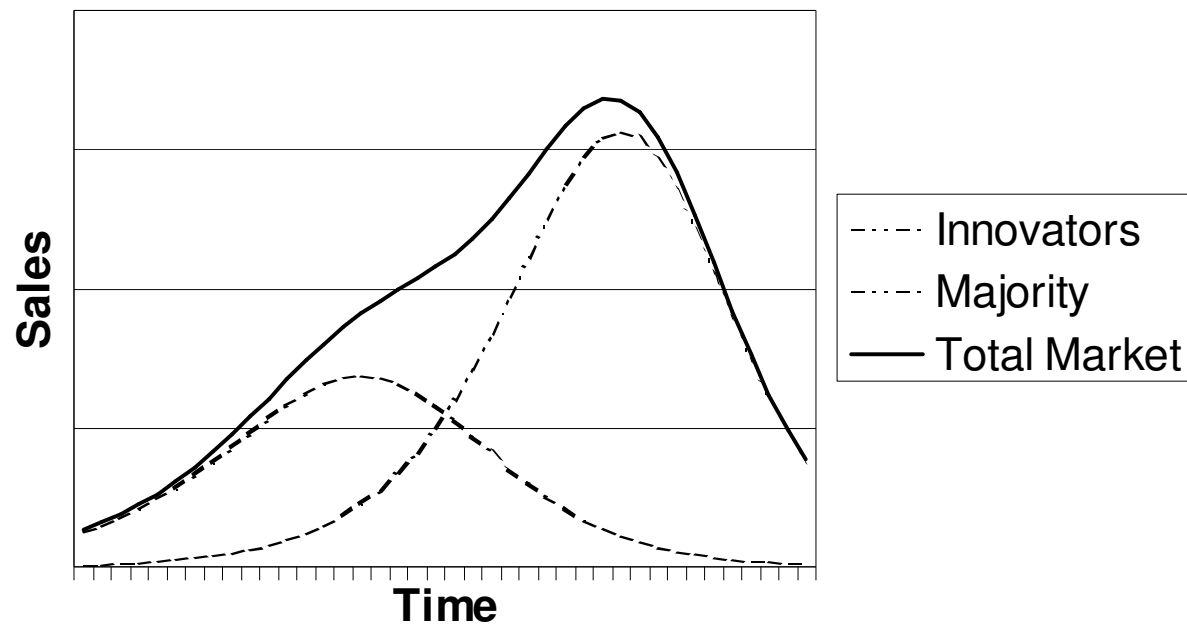
# Saddle's explication

**Dual Market - the saddle case**

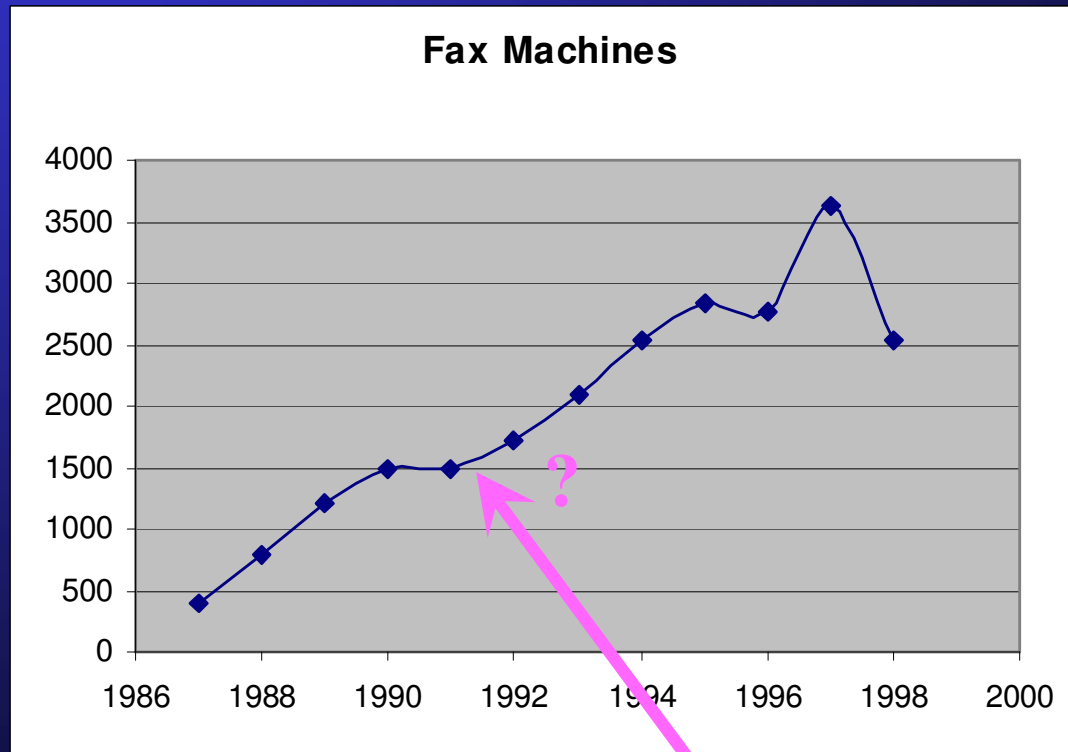


# Saddle's Criticality

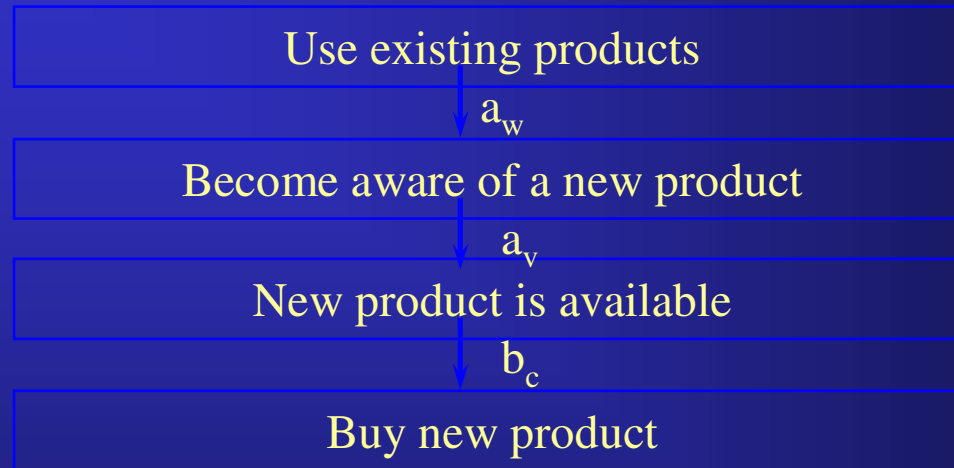
**Dual Market - the non-saddle case**



# Fax Machines



# Evaluation of Sales Formations



$$P = \sum_{c=1}^N a_w a_v b_c$$

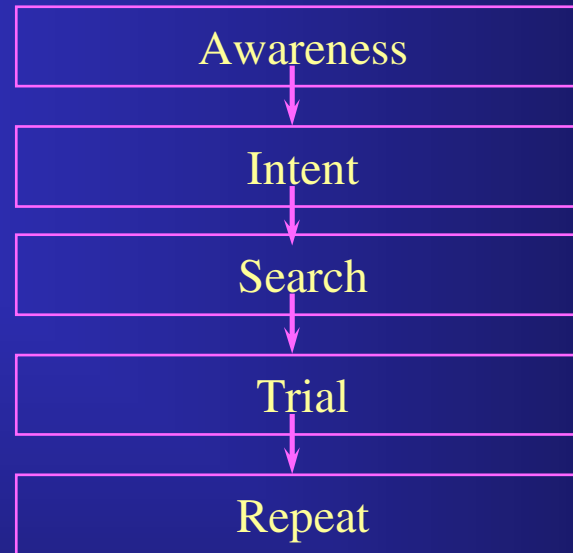
$$P = \sum_{c=1}^N a_w a_v t_c r_c$$

Where:  $t_c$  - trial probability, given awareness and availability

$r_c$  - long run share of purchases per period for new brand by customer  $c$ , given that he tried the product

# Test Market Analysis

Hierarchy of effects model:



Recursive methods - TRACKER (Blattberg and Golanty, 1978)

$$T_t = T_{t-1} + \alpha_2 (A_t - A_{t-1}) + \beta_2 (A_{t-1} - T_{t-1})$$

**Where:**

- T - the trial at time t
- A - awareness at time t
- The coefficients are estimated by a regression.

# Sales Forces

## Sales force sizing

$$\text{Maximize } Z = PQ(X) - C_1(Q) - C_2(X)$$

Where:  $Z$  = profit,  $P$  = selling price,  $Q(X)$  = number of units sold as a function of selling effort,  $C_1(Q)$  = total cost of producing and merchandising  $Q$  units,  $C_2(X)$  = total cost of selling effort of level  $X$

## Allocation of selling resources across products

$$3N = ND_c + \frac{N}{2} D_h + \frac{N}{4} D_q$$

Each salesperson contacts  $N$  customers and promotes three products on each contact. The total effort is  $3N$ .  $D_c$  is the number of product receiving complete coverage,  $D_h$  is the number of products receiving half coverage and  $D_q$  are receiving quarter coverage.

# The effect of Promotions

- Couponing
- Price-off
- Sampling

$$P = (1 - s)N_p a_w a_v TR + N_p a_v U_s R_s$$

## Where:

s - percentage of target group sampled.

$N_p$  - number of consumers purchases in the product category per period

$R_s$  - long run share of purchases for new product among those who have even made a trial purchase

$U_s$  - Proportion of samples sent that are used by members of target group

# Awareness, Trials and GRPs (PDMA Handbook)

