5 Cost-Leadership Strategies

1. Low Cost Strategy Utilizing Experience Curve Effect

1.1 Experience curve Effect

◆Phenomenon in which unit cost decreases at certain rate every time cumulative production quantity doubles

■Easy Example

At certain factory, the cumulative production quantity since its start up was 100 pieces, whereat the cost per unit was 100 Yen.   Reportedly, this cost per unit kept on decreasing: When the cumulative production quantity became twice as much to 200 pieces, the unit cost came down to 80 Yen (100X0.8), and likewise, with 400 pieces at 64 Yen (80X0.8), and 800 pieces at 51.2 Yen (64X0.8).   In this way, the experience curve effect is about unit cost which decreases at certain rate (80% in this example) each time the cumulative production quantity doubles. This rate (80%) is called a proficiency rate.
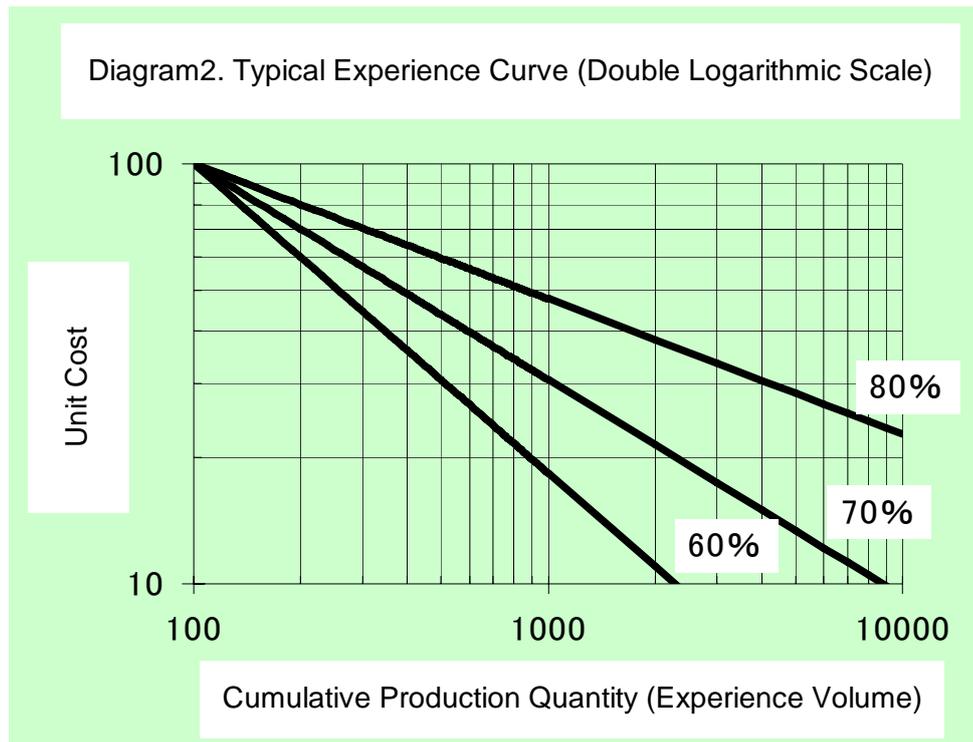

Diagram 1. Typical Experience Curve (Standard Scale)
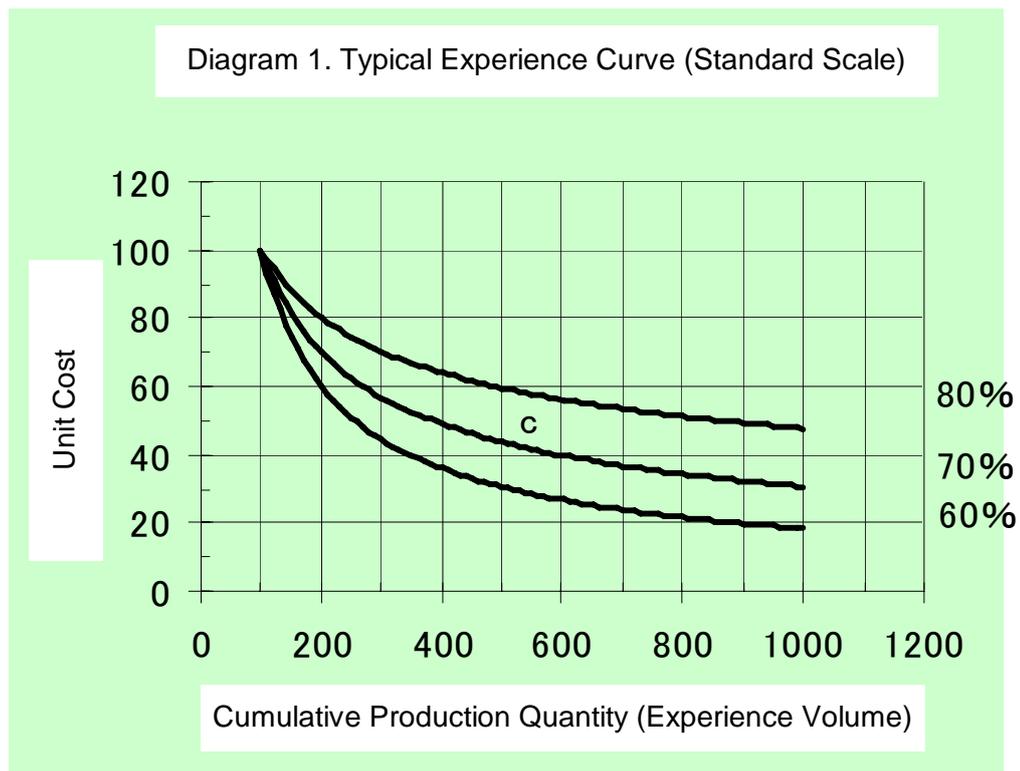
Numerical Example of Experience Curve

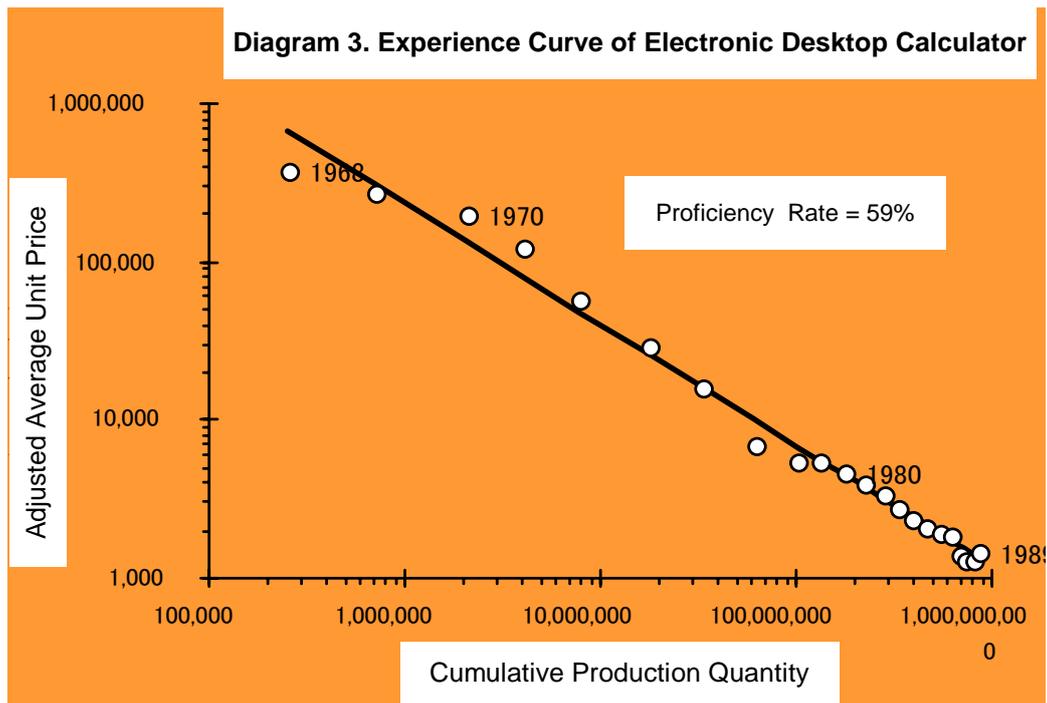| Cumulative Production Quantity		100	200	400	800	1000	5000	10000
Unit Cost	Proficiency Rate 80%	100	80.0	64.0	51.2	47.7	28.4	22.7
	Proficiency Rate 70%	100	70.0	49.0	34.3	30.6	13.4	9.4
	Proficiency Rate 60%	100	60.0	36.0	21.6	18.3	5.6	3.4

■Background to Finding

This Experience Curve Effect was found in the1930s in the process of researching the production cost of aircrafts in the U.S. Inasmuch as the production of aircrafts in general did not adopt a production system for the economy of scale to work strongly, a chronological cost reduction could not be fully explained by the economy of scale alone. With that, by separating the economy of scale describing the relationship between production scale and unit cost、a relationship between cumulative production quantity and unit production cost came to be called Learning Curve. Since then, similar studies were conducted on various industries to have found, not limited to production cost, the same kind of phenomena regarding unit cost including overhead cost relevant to selling. To that end, a case which is not limited to production cost has been named Experience Curve separating from Learning Curve.

■Graph

The experience curve is expressed on a graph in which the vertical axis represents unit cost and the horizontal axis the cumulative production quantity. On a graph with a standard scale, the experience curve is a downward-sloping and convex-shaped curve toward the original point (Diagram 1), while normally this is drawn as a straight line on a graph using a double-logarithm scale. (Diagram 2).

Diagram2. Typical Experience Curve (Double Logarithmic Scale)

100

Unit Cost

80%

70%

60%

10

100   1000   10000

Cumulative Production Quantity (Experience Volume)

However, the value of cost needs to be adjusted by using the deflator in order to eliminate inflationary effects. The ratio of cost descent indicated by the experience curve drawn through such manners differs by industry: Every time the cumulative quantity doubles, some industries see their unit cost decreased to only 90% of their earlier figure, while others witness as much as 60%. This ratio, normally called a proficiency ratio, is different by industry, while it is said that there is little difference in the one among firms within an industry which produces the identical products. Although the vertical axis of the experience curve is essentially supposed to indicate unit cost, in case the experience curve of an industry as a whole is drawn, the average shipment price of that industry comes to be often employed as its proxy variable (Diagram 3).
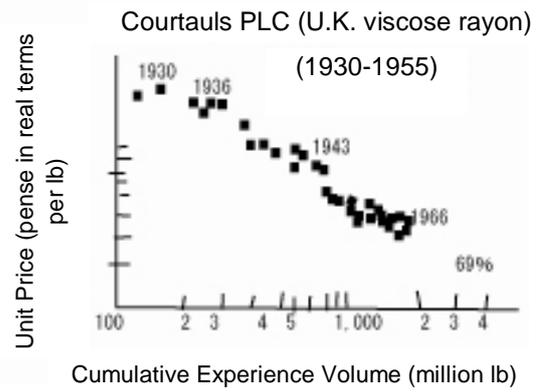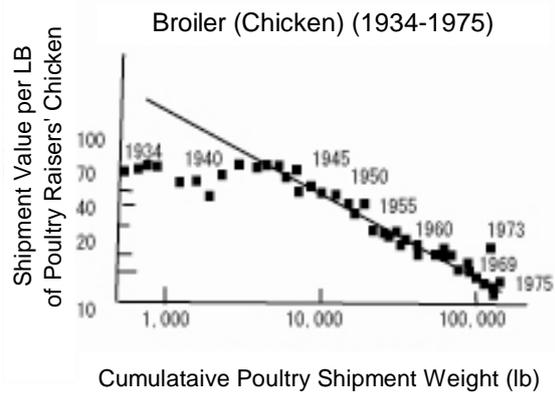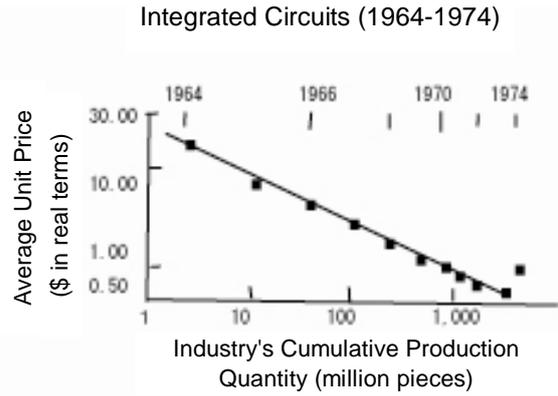
Diagram 3. Experience Curve of Electronic Desktop Calculator

Proficiency Rate = 59%

Adjusted Average Unit Price

1,000,000

100,000

10,000

1,000

100,000   1,000,000   10,000,000   100,000,000   1,000,000,00
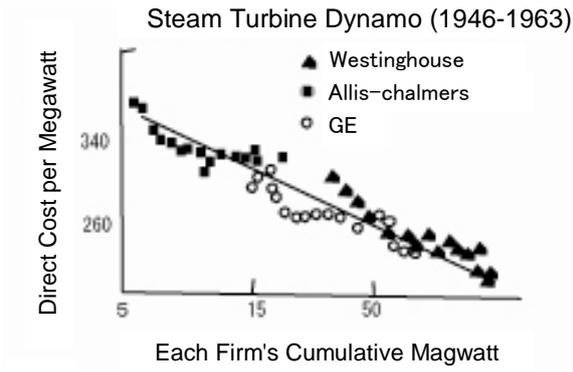0

1968

1970

1980

198

Cumulative Production Quantity
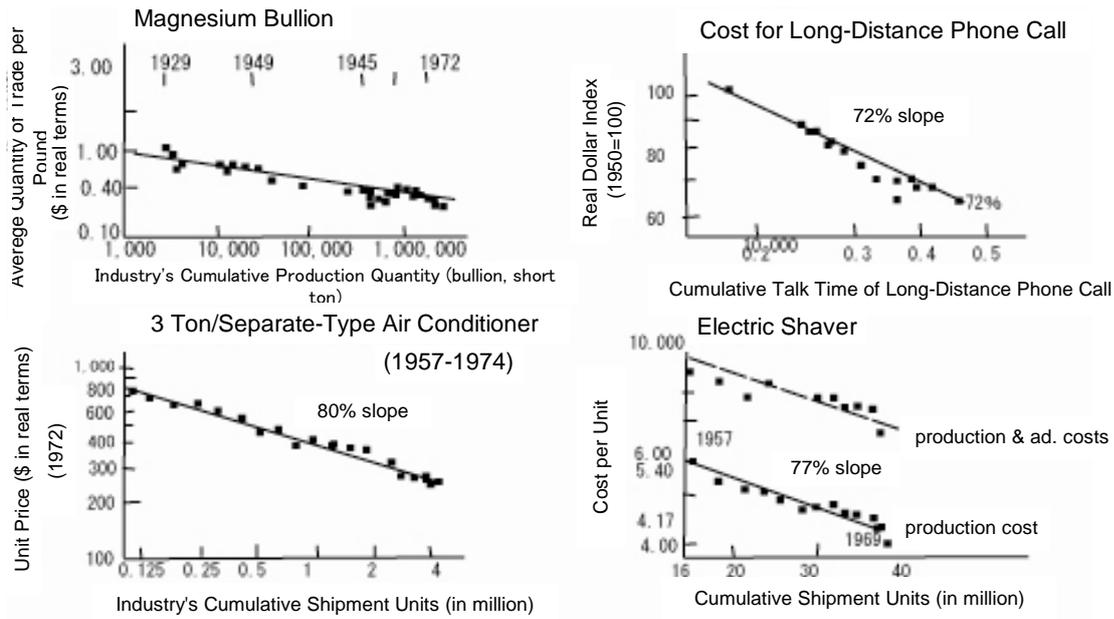
■ Variance in Proficiency Ratio by Industry

Proficiency ratio varies by industry.

It is said that there is no big difference in this ratio among firms producing the same product.

What does it mean to each firm?

Steam Turbine Dynamo (1946-1963)

Direct Cost per Megawatt

▲ Westinghouse
■ Allis−chalmers
○ GE

340

260

5   15   50

Each Firm's Cumulative Magwatt

Integrated Circuits (1964-1974)

Average Unit Price ($ in real terms)

1964   1966   1970   1974

30.00

10.00

1.00

0.50

1   10   100   1,000

Industry's Cumulative Production Quantity (million pieces)

Broiler (Chicken) (1934-1975)

Shipment Value per LB of Poultry Raisers' Chicken

100
70
40

20

10

1934   1940   1945   1950
1955
1960   1973
1969
1975

1,000   10,000   100,000

Cumulataive Poultry Shipment Weight (lb)

Courtauls PLC (U.K. viscose rayon) (1930-1955)

Unit Price (pense in real terms per lb)

1930
1936
1943
1966
69%

100   2 3 4 5   1,000   2 3 4

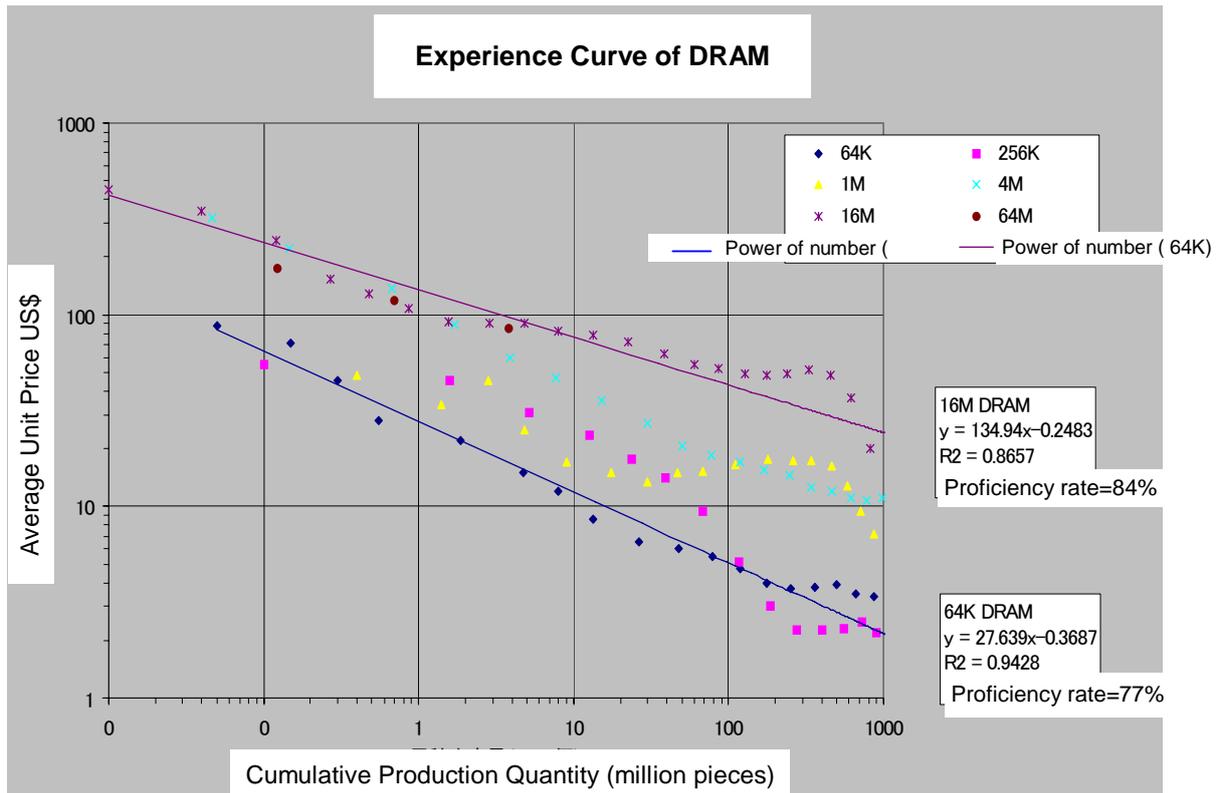Cumulative Experience Volume (million lb)

Note: Scrupulously the experience curve is a diagram to show the relationship between the experience
volume and cost. However, due to scarcity in the publication of cost figures, the relationship between
the industries' shipment price ($ denomination in real terms) and experience are shown in most of the
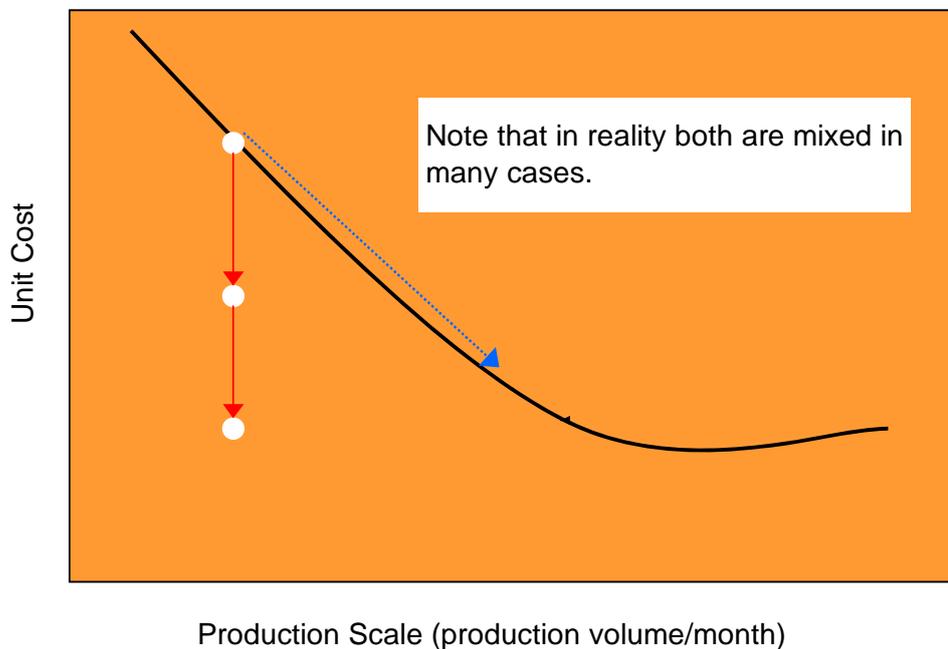above 8 diagrams.
Data: The Boston Consulting Group

Diagram 3-3 Examples of Experience Curve

Origin: D. F. Abell & J. S. Hammond (Author) I. Kataoka (Translator) (1982). *Strategic Marketing
Plan*, Diamond Inc.

Experience Curve of DRAM

Average Unit Price US$

- ◆ 64K
- ■ 256K
- ▲ 1M
- ✕ 4M
- ✳ 16M
- ● 64M

—— Power of number (———— Power of number (64K)

16M DRAM
$y = 134.94x^{-0.2483}$
$R^2 = 0.8657$
Proficiency rate=84%

64K DRAM
$y = 27.639x^{-0.3687}$
$R^2 = 0.9428$
Proficiency rate=77%

Cumulative Production Quantity (million pieces)

■Economy of Scale and Experience Curve Effect

Unit Cost

Note that in reality both are mixed in many cases.

Production Scale (production volume/month)

■Causes to Sprout Experience curve

(1)Increase in Workers' Efficiency

7

In repeating certain job, workers familiarize themselves with it and learn remedies and shortcuts to enhance their efficiency. Thus, the more jobs there are that workers decide on their production speed, the higher their proficiency level becomes through experience.

(2)Job Specialization and Method Improvement

Specialization in certain job results in an enhancement of its production efficiency. (Division of labor increases workers' experience volume.) Also, some improvement of processes and movements contributes to an efficiency increase.

(3)New Production Process

Particularly in capital-intensive industries, new developments and improvements of their manufacturing processes can become significant sources of their cost reduction. For instance, in the semiconductor industry with a low labor-intensive level, firms concentrate a fairly large portion of their R&D activities on the upgrading of their production technology, thereby showing the industry's experience curve at 70% to 80%.

(4)Increase in Efficiency of Production Facilities

When production facilities are designed in the beginning, their production efficiency often stays at a relatively low level. As the manufacturing experience using these facilities increases, a breakthrough step may be found aiming at an advancement of the production efficiency

(5)Change in Mix of Utilized Resources

With the accumulation of experience, producers often turn out to be able to utilize different or cheaper resources. Such examples are unskilled laborers switching positions with proficient workers, and automatic machines replacing labor force.

(6)Standardization of Products

Standardization makes it possible for workers to repeat jobs required for acquiring their proficiency. In the production of Ford's Model T, for instance, standardization was pursued positively.   As a result, there were price reductions in line with the 85% experience curve over a number of times during the period of 1909 through '23.   Even for a case in which a broad range of product lines is necessary, the standardization at the level of parts can provide the full benefit of a greater experience effect.

(7)Product Design

Along with the accumulation of experience on a specific product, its maker and customers come to be able to clearly capture the functions desired for this product. As such an understanding grows deeper, while improving each of the product functions observed from various angles, it becomes all possible for the maker to apply a product design for economizing raw materials, and to enhance an efficiency in the production process and to introduce

lower-cost parts/materials.

(8)Boost in Yield Ratio

With such forces as in the above, the yield ratio (ratio of conforming units) goes up.   In the fields of semiconductors, liquid crystal panels and CCD, an uplift of the yield ratio constitutes an enormous factor in terms of their cost reduction.   A mass production of a new product in these industries sometimes gets started with a 10% yield ratio. If the yield ratio becomes twice as much, an input cost like that of raw materials drops as much as 50% by a simple arithmetic.

The above-mentioned factors indicate that the reduction in cost based on experiences does not arise spontaneously、but rather that that is a result of powerful efforts and pressures aiming at the cost reduction.   And the experience effect and economy of scale proceed simultaneously in many instances.   However, the experience effect described here primarily refers to the effect ingenerated by the experience in consequence of inventive brain, skillfulness, technical capability and masterfulness, all of which human beings are possessed.

1.2 Penetrating Pricing Policy

As stated in the above, that <u>all firms within certain industry have just about the same proficiency ratio</u> provides an important bearing in terms of a pricing policy.   In other words, if one firm can project the industry's proficiency ratio from its own data, <u>as long as the cumulative quantity can be found, this firm can project and foresee costs not only of its own but of other firms.</u>

Assuming the proficiency ratio is equivalent in an industry, it does not mean that each firm's cost is identical at the same point of time. Chart 1 is to show that, for two firms having the proficiency ratio of 80% and initially the same cumulative production quantity and unit cost, if there is a variance in the sales growth rate between these two, there occurs a big difference in cost position in the next 4 years. To compare one firm of a low growth at 10% and another of a high growth at 50%, although the initial cost is identical 100 for both, the former's cost becomes 56 and the latter's 44 in 4 years to come, hence the cost of the low-growth firm turning out nearly 1.3 times as high as that of the high-growth one.   Accordingly, <u>it is a strategically critical issue for a firm to slide down on the industry-common experience curve more speedily than others</u>.

Chart1　Variance in Experience Volume and Speed of Cost Decrease

Low-Growth Firm

Yr.	Sales Quantity	Cumulative Production Quantity	Unit Cost	Initial Price
0	1000	1000	100	110
1	1100	2100	79	87
2	1210	3310	68	75
3	1331	4641	61	67
4	1464	6105	56	61
5	1611	7716	52	57
6	1772	9487	48	53
7	1949	11436	46	50
8	2144	13579	43	47
9	2358	15937	41	45
10	2594	18531	39	43

High-Growth Firm

Yr.	Sales Quantity	Cumulative Production Quantity	Unit Cost	Initial Price
0	1000	1000	100	88
1	1500	2500	74	69
2	2250	4750	61	60
3	3375	8125	51	54
4	5063	13188	44	49
5	7594	20781	38	46
6	11391	32172	33	43
7	17086	49258	29	40
8	25629	74887	25	38
9	38443	113330	22	36
10	57665	170995	19	34

　　Such a gap in sales growth rate should be linked with changes in the market share.　The growth rate of a firm that expands its market share is higher than an average growth rate of the industry, and conversely, the growth rate of one that loses its market share becomes lower than the industry's average growth rate.　The cumulative production quantity of a firm that maintains the top share

since the industry's introductory period is the largest in this industry, hence this firm's cost at the lowest in the same industry.   Also, even when a firm does not occupy a top share in the beginning, if it attains the top position preferably in an early stage of the life cycle, and expands or maintains its share, it can gain the lowest-cost position in the industry.   This kind of firm can establish an overwhelming competitive advantage over other firms on the cost front.

One variable that influences market share is price.   When furnished products are the same, a firm setting its price lower than others should increase its share.   The firm can expand its market share by providing its product at a price lower than other firms', even squeezing its margin at first. This leads the firm to attaining a greater cumulative production quantity than others, and owing to the experience curve effect it can build a lower cost than others.   Consequently at the next time point this firm is also capable to set out a price lower than others' taking advantage of its low cost position, and further expands its market share.   Keeping up this cycle, this firm is set to establish a cost advantage that overwhelms competitors.   In this way, to set a relatively low price―albeit sacrificing the margin―with an objective to expand a market share is called Penetrating Pricing Policy.

This penetrating pricing policy has been considered effective in a period for a product to proceed from its introductory stage to growth phase.   First, in the introductory period when the market hardly expands, a firm presents a drastically low price, like below its cost in an extreme case, and boosts demand.   With that, by increasing its sales at a growth rate higher than other companies', this firm can expand its share as well as reduce its cost more speedily than others, and earn the top share while competitors are hesitant about reducing their prices. Even when the whole market turns into a growth period with rivals starting to pick price competitions, this firm can counterwork leveraging its cost advantage and knock out these opponents. By maintaining the top share in this way, the firm is able to achieve a higher profit ratio than others, as there would be no competitors challenging with the price in due course, in the large-scale market during its later growth phase and maturation period.

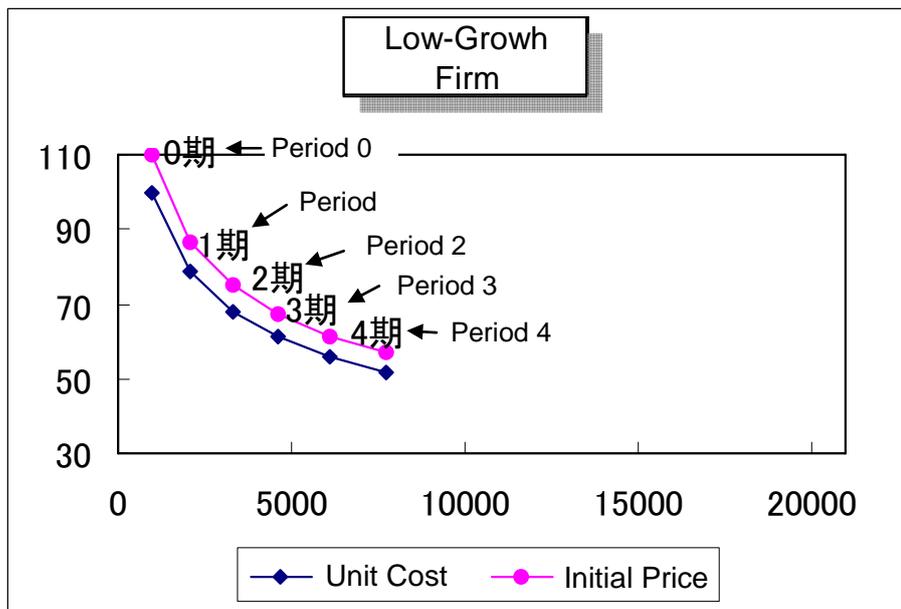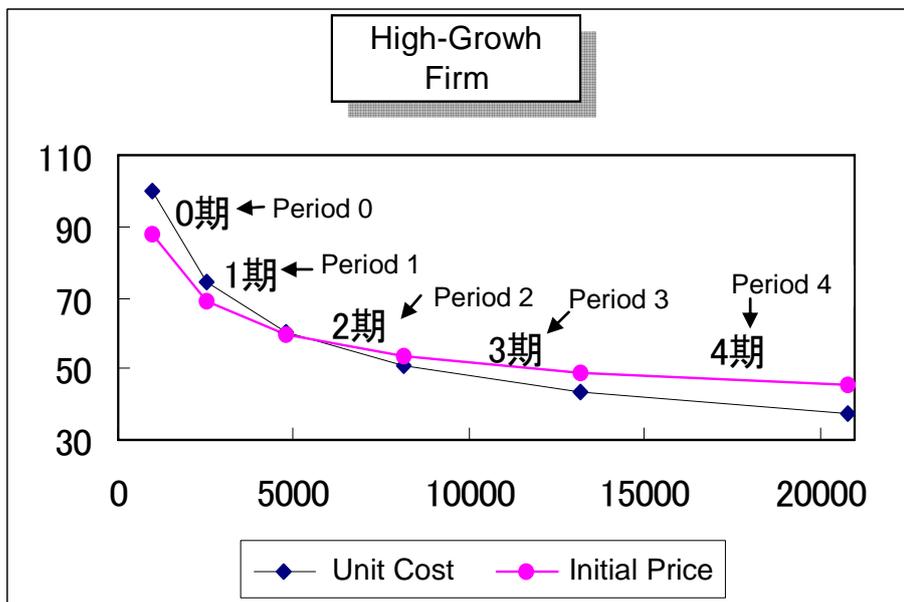### Diagram 4   Unit Cost and Price of Low-Growth Firm

### Diagram 5   Unit Cost and Price of High-Growth Firm

Diagrams 4 and 5 have been drawn based on the assumption that, in the example of Chart 1, the variance in growth ratio between the two types of firms, 10% and 50%, has transpired as the result of the following: the low-growth firm's price is set to bank on a 10% margin on top of the initial cost, while the price of the high-growth firm is set 20% lower than that of the low-growth firm. Except, in order to make the variance in real value easy to see on the graphs, the standard scale marks instead of log scale are being used on both axes. Indicated in these diagrams are the profits/losses of the current period in the form of the dimensions surrounded by the current-period's price and

initial cost, and the cost at the period's close. It is clear that, while the firm of the low growth that sets a high price earns a bigger profit in the periods 0 and 1, the profit amount of both firms in the period 2 becomes almost even, and in the period 3, the firm with a low price that attains the high growth gains a larger profit amount.

A typical example of a success in having implemented this type of pricing strategy is known to be the semiconductor business of Texas Instruments Inc. (IT).   The proficiency rate of semiconductors is normally said to be 70%, indicating it is a business under a significant influence of the experience curve effect. TI has expanded its share and earned a vast amount of profit by employing an aggressive capital investment and low-price strategy in the respective introductory period of each product evolving from transistor to IC, and to LSI.

Experience Curve of Playstation
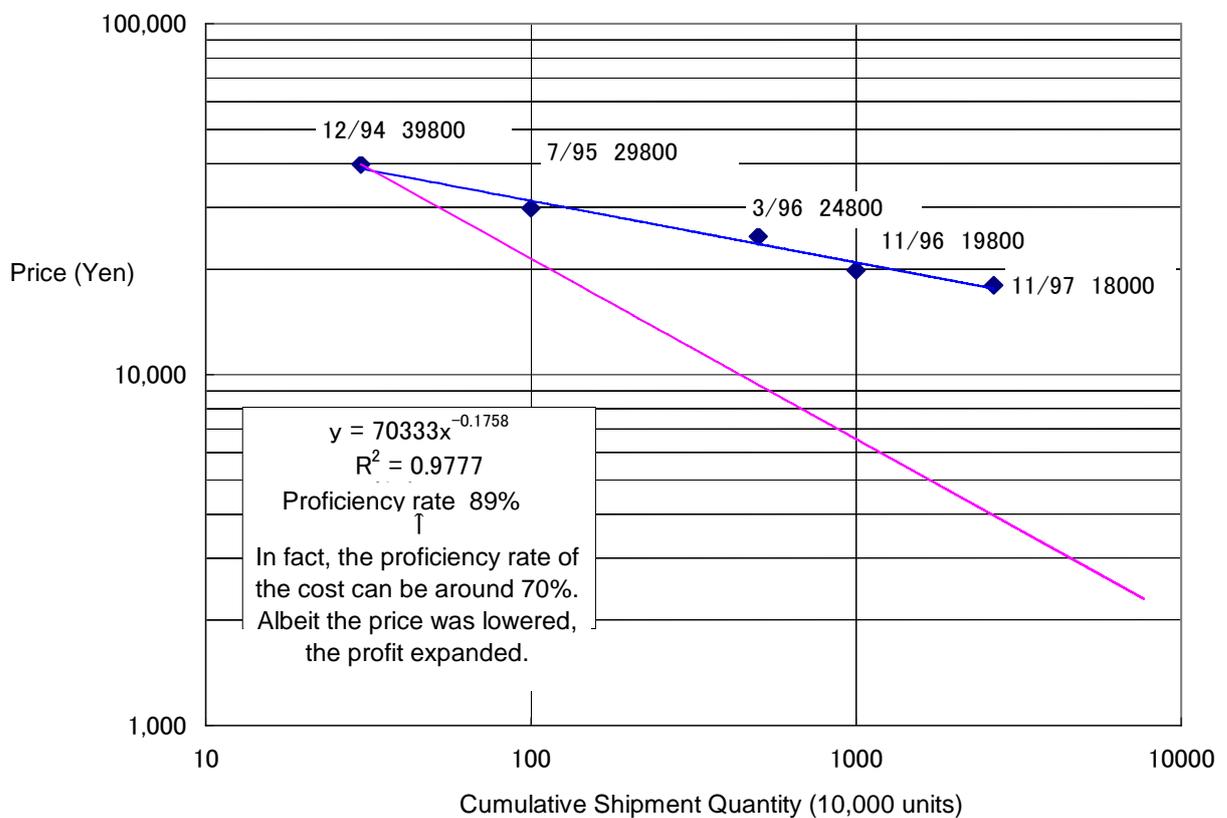
Also, Sony Computer Entertainment, Inc. that markets Playstation ("PS") has reduced the machine-body prices of PS and PS2 in stages leveraging the experience curve effect.   As companies with inferior shares could hardly follow these price cuts, the PS's share has expanded. A positive growth cycle has been established where a company with a large cumulative production quantity, resulted from disseminating more quantity, boosts its diffused quantity even further.

1.3 Limits of Strategy Pursuing Experience Effect
■Notanda on Application of Experience Curve

Nonetheless, the cost-leadership strategy that pursues the experience effect is not necessarily advantageous all the time.   For example, it is most expedient to secure a leadership in cost in an early stage of a product's life cycle when an experience volume can be easily doubled. In addition, when a market's growth rate is high, it is possible to accumulate experience in a short time span and at a relatively low cost without confronting a fierce protest as no sales of rivals is taken away. Or conversely, an accumulation of experience is difficult in the later stage of a product's life cycle or in a market with a low growth rate.

To secure an experience volume, i.e. to expand a share, it is necessary to expand a production capacity, develop new sales channels and to invest in advertising and marketing activities. Besides, with a squeeze on profit margin aiming at a share expansion, the strategy pursuing the experience curve effect, in a short term in its early phase, is risky to involve a low profit and high cost.

An example: A prime rival at the industry's top position has 24% market share, whereat own firm's share is 6%.   When the market as a whole is growing at 8%, and the prime rival is increasing its sales at the same rate with the market and maintaining its share, it is necessary for own firm to keep on increasing its sales at an annual rate of 26% (3 times as much as the industry's average) for the next 9 years so as to secure the market position equal to its rival. Furthermore, during the same period own firm has to increase its production capacity by 640%.

The experience-effect-pursuing strategy is not advantageous in such situations that a company does not possess enough resources required to secure a market leadership, or, there is a high chance to run into counter offensive by aggressive rivals, or, the growth rate of the market is low. The condition to employ this strategy is limited to a situation where all answers to the following questions are "Yes":

 ・In that industry, is there an enough segment in which the experience effect brings about an important cost advantage?
 ・In that industry, is it attractive to become the leader?
 ・Is own firm equipped, or can it be in future, with managerial resources required for its share expansion?

Even if all answers to the above-stated questions are "Yes", the cost-leadership strategy to pursue the experience effect does not preserve its effectiveness forever. As a limitation of the strategy to pursue the experience effect, it is pointed out that an accumulation of past experience does not provide a cost advantage due to structural changes in market needs and technological innovations (product/manufacturing technology), etc.

■Example of Ford

Ford achieved a successful outcome by pursuing its experience effect with "Model T" launched in 1908. This company limited its product to a single mode, built large-scale assembly factories, segmentalized jobs sophisticatedly, implemented production facilities specialized in specific jobs, reduced its outsourcing cost by mass purchase and simultaneously conducting the vertical integration, thus cutting the product cost uncompromisingly.   Reflecting the cost reduction on its

pricing, Ford was in the market-leader position occupying a 55.4% share in 1921.

The figure is omitted
due to copyright.
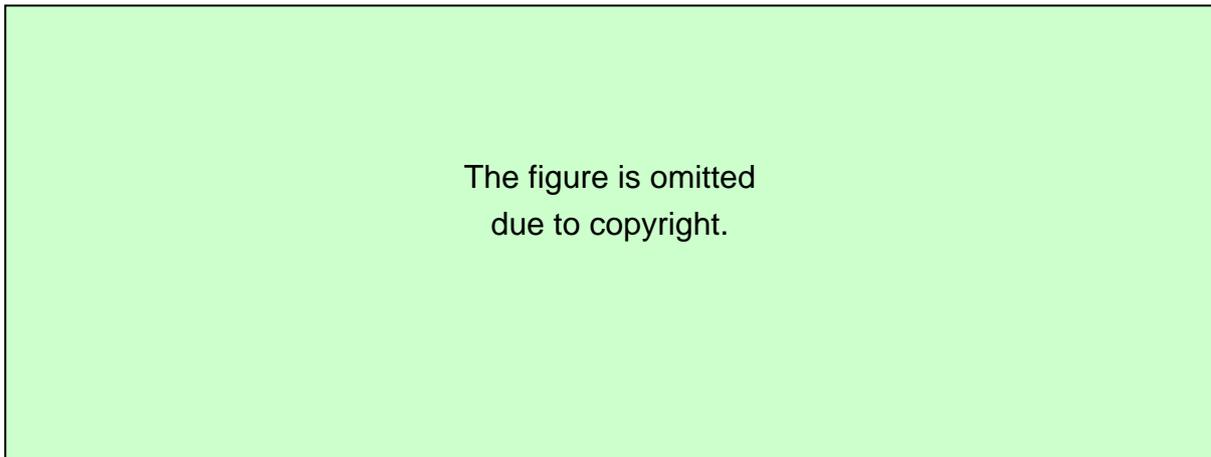
Origin: Abernathy and Wayne (1974), *Limits of Learning Curve*, Harvard Business Review 52(5)

During this time, however, consumers grew dissatisfied with cars that were merely cheap and of practical use. Such additional features as riding comfort and "sportiness" were demanded with cars. It was General Motors (GM) that appropriately responded to such structural change in the market needs.   GM offered a multitude of models in full line that met "every pocketbook", and, at the same time, facelifted these models every year.

Meanwhile, Ford introduced Model A in order to correspond to demands of the new market, at which point in time the experience accumulated with Model T turned out not to furnish any cost advantage. Moreover, with the confusion in factories originated by frequent design changes of Model A, which simultaneously blocked an accumulation of new experiences, the factories were pushed into closing for a year starting in 1927. Unable to adjust itself to both the new market demands and new technology, Ford resulted in giving up its industrial top spot to GM, and since then has not been able to recapture that position in U.S. market to date.

Accumulating experience faster than rivals in a short period often requires specialized laborers and facilities/organizations that cannot be converted to other applications, thereby it is possible to enhance productivity for specific products.   On the other hand, this loses flexibility, making it difficult to respond to new market needs or technologies. These phenomena is called "Dilemma of Productivity."

■ Shared Experience

When there are products using the common parts, some apparent variance in proficiency ratio takes place for these products depending on firms.

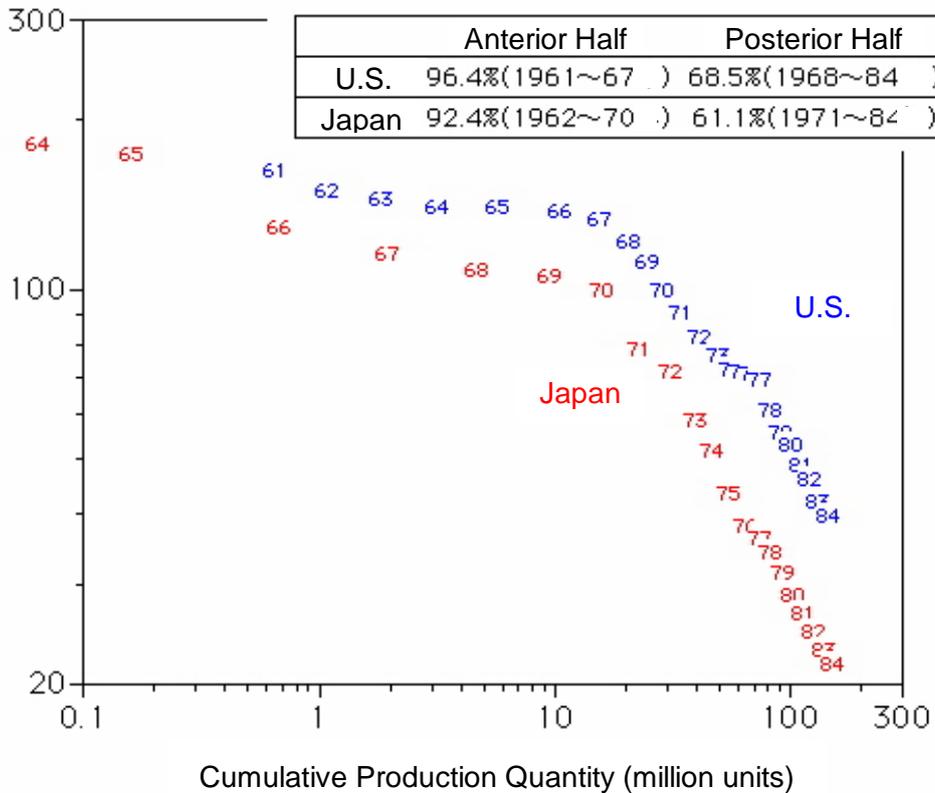Example: Interpretation on Honda's Success

The figure is omitted
due to copyright.

Origin: Day & Montgomery (1983), *Diagnosing the Experience curve*, Journal of Marketing, 47(2)

■Inflection of Experience Curve in Industry Level
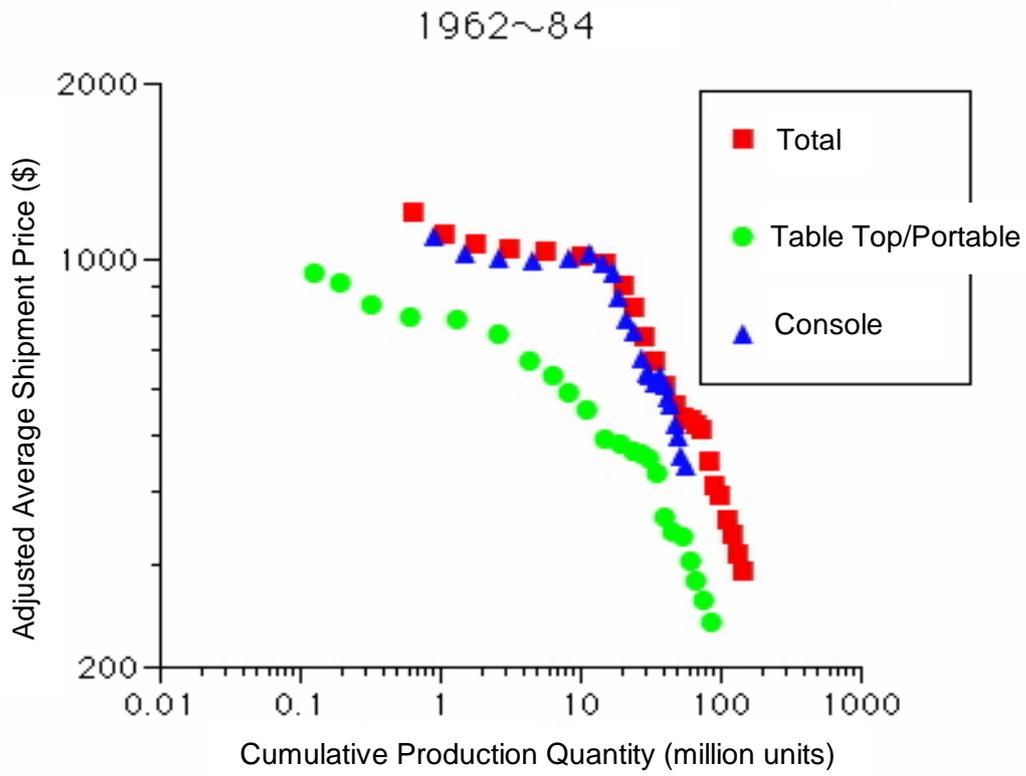
●Variance between Japan and the U.S.?

Diagram 2-7 Experience Curves of Color TV Industry in Japan & U.S.

Average Shipment Price Index (1970=100)

	Anterior Half	Posterior Half
U.S.	96.4%(1961~67)	68.5%(1968~84)
Japan	92.4%(1962~70)	61.1%(1971~84)

Cumulative Production Quantity (million units)

●Component Ratio?

Diagram 2-9   U.S.: Experience Curves of Color TV by Type

1962~84

Shintaku, Junjiro (1994), *Competitive Strategies of Japanese Companies*, Yuhikaku Publishing

●Mechanical Type Inflects, Too?

Diagram 1-8   Experience Curves of Watches in Japan
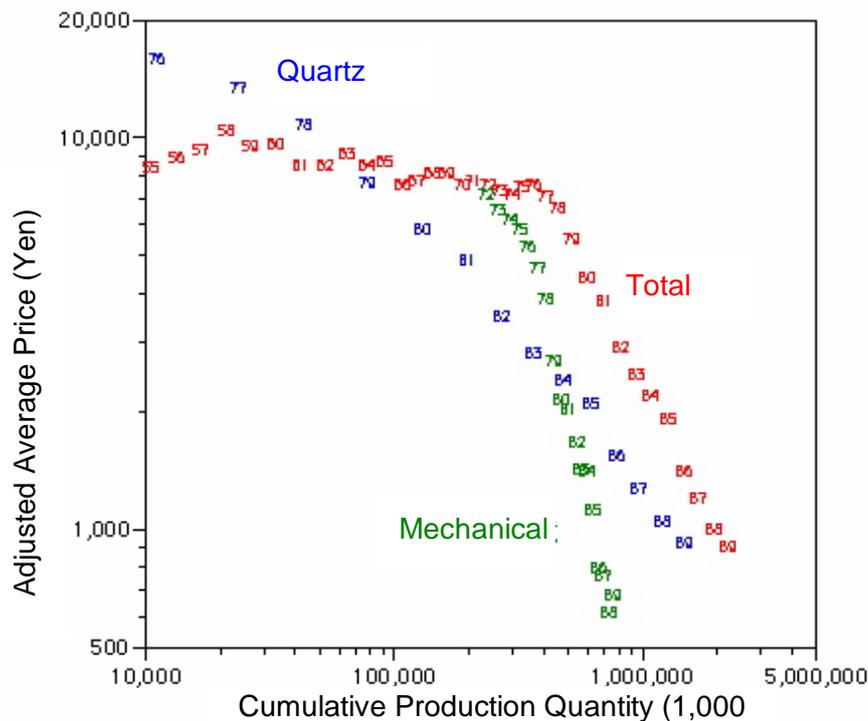
Shintaku, Junjiro (1994), *Competitive Strategies of Japanese Companies*, Yuhikaku Publishing

(1)Conversion of Fundamental Technology

When the fundamental technology employed for certain product (process) significantly changes in the whole industry, so does its proficiency ratio which is the basis of the experience curve, and this curve inflects. An example of this is a change from the mechanical technology to the electronic technology

(2)Increase in Exit Corporations

When the number of firms exiting from certain industry increases after their defeats in competition, none of these firms' production quantity comes to be added to the entire industry's cumulative quantity, and the industry's experience curve inflects downward.

(3)Intensification of Price Competition

In an industry where all competitors employ a high-margin pricing policy, if a price competition becomes intense due to some reason, every company's margin gets gradually squeezed, albeit the proficiency ratio of cost is constant, the industry's experience curve expressed in price inflects downward.

(4)Increase in Ratio of Low-Price Products

When there are products of different specifications ranging in a broad price zone in the industry, if a composition ratio of products in the low-price zone goes up, an average price of the whole industry goes down, and the industry's experience curve inflects downward.

■