

What Makes It Cheaper Is the Count, Not the Calendar

— The tenth year at ten a year and the first year at a hundred a year both give exactly **0.227061661** — ten times the elapsed years, the same number built — at a learning rate of **1.0** the price stays at **1** however much is accumulated — [Paper 434]

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— *From thinking to syncing.* —

Abstract

Things are said to get cheaper the more one makes. They are also said to get cheaper with time. This paper shows that these are two different statements—and that which one acts can be separated by numbers. No new theorem or law is claimed. First, a learning rate of 0.80 corresponds to an exponent of **−0.321928**, and doubling the count gives exactly 0.800000000 (Section 2). Second, a cumulative count of 4 gives 0.640000, 8 gives 0.512000, and 1000 gives 0.108197 (Section 2). Third, this is the core of the paper. The tenth year at ten a year and the first year at a hundred a year give exactly the same **0.227061661** (Section 3). Fourth, compared at the same year, building faster is always cheaper by **2.0986** (Section 3). Fifth, at a learning rate of 1.0 the price stays at **1** however much is accumulated (Section 4). Sixth, the separator is whether the calendar advanced or the count did (Section 4). **Keywords:** learning curve, experience curve, Wright’s law, cumulative production, learning rate, power law, unit cost.

Scope of this paper (scope note): No new theorem or law is claimed—learning curves, experience curves and power-law fitting are all standard. No learning rate is asserted—0.80 is representative for exposition and runs from 0.7 to 0.95 across industries and processes; it is not the value of any particular field. The mechanism is not decomposed—how much comes from practice, process improvement, economies of scale or redesign is not the subject. Fitting statistics are not treated—whether a power law is the best fit, and the error on the exponent, are not the subject. No prediction is claimed—no method for forecasting future prices is offered. The effect of time is not denied—routes by which calendar time itself acts (material prices, technology arriving from outside) are possible. This paper does not deny them; it shows what a count-only model says. Relation to earlier papers: Paper 433 showed that an effect continues after the cause is gone—there time was the actor; here it is not. Paper 300 showed that common root and distinct root can be decided—“cheaper with time” and “cheaper with count” are distinct roots by that criterion. Paper 427 showed that event time does not line up with clock time—there too, an externally imposed clock and an internally counted number were different things. Paper 417 showed that the ceiling on chain length is not a fact about animals—there too a multiplication held all the way down. What is added is giving the price at six cumulative counts, using the exact learning rate on doubling as a check of the definition, matching exactly the point where two production speeds give the same price, showing the same-year ratio to be independent of the year, placing a learning rate of 1.0 as the other side of the boundary, and placing the separator at “calendar or count”.

1. Notation and the Question

Setting: Write the unit price against the cumulative count n , with the first unit at 1.

$$C(n) = n^b, \quad b = \frac{\ln r}{\ln 2}$$

Here r is the learning rate, the ratio of prices when the cumulative count doubles. Below, $r = 0.80$.

Observation 1.1

“Cheaper with time” and “cheaper with count” happen together. The years pass and the units accumulate—which makes it hard to tell which is acting.

Observation 1.2

But they can be separated. Change the speed of production and years and count come apart—simply arrange for the same year to carry different counts.

Question: Pulled apart, which one does the price follow.

2. Doubling the Count Gives Exactly 0.80

Computation 2.1: Take the exponent from the learning rate of 0.80.

$b = \ln 0.80 / \ln 2 = -0.321928.$

Observation 2.2

It is negative. More count, lower price—a check that the direction is right.

Computation 2.3: Take the price at several cumulative counts.

Cumulative count	Price (first unit = 1)
1	1.000000
2	0.800000
4	0.640000
8	0.512000
100	0.227062
1000	0.108197

Observation 2.4

Each doubling gives exactly 0.80. $0.64 = 0.80^2$ at four, $0.512 = 0.80^3$ at eight—as the definition requires, confirming the implementation.

Observation 2.5

At a thousand it is 0.108197. About a ninth of the first unit—three orders of count buy one order of price.

Observation 2.6

Being a power law, it never stops falling. There is no floor in the expression—but the rate of fall slows sharply.

3. The Tenth Year and the First Give the Same Value

Computation 3.1: Vary the speed of production and compare prices at the same year.

Year	Ten a year	A hundred a year	Ratio
1	0.476510	0.227062	2.0986
5	0.283827	0.135246	2.0986
10	0.227062	0.108197	2.0986

Observation 3.2

The tenth year at ten a year equals the first year at a hundred a year. Both **0.227061661**—ten times the elapsed years, and the same total of one hundred built.

Observation 3.3

That is the separator. Different years and the same price means the price does not follow the years—and the agreement is not a coincidence but an exact identity.

Observation 3.4

At the same year, faster is always cheaper by **2.0986**. The ratio does not depend on the year—being a power law, the ratio of speeds, 10, raised to -0.321928 appears directly.

Observation 3.5

So “we have been doing this for years” is no ground for a price. The ground is “we have built this many”—years do not substitute for units.

4. The Separator

The separator: did the calendar advance, or did the count.

Observation 4.1

Advancing the calendar without building adds nothing to the count. An idle factory sees no fall in price—in this model, at least.

Observation 4.2

Accumulating units brings the fall even in a short span. A hundred in one year reaches where a hundred in ten years reaches—speed matters because it accumulates sooner.

Observation 4.3

These are distinct roots by the criterion of Paper 300. Both are called “it got cheaper”—one a function of the calendar, one of the count.

Computation 4.4: Place the other side of the boundary. Set the learning rate to 1.0.

The exponent becomes 0 and the price stays at 1 even at a thousand units.

Observation 4.5

The control does work. It shows the fall comes from the learning rate alone—accumulating does not itself lower the price; $r < 1$ does.

Observation 4.6

To be honest—routes by which calendar time itself acts are possible. Material prices change; technology arrives from outside—this paper does not deny them, and only shows what a count-only model says.

Observation 4.7

One last thing—the learning rate of 0.80 is representative. It runs from 0.7 to 0.95 across industries and processes—what does not move is that so long as $r < 1$, the price follows the count rather than the calendar.

5. Roll Call and Closing

1. The exponent is **−0.321928** (Computation 2.1): **from a rate of 0.80.**
2. Doubling gives exactly **0.800000000** (Observation 2.4): **a check of the definition.**
3. **0.512000** at eight (Computation 2.3): **that is 0.80^3 .**
4. **0.108197** at a thousand (Computation 2.3): **three orders buy one.**
5. Tenth and first year both **0.227061661** (Observation 3.2): **the core.**
6. Ten times the elapsed years (Observation 3.2): **the same count.**
7. **2.0986** at the same year (Observation 3.4): **independent of the year.**
8. At a rate of 1.0 the price stays **1** (Computation 4.4): **the other side.**
9. What lowers it is $r < 1$ (Observation 4.5): **not accumulation itself.**
10. The separator is calendar or count (Observation 4.3): **distinct roots by Paper 300.**

Closing: “Cheaper with time” and “cheaper with count” happen together—the years pass and the units accumulate—which makes it hard to tell which is acting. But change the speed of production and years and count come apart. Pulled apart, the price follows the count—a learning rate of 0.80 gives an exponent of **−0.321928**; doubling gives exactly 0.800000000, four units give 0.640000, eight give 0.512000 and a thousand give **0.108197**. Three orders of count buy one order of price, and the rate of fall slows sharply. And it does not follow the years—the tenth year at ten a year and the first year at a hundred a year give exactly the same **0.227061661**, ten times the elapsed years with the same total of a hundred built. Different years and the same price means the price does not follow the years, and the agreement is an exact identity rather than a coincidence. At the same year, faster is always cheaper by **2.0986**, a ratio independent of the year, since a power law returns the ratio of speeds raised to the exponent. So “we have been doing this for years” is no ground for a price; the ground is “we have built this many”. One thing

separates them—did the calendar advance, or did the count. Advancing the calendar without building adds nothing, and in this model an idle factory sees no fall; accumulating brings the fall even in a short span, and speed matters because it accumulates sooner. They are distinct roots by the criterion of Paper 300, one a function of the calendar and one of the count. Setting the learning rate to 1.0 makes the exponent 0 and the price stays at 1 even at a thousand units—showing that what lowers the price is not accumulation itself but $r < 1$. To be honest—routes by which calendar time itself acts are possible: material prices change, technology arrives from outside. This paper does not deny them and only shows what a count-only model says. One last thing—the learning rate of 0.80 is representative and runs from 0.7 to 0.95. What does not move is that so long as $r < 1$, the price follows the count rather than the calendar.

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