A Study of Long Distance Rates: Divestiture Revisited

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Introduction

The breakup of the old Bell System occurred on January 1, 1984 with the divestiture of the local Bell companies from AT&T. One major force that led to divestiture was government policy to stimulate competition in the provision of long-distance service. The coming tenth anniversary of divestiture thus is an opportune time to explore the effects of divestiture and competition on long-distance rates. Such an exploration is also opportune because of recent pressures to stimulate competition in the provision of toll service within the local jurisdictions of the Bell companies.

The methodology used in this study is an examination of the nearly eigthty-year history of AT&T long-distance rates. The examination was conducted to determine overall trends and the factors most likely influencing these trends. This historical perspective places the more recent effects of competition and divestiture in a historical perspective. In this way, it can be determined whether competition and divestiture had any real effect on the overall patterns of the rate history.

If there were any hypothesis behind the breakup of the Bell System it was that competition and divestiture would cause a decrease in long-distance rates thereby benefiting consumers. In a talk last year, Robert E. Allen, Chariman of AT&T, claimed that competition in the long-distance market "... delivered what competition is supposed to deliver: lower prices." [1] We shall see whether competition has lowered long-distance rates or whether other forces were the likely cause.

The study described in this report is particularly relevant since a great debate has started over whether any real price competition has occurred in the long-distance market. A recent paper by William E. Taylor and Lester D. Taylor concludes "... that the overall reduction in interstate long-distance prices and expansion of interstate demand is *more than* explained by the reduction in carrier access charges paid by the long-distance companies to the local telephone companies." [2] As would be expected, AT&T claims

that price competition has indeed occurred, and at least one study supports the conclusion that "... the long-distance industry is highly competitive, and it will remain so." [3] Meanwhile the local Bell companies claim the opposite and accuse AT&T of conspiracy with its competitors. How does one discover the truth in all these conflicting claims and statements?

Rate Histories

The long-distance day rates for a three-minute telephone call between New York City and Los Angeles carried over AT&T's network were determined from historical data compiled by the FCC and AT&T. [4],[5] The yearly rates from 1915 to 1993 are plotted in Figure 1 in each year's dollars. Corrections for inflation were not used since inflation would simply make the decreases over time even more dramatic and would also mask yearly rate changes.

This and succeeding graphs of rates plot the rates along the ordinate on a logarithmic scale. Such a log scale is appropriate since telephone rates usually decrease exponentially with time. Exponential curves appear as straight lines on a log scale.

As expected, the eighty year history plotted in Fig. 1 is nearly linear, except for certain periods which will be discussed below. A regression analysis was performed using an exponential model, and the regression line covering the full 80-year period is shown in Fig. 2. The correlation coefficient for this regression is -0.962. One exception to the overall pattern of ever decreasing rates is the rise in rates that occurred in the early 1980s. One possible reason for this rise might be AT&T's concern over the finnacial uncertainties of the divestiture that was about to happen in 1984. This rise, whatever the reason, was followed by sharp decreases, so that by 1990 the rates were back on the long-term regression line.

The rate history shows lengthy periods when rates were flat. The lengthiest period was immediately after World War II from 1945 to 1959. During this period, the Federal government first instituted the policy of using the profits from long-distance service to subsidize local rates. [6] This period was also a time of great technological innovation in the provision of long-distance service, with the use of coaxial cable, microwave radio, and transistors. But more about technology later.

If the plot of Fig. 1 is examined "by eye," it seems that the period from 1915 to 1958 could be fitted by one straight line and the period from 1959 to 1993 by a second straight line with a flatter slope. Such "by eye" lines are shown in Fig. 3. The implication of two such lines with different slopes is that long-distance rates in the distant past were decreasing more quickly than in the more recent past.

Since the day rate for long-distance service is the highest rate, it might be akin to a "list price" charged to some but not to large purchasers, particularly with the advent of competition. For this reason, it was decided to examine AT&T's lowest rates. Figure 4 shows the lowest long-distance rate for a ten-minute call between New York City and Los Angeles from 1919 to 1993. This

plot is very nearly linear, and the results of a regression analysis are shown in Fig. 5. The correlation coefficient for this regression is -0.988.

Effects of Competition

It is very clear from the preceeding graphs that long-distance rates have been decresing nearly exponentially over the last 80 years or so. There does not seem to be any change in this long-term pattern that was stimulated by either competition or by divestiture. If anything, divestiture resulted in an initial increase in rates that a few years later was eliminated by reductions that brought the trend back to the long-term rate of decrease.

The factor that has caused this dramatic history of rate reductions is technological innovation and the resulting increases in productivity. The many technological innovations responsible for this remarkable history are described in the Appendix to this report.

Costs of Competition

One would expect that competition would increase the costs of sales and advertising. Figure 6 shows AT&T's expenses for sales and advertising applicable to long-distance services from 1970 to 1992. The data comes from AT&T's reports to the FCC on Form M. Although these expenses were increasing from 1970 to 1983, a large jump occurred in 1984 followed by a sharp rise in the rate of increase.

AT&T's advertising and sales expenses were about $2.1 billion in 1992 compared to only about $0.25 billion ten years earlier in 1982. It is interesting to state these expenses as a percentage of long-distance revenues. The actual revenues as reported to the FCC on Form M are shown in Figure 7. The revenues before divestiture in 1984 were net of separations (or today's access charges). The large increase that occurred in 1984 was the result of the inclusion of access charges and also because AT&T assumed all the intra-LATA toll traffic previously carried by the local Bell companies. Figure 8 shows the advertising and sales expenses as a percentage of long-distance revenue from 1970 to 1992. The percentage increased from 1970 to 1983, when it reached a maximum of about six percent. With the great increase in long-distance revenue that occurred in 1984, the percentage dropped to early 1970 levels of a little more than two percent. This was followed by sharp increases until a level of about six percent was again reached in 1992.

The conclusion from this data is that competition is costly to AT&T in terms of the expenses of advertising and sales.

A second dimension of competition in long-distance service is the effect of the cost of access charges paid by AT&T to the local telephone companies. In 1984, the access charges paid by AT&T were $20,633 million, or 56.7% of telecommunication service revenues of $36,414 million, and advertising and sales expenses

for telecommunication services were $776 million. In 1992, access charges paid by AT&T had decreased to $18,132 million, or 45.8% of telecommunication service revenues of $39,580 million, and advertising and sales expenses for telecommunication services had increased to $2,111 million.

Thus, from 1984 to 1992, access charges decreased by $2,501 million but advertising and sales expenses increased by $1,334 million thereby offsetting a little more than half of the savings in decreased access charges. Since the rate of decrease in the lowest long-distance rates remained fairly constant over this period, any net savings from decreases in access charges over increases in the expenses of advertising and sales do not appear to have been passed on to consumers by AT&T. To some extent, this confirms the findings of the previously-mentioned study by Taylor and Taylor. [2]

The access charge and revenue figures are from AT&T Annual Reports and the data for advertising and sales expenses are from Form M.

Policy Implications

The results of this study show quite clearly that neither competition nor divestiture have had any real effects on long-distance rates. These rates have always been decreasing because of technological innovation and increases in productivity. At the same time, these same technological innovations have been increasing the quality of long-distance serive in such terms as reliability (increased call completion rates), clarity (improved frequency repsonse and signal-to-noise ratios), and speed (faster call connections). By all measures, long-distance service continues to be both a great success and a bargain.

The old Bell System, under AT&T's direction, did a great job at providing long-distance service and in serving the public. At a time when it is in vogue to bash any form of monopoly, the old Bell monopoly shows that regulation coupled with technological innovation and a sense of public mission can indeed be a force for the good.

The provision of telephone service was viewed for decades as a natural monopoly. It has only been during the past decade or so that government policy has decided to stimulate competition in the provision of long-distance service, while at the same time continuing to regulate AT&T but not AT&T's competitors. The history of ever decreasing long-distance rates along with conclusion reported in this study that competition has not resulted in any change in the rate of reduction of long-distance rates over time strongly implies that the model of natural monopoly for long-distance service was perhaps appropriate. It therefore is no surprise that the differences in rates among the various providers of long-distance service are negligible.

I conclude that today's stimulated and forced competition is a sham benefitting AT&T's competitors and not the public. In fact, the costs of competition from additional sales and advertising expenses might actually be resulting in slightly higher long-distance rates to consumers.

All this implies great caution before extending and promoting competition in the provision of toll service within the local jurisdictions of the local phone campanies. If it is believed that these toll rates are too high, then the appropriate local regulatory bodies should cause the rates to be reduced, recognizing that rates for basic service will almost certainly increase. The profits of the local telephone companies need to be examined, along with the apparent desires of the local companies to extend their local monopolies into the provision of entertainment television, either through the acquisition of CATV companies or by rewiring their territories with broadband optical fiber to homes.

Before the mistakes of the past are repeated -- namely, the promotion of competition for its own sake -- there is a great need for much discussion of these issues by the appropriate policy makers at the local and Federal levels, along with due consideration of the public.

Appendix: Advances in Technology

Advances in technology clearly have had a dramatic effect on long-distance rates throughout the history of long-distance telephone service. This Appendix summarizes many of these advances in technology. [7],[8]

The audion tube was invented around 1906 and was first used in 1912 an actual electrical circuits as an audio amplifier. In 1915, the audion vacuum tube was used for amplification of telephone signals along the great distances of transcontinental telephone routes. Without the vaccum tube, transcontinental telephony would not have been possible because the signals would have become smaller and smaller with distance unitl they were lost in noise.

Early transcontinental telephone calls were carried across pairs of open wire. The first commercial use of multiplex technology occurred in 1918 when four telephone signals were combined together through frequency-division muliplexing. The technology of open-wire multiplexing technology progressed. In 1928, single-sideband was used so that different frequency bands could be used for bidirectional transmissions over the same pair of wires. In the late 1930s, multipair cable was used for transcontinental routes with 12 voice circuits being multiplexed over each pair. Repeater technology also progressed so that less costly repeaters could be spaced more frequently thereby enabling the use of more bandwidth to multiplex more circuits.

Negative feedback was invented in 1927 and was first used in transcontinental telephone routes in the early 1930s. Negative feedback greatly improved the quality of the vacuum tube amplifiers used in repeaters.

Bell Labs and AT&T's Western Electric Company were involved in the defense effort for World War II, and this was the stimulus for tremendous advances in technology. After the war, these technological advances, which were very applicable to telecommunication, were applied to the civilian side of the economy. Microwave radio and coaxial cable were two such advances. The first coaxial cable system, L1, was first placed in service in 1946, consisted of 4 pairs of coaxials, and had a total capacity of 1800 two-way voice circuits. The vacuum tube repeaters were later replaced with transistors in the L4 system, whxh was placed in service in 1967 with 32,400 two-way voice circuits carried over 11 pairs of coaxials. The last coaxial system, L5, first saw service in 1978, carried 132,000 two-way voice circuits, and used integrated circuits in its repeaters.

The first transcontinental microwave radio system was placed in service in 1950 and carried 2400 two-way voice circuits. The horn antenna, first used in the late 1950s, allowed the simultaneous use of both the 4-GHz and 6-GHz bands for a total capacity of 16,800 two-way voice circuits. Microwave technology continued to progress until the ultimate system, AR6A, utilizing single-sideband, suppressed carrier microwave transmission, when combined with the TD system gave a total route capacity of 61,800 two-way voice circuits.

Communication satellites located in geosynchronous orbits above the earth's equator were first used to carry telephone calls in the mid 1970s. Communication satellites have considerable bandwidth and can carry nearly 100,000 voice circuits per transponder (with typically 24 transponders per satellite). However, the delay needed for the radio signals to travel back and forth between the satellite and the earth bothers most people. Communication satellites are therefore best suited for reaching otherwise inaccessible portions of the earth.

Today's transmission medium with the greatest capacity is optical fiber. A single strand of fiber today carries 2 Gigabits, which is equivalent to over 30,000 telephone circuits. A typical fiber transmission system across the country will have dozens of fiber strands in a single cable. As the optical fiber itself improves, the need for detecting and regenerating digital signals along the way becomes less frequent. Regenerative repeaters are being implemented as optically-active portions of the fiber which use light amplification to boast the digital signals.

The manner in which telephone circuits are connected and created across long distances has likewise progressed greatly because of technological innovations. In the earliest days of telephone service, human operators connected the circuits along the way to create the path needed for a long-distance call. Automated electromechanical switching was first used in the Bell System in 1919 on a local level. This technology later was used on long-distance circuits thereby reducing the need for a large number of human operators to connect circuits across the continent for long-distance calls. Direct distance dialing (DDD) was first offered in the early 1950s thereby eliminating entirely the need for human operators to set-up long distance calls.

The way in which many telephone calls are combined, or multiplexed, together to share a transmission medium has progressed greatly too. The way of the past was to shift each signal in frequency to its unique individual band (frequency-division multiplexing). Today's way is to convert each signal to a digital format and then combine the digital signals in time (time-division multiplexing). Modern switching machines switch these digital signals directly.

Automation has had much impact on the tasks performed by human operators. Speech synthesis handles standardized instructions to telephone callers. Speech recognition is now being used to eliminate further the need for intervention by human operators, thereby leading to improvements in operator productivity.

This eighty-year progression of technology is an exciting story. The price of long-distance service has declined continuously, while simultaneously quality has increased steadily. The provision of long-distance service is a wonderful success story -- thanks to technology.

References

[1] Robert E. Allen, "Adam Smith and Telecommunications," remarks before the Federal Communications Bar Association (Washington, DC), December 3, 1992.

[2] William E. Taylor and Lester D. Taylor, "Postdivestiture Long-Distance Competition in the United States," American Economic Review, Vol.83, No.2 (May 1993), pp.185-190.

[3] Michael E. Porter, "Competition in the Long Distance Telecommunications Market: An Industry Structure Analysis," Monitor Company, Inc., 1990.

[4] Statistics of Communications Common Carriers, Federal Communications Commission, 1991/1992 Edition, p.259.

[5] "Comparison of Major Rate Changers from 1915 to September 19, 1959," AT&T Archives.

[6] Peter Temin, The Fall of the Bell System, Cambridge University Press, 1987, p.20.

[7] John R. Pierce and A. Michael Noll, Signals: The Science of Telecommunications, Scientific American Library (New York), 1990.

[8] A. Michael Noll, Introduction to Telephones & Telephone Systems (Second edition), Artech House (Boston), 1991.

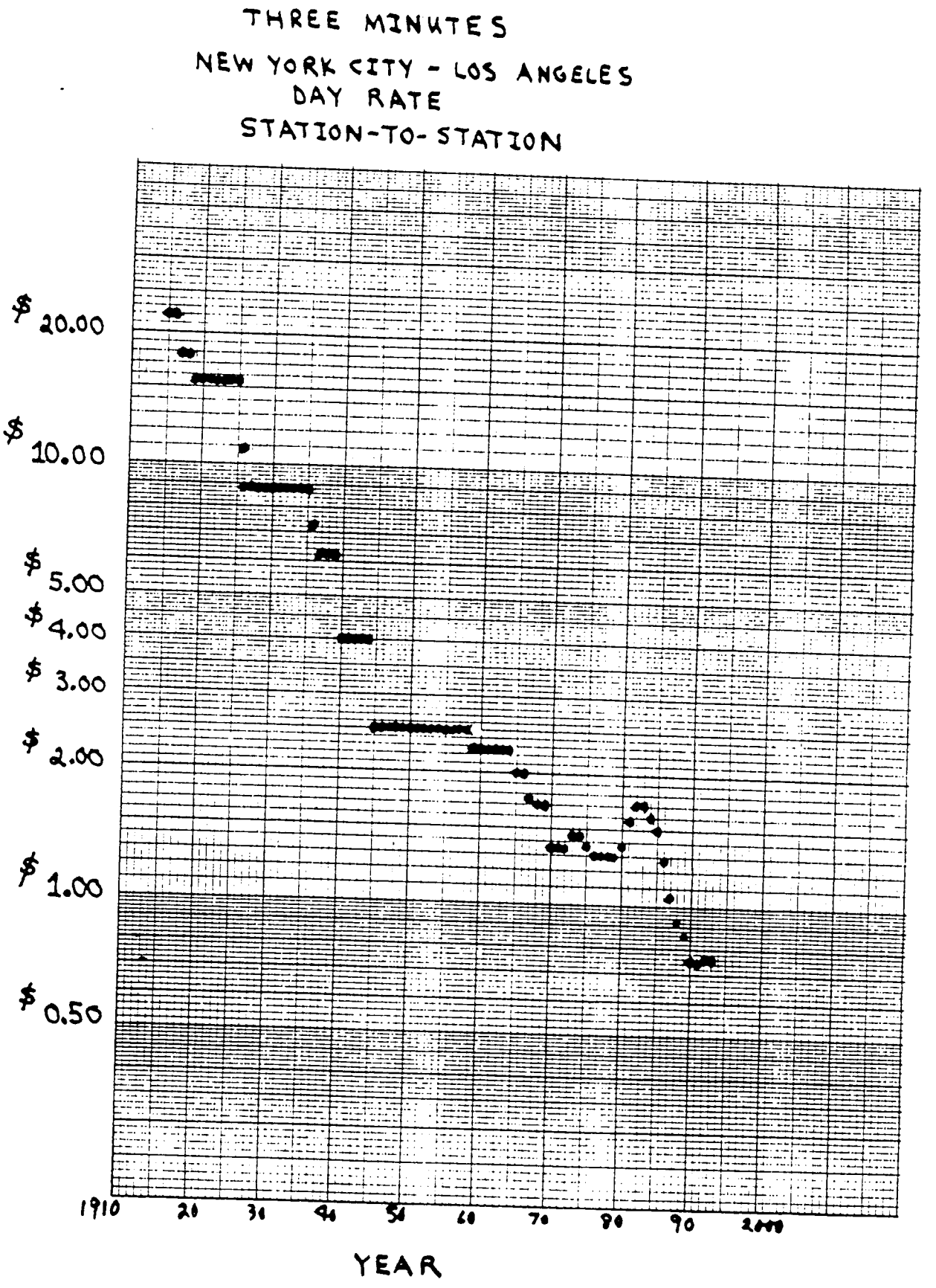
THREE MINUTES
NEW YORK CITY - LOS ANGELES
DAY RATE
STATION-TO-STATION
$ 20.00
$ 10.00
$ 5.00
$ 4.00
$ 3.00
$ 2.00
$ 1.00
$ 0.50
1910
20
30
40
50
60
70
80
90
2000
YEAR

FIG. 1.

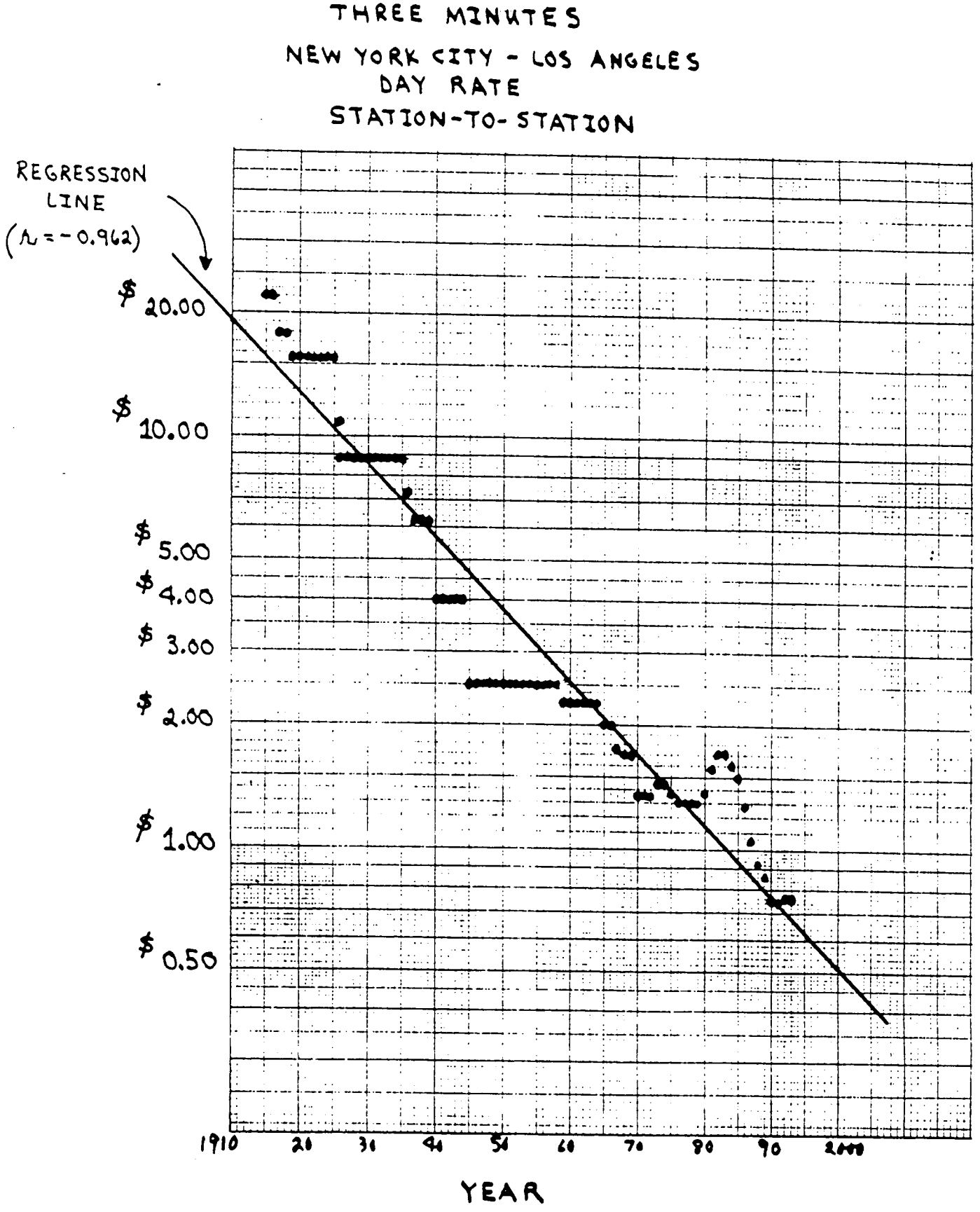
THREE MINUTES
NEW YORK CITY - LOS ANGELES
DAY RATE
STATION-TO-STATION
REGRESSION LINE
(r = -0.962)
$ 20.00
$ 10.00
$ 5.00
$ 4.00
$ 3.00
$ 2.00
$ 1.00
$ 0.50
1910
20
30
40
50
60
70
80
90
2000
YEAR

FIG. 2.

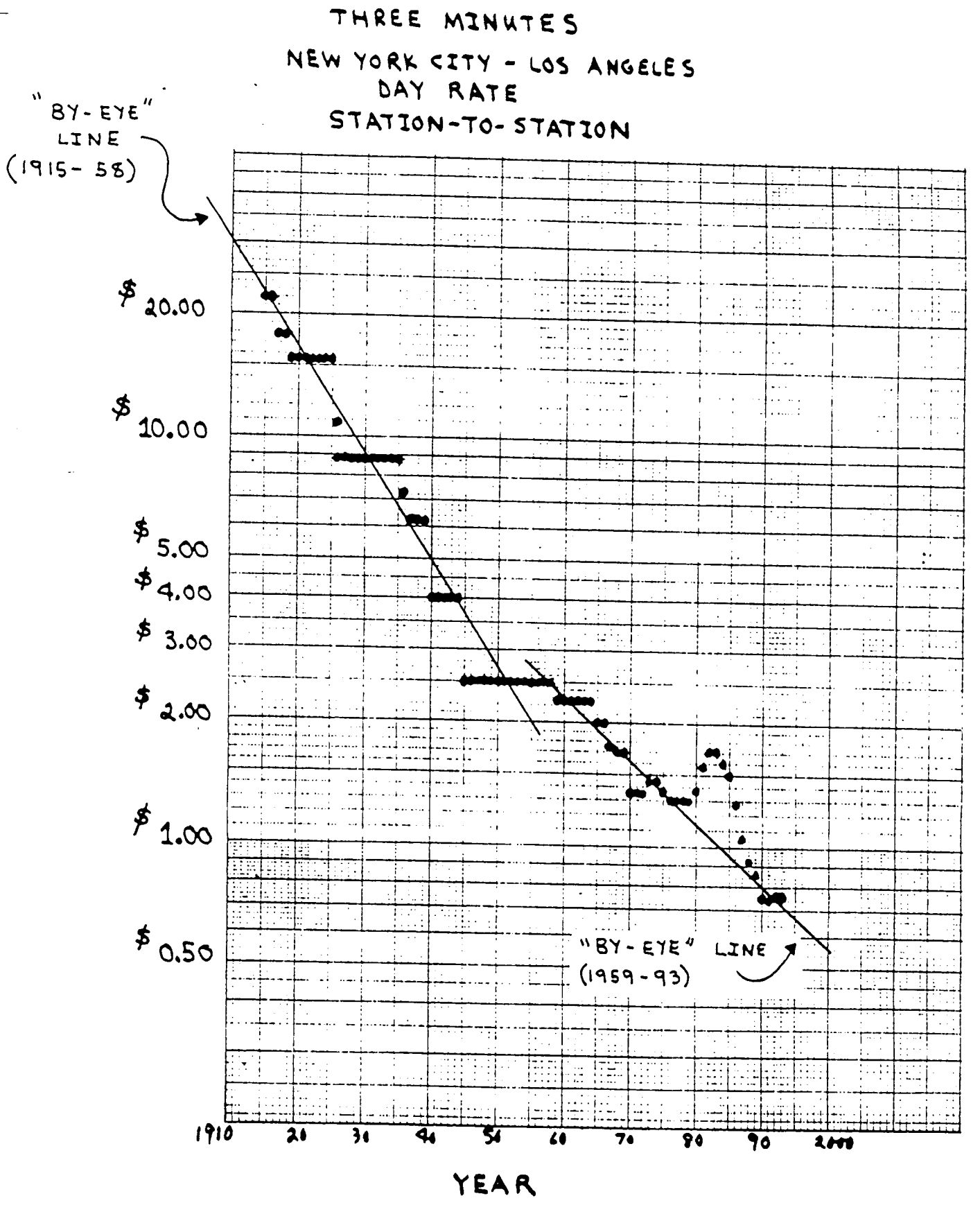
THREE MINUTES
NEW YORK CITY - LOS ANGELES
DAY RATE
STATION-TO-STATION
"BY-EYE" LINE (1915-58)
$20.00
$10.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.50
"BY-EYE" LINE (1959-93)
1910
20
30
40
50
60
70
80
90
2000
YEAR

FIG. 3.

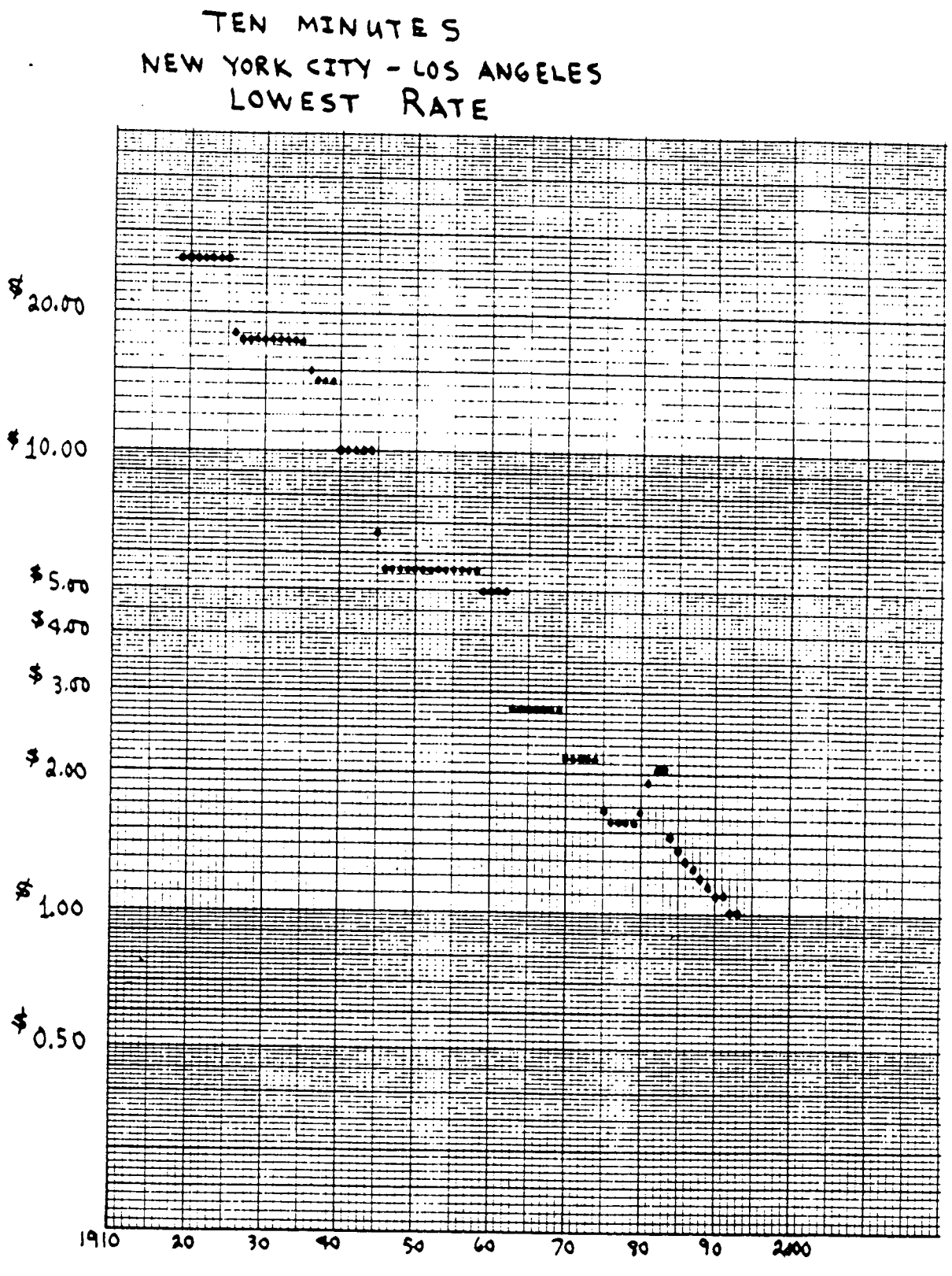
TEN MINUTES
NEW YORK CITY - LOS ANGELES
LOWEST RATE
$20.00
$10.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.50
1910
20
30
40
50
60
70
80
90
2000
YEAR

FIG. 4.

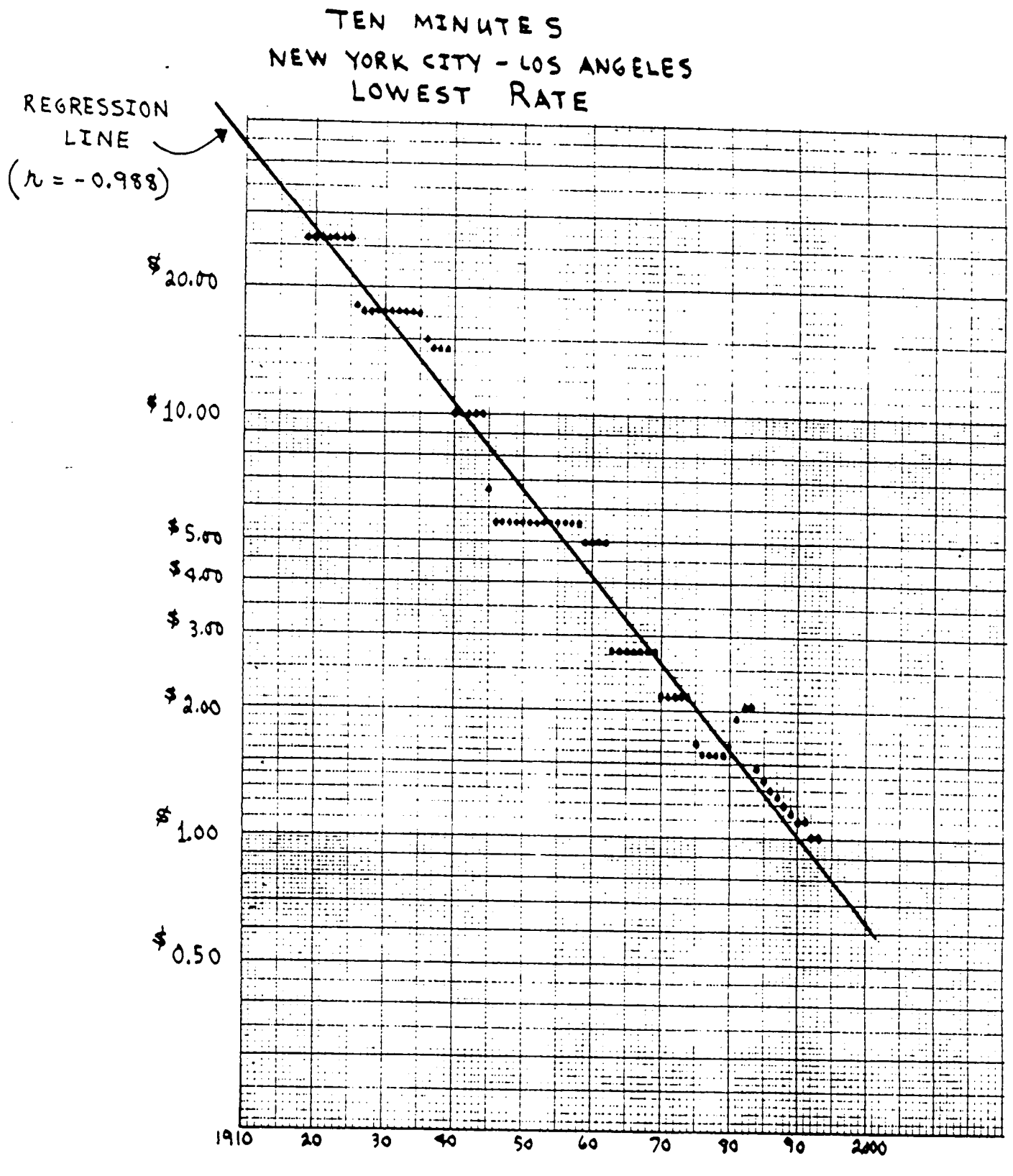
TEN MINUTES
NEW YORK CITY - LOS ANGELES
LOWEST RATE
REGRESSION LINE
(r = -0.988)
$20.00
$10.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.50
1910
20
30
40
50
60
70
80
90
2000
YEAR

FIG. 5.

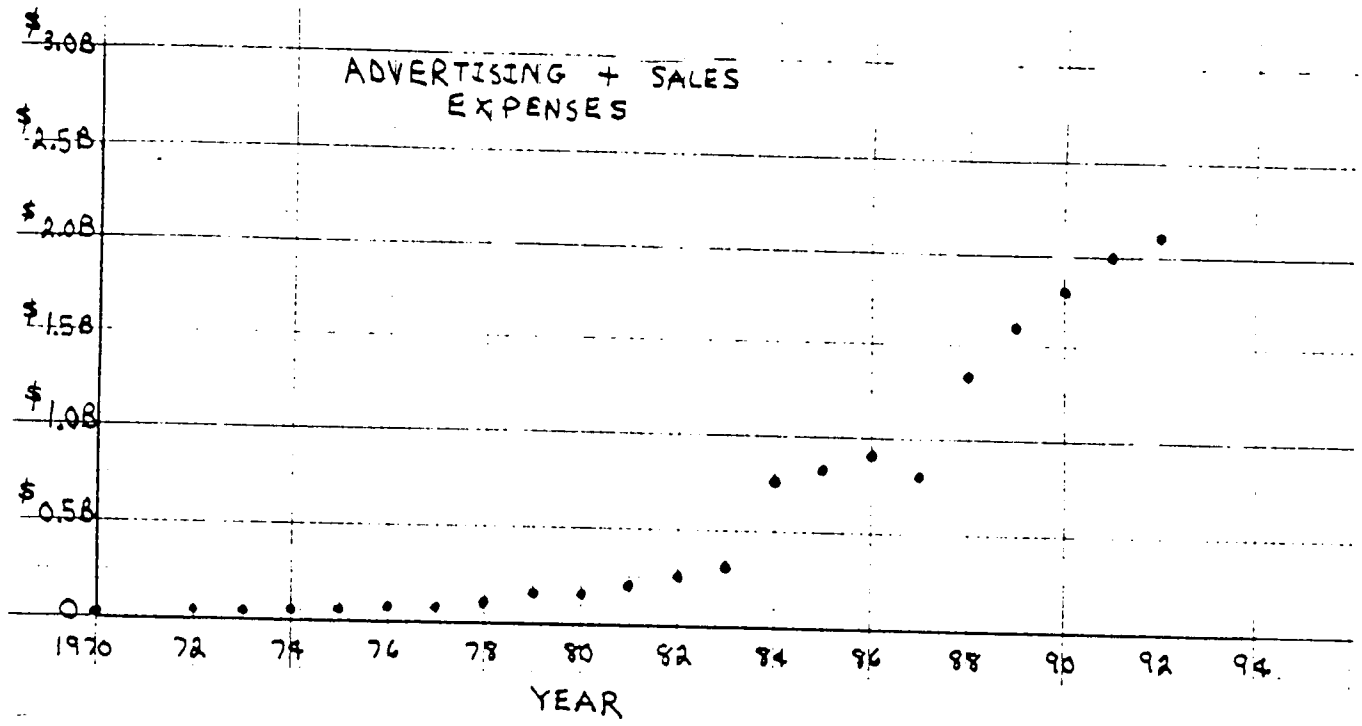
ADVERTISING + SALES EXPENSES
$3.0B
$2.5B
$2.0B
$1.5B
$1.0B
$0.5B
0
1970
72
74
76
78
80
82
84
86
88
90
92
94
YEAR

FIG. 6.

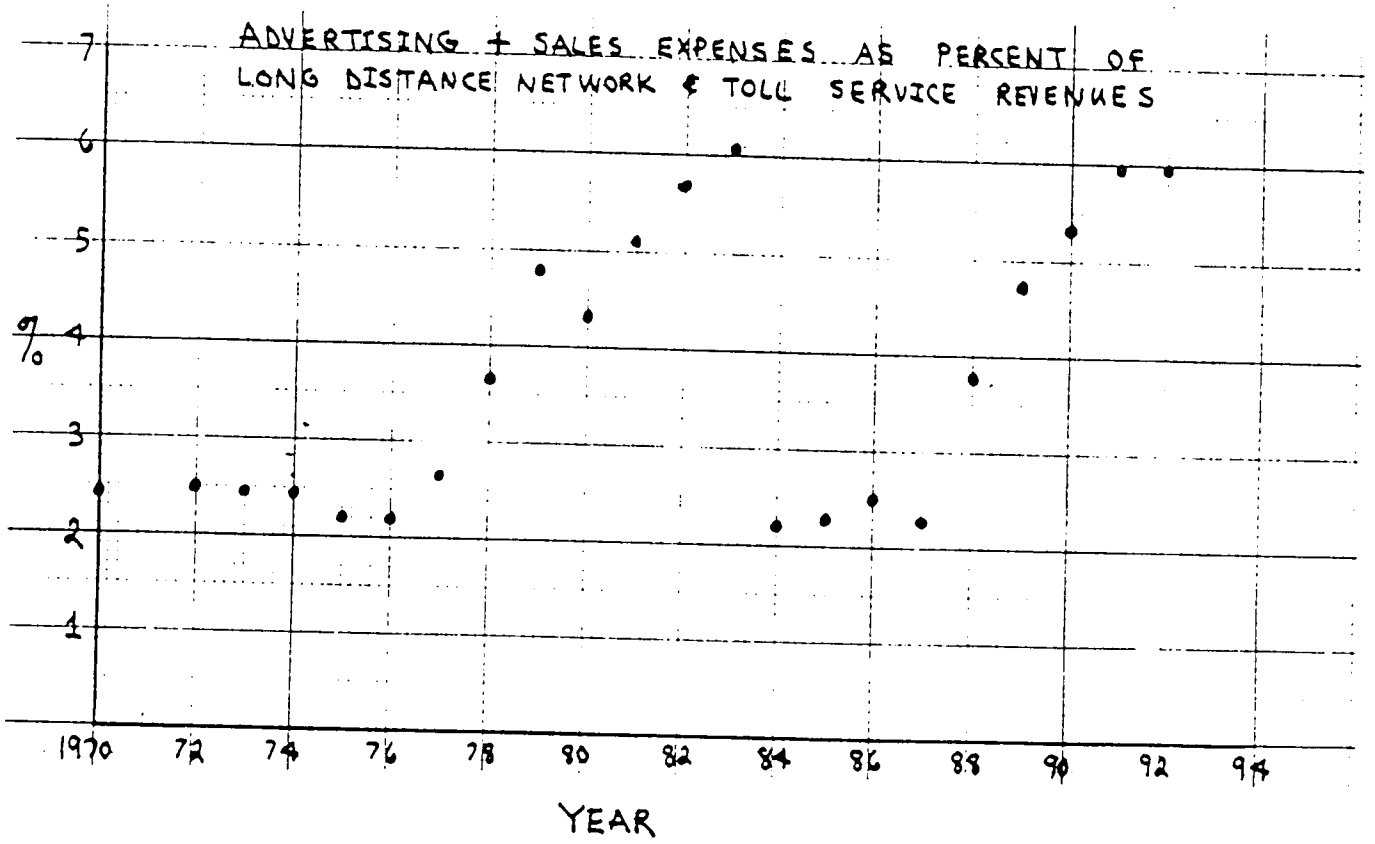
ADVERTISING + SALES EXPENSES AS PERCENT OF LONG DISTANCE NETWORK & TOLL SERVICE REVENUES
7
6
5
%
4
3
2
1
1970
72
74
76
78
80
82
84
86
88
90
92
94
YEAR

FIG. 8.

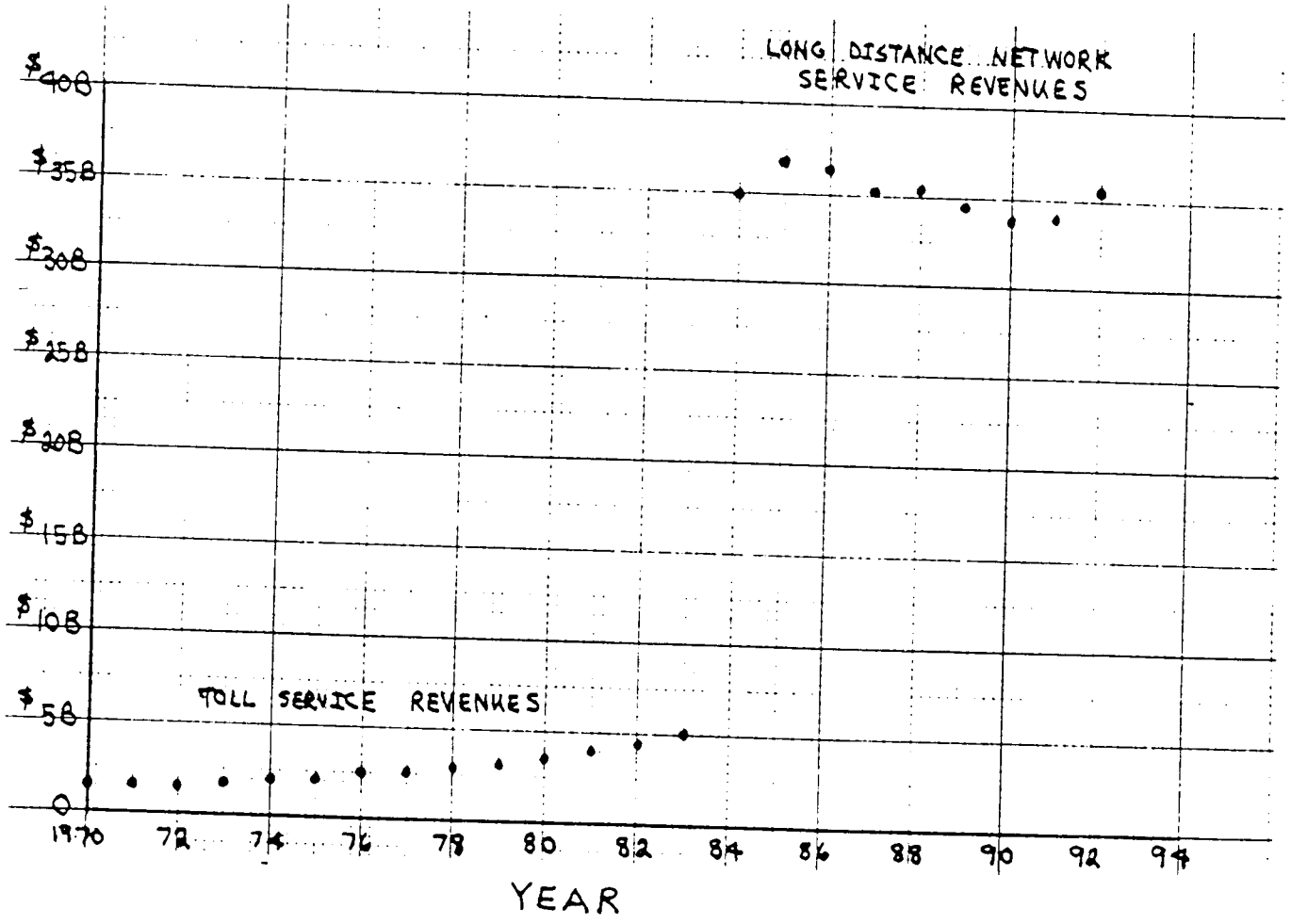
LONG DISTANCE NETWORK
SERVICE REVENUES
$40B
$35B
$30B
$25B
$20B
$15B
$10B
$5B
0
TOLL SERVICE REVENUES
1970
72
74
76
78
80
82
84
86
88
90
92
94
YEAR

FIG. 7.