Division of Research
School of Business Administration

January 1992

THE IMPACT OF THE MARKET PIONEER'S LEADTIME ON MARKET SHARE

Working Paper #673

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Abstract

Previous research has established that market pioneers typically have sustainable market share advantages over later entrants. Longer pioneer leadtimes versus later entrants should also increase pioneer market share advantages. Using data from 34 product categories, we find that by dividing the data into three groups identified by era of entry, pioneer leadtime has a meaningful and statistically significant impact on market share. The key difference between these groups is average pioneer leadtime, which has declined significantly over time. Since product life cycles are speeding up, a year of leadtime is worth more today than in the past.

I. Introduction

While various studies report sustainable market share advantages for market pioneers, these studies have not empirically documented the importance of the pioneer's leadtime. For example, see Whitten (1979), Robinson and Fornell (1985), and Urban, Carter, Gaskin, and Mucha (1986). Whitten (1979) describes leadtime as, "the amount of time that an innovative first entry brand has to inform potential customers of its existence prior to the entry of rival brands." (p. 6).

The market pioneer's leadtime should be important. For example, imagine the second entrant comes in one week after the pioneer. This has a much different impact on the pioneer's chances to develop sustainable competitive advantages than if the second entrant delays five years. Thus, both market pioneering and the pioneer's leadtime should have an important influence on their sustainable competitive advantages.

To estimate the importance of the pioneer's leadtime, it is critical to recognize that product life cycles are speeding up over time. See Qualls, Olshavsky, and Michaels (1981) and Gort and Klepper (1982). For example, in markets pioneered prior to World War II below, the average pioneer leadtime over second entrants is 20 years. In markets pioneered between 1960 to 1974 below, the average pioneer leadtime is 4 years.

Since product life cycles are speeding up, a year of pioneer leadtime is worth more today than in 1915. Recognizing these differences, the Urban et al. (1986) data are broken up into three subsamples: pre-World War II, 1944-1956, and 1960-1974. The importance of the pioneer leadtime is supported for the first and third subsamples. These two subsamples cover 82% of the product categories.

The empirical results below indicate that a one year pioneer lead in a market pioneered between 1960 to 1974 is worth roughly the same as a three year lead in a pre-World War II market. A four year lead is worth roughly the same as a twenty year lead in a pre-World War II market.

A second dynamic factor also influences pioneer market share advantages. Robinson and Fornell (1985), Robinson (1988), and Brown and Lattin (1991) report that market pioneer share advantages slowly deteriorate over time. The empirical results below also examine this slow deterioration. Holding positioning and advertising constant, second entrants in markets pioneered prior to 1960 have typically caught the market pioneer. Even so, third and later entrants have not caught the pioneer. Also, in markets pioneered since 1960, even second entrants have not caught the market pioneer.

II. Model Replication

Urban et al.'s (1986) award winning paper documents the important impact of market pioneering on market share for low-priced consumer good brands. Their multiplicative market share model is replicated, modified slightly, and then extended. Statistical analysis of their multiplicative model specification for brand *n* in category *c* arises by taking the log of each variable. This is shown in equation 1.

$$S'_{nc} = \alpha_1 E'_{nc} + \alpha_2 L'_{nc} + \alpha_6 P'_{nc} + \alpha_7 A'_{nc} \qquad (1)$$

S'_{nc} = log of the ratio of the market share of the nth brand to enter category c to the market share of the first brand to enter the category,

E'_{nc} = log of the order of entry of nth brand in category c (n = 1, 2, 3, . . .),

L'_{nc} = log of the number of years between n and n - 1 brand entry plus one (L_{nc} = 1 if entry is in the same year),

P'_{nc} = log of the ratio of preference given evoking for nth brand to preference of first brand given evoking,

A'_{nc} = log of the ratio of the last 3 years of advertising for nth brand to the last three years advertising for first brand.

α_1, α_2, α_6, and α_7 are the replicated model coefficient parameters. α_3, α_4, and α_5 are discussed in the model extensions below. Equation 1 is estimated using ordinary least squares. Since the data are cross-sectional, the residuals were examined for heteroskedasticity. Using White's (1980) test, there was not any indication of heteroskedasticity. Thus, similar to Urban et al. (1986), the reported results use ordinary least squares estimation.

The Urban et al. (1986) results are replicated in Table 1's first column. The replication covers 95 observations across 34 product categories. Because of minor data input and product category changes, the replicated results are not identical to Urban et al. (1986). The replicated results though are essentially equivalent in terms of estimated signs, coefficient magnitudes, and statistical significance. For example, the Urban et al. (1986) coefficient estimates are -.49, .07, 1.11, and .28. This compares to the replicated estimates of -.45, .05, 1.12, and .28.

Measuring Market Pioneer Leadtime

In Urban et al. (1986), a market pioneer is defined as the first category entrant. In equation 1 above, order of market entry (E'_{nc}) measures the entry order. For example, first, second, third, etc. Since order of market entry is important, the pioneer's leadtime should also be important. This is because both

factors help a market pioneer lay the groundwork to develop sustainable competitive advantages.

For example, Carpenter and Nakamoto (1989) describe how customer preferences evolve over time. Knowledge about the category is initially minimal and consumers are exposed to products sequentially - first the pioneer and subsequently later entrants. Each time buyers use the pioneer's brand, they update their preferences. As long as they are satisfied with the pioneer's brand, the buyer's ideal point will move closer and closer to the pioneer's attribute mix. The closer the ideal point has shifted to the pioneer, the more solidly entrenched the pioneer will be as the industry standard. Thus, as the pioneer's leadtime increases, the more difficult it will be for later entrants to compete with the industry standard.

Urban et al. (1986) measure leadtime using the lag between entry dates (L'_{nc}). As defined above, this measures the difference in entry dates of the nth brand from its immediate predecessor. It is calculated as the log of this difference plus one. (One is added because the multiplicative model uses logs and a number of brands entered in the same year.)

Since we are interested in pioneer advantage over later entrants, we modified the leadtime variable to reflect the difference in year of entry of the first entrant from the year of entry for each later entrant. Increasing leadtime should decrease market share of a later entrant relative to the market pioneer.

To illustrate the difference in approaches, consider a product category in which the first entrant introduced its brand in 1950, the second entrant in 1957, the third in 1960, and the fourth in 1968. The lag between entry dates are 7 years for the second entrant, 3 years for the third, and 8 years for the fourth. In contrast, the modified leadtimes are 7 years, 10 years, and 18 years. In model estimation,

we remained consistent with the Urban et al. approach of adding one year to leadtimes to insure that the log of leadtime (LT') never equals zero.

Though the modification of the leadtime variable better describes the phenomenon we are trying to capture - which is the leadtime impact on pioneer advantages - the results are no stronger. As shown in Table 1, after substituting pioneer leadtime for the lag between entry variable, the coefficient estimate changes from .05 to .10. The estimate remains small and is not statistically significant. More important, while the expected sign is negative, the estimated sign is positive.

III. Model Extensions

To address this non-result for pioneer leadtimes, the Urban et al. (1986) model is extended in two ways. First, a market age variable helps capture the slow deterioration of pioneer share advantages over time. While this model is not as parsimonious as Urban et al. (1986), it yields the expected negative sign for pioneer leadtime. Second, pioneer leadtime interaction terms are added to account for the product life cycle speeding up over time. This provides insights into the changing importance of pioneer leadtime over time.

Adding a Variable for Market Age

How important is the slow deterioration of pioneer share advantages over time relative to a later entrant's gradual climb? In Robinson and Fornell's (1986) consumer goods sample, average market share levels are compared for businesses that have been in the market less than 20 years versus 20 years or more. The average pioneer market share declines from 35% to 27%. While the average early

follower share remains constant at 17%, the average late entrant share increases from 11% to 16%. Thus, after 20 years or more, the average pioneer market share advantage versus late entrants declines from 24% to 11%. Brown and Lattin (1991) report similar results[1].

In equation 2, the log of market age (MA') is added to the model specification. All brands in category *c* have the same market age. Market age is estimated by subtracting the entry date of the category's pioneer from 1984 and then taking the natural logarithm. 1984 roughly corresponds to the time the market share data were gathered. Because the youngest market started in 1974, the minimum market age is 10 years.

$$S'_{nc} = \alpha_1 E'_{nc} + \alpha_2 LT'_{nc} + \alpha_5 MA'_{nc} + \alpha_6 P'_{nc} + \alpha_7 A'_{nc} \qquad (2)$$

As a market ages, pioneer share advantages should deteriorate while the share of a later entrant should increase. Thus, the expected sign of α_5 is positive.

In Figure 1, market age has the expected positive sign (.17) and is statistically significant at the 1% level. This model extension also changes the estimated pioneer leadtime estimate from a positive .10 to the expected negative sign of -.08. The order of entry impact remains negative (-.66) and statistically significant.

Adjusting for Shorter Product Life Cycles

Is studying the raw data for pioneer leadtimes, one result was clear: the average leadtime has reduced dramatically during the last 75 years. As shown in

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[1] Brown and Lattin (1991) measure the deterioration of pioneer advantages over time by dividing the entrant's time in the market by the market pioneer's time in the market.

Figure 1, the average pioneer leadtime over second entrants declined from 20 years before World War II, to 10 years from 1944 to 1976, to 4 years from 1960 on. During those time periods, the average pioneer leadtime over all entrants declined from 41 to 17 to 10 years.

The decline in average pioneer leadtime is a clear indication that product life cycles are speeding up. This is consistent with empirical evidence set forth by Qualls, Olshavsky, and Michaels (1981) and Gort and Klepper (1982). There are many reasons for this result. First radio and magazines, then television and other national advertising sources have enabled firms to inform a national audience from the moment of entry. By using modern transportation methods and national chains, national distribution can be achieved in a matter of weeks or months. Coupons and end - of - aisle displays can generate widespread trial. Because the availability of these options has increased over the decades, awareness, distribution, and trial are all generated much faster today

In short, a year of leadtime is worth more to a pioneer today than it was in 1920, or even in 1950. Trying to explain the influence of leadtime on pioneer advantage is difficult unless the differences in the value of leadtime over the decades is taken into account. Therefore, the data are grouped into three different time periods.

The time periods are pre - World War II (which is 1936 and earlier), 1944 to 1956, and 1960 to 1974. The groups are based on the natural gaps that arise in the data. For example, no markets were pioneered from 1937 to 1943 and from 1957 to 1959. The groups are also selected because average pioneer leadtimes clustered around distinctly different values. The time periods cover 12, 6, and 16 product categories.

To recognize these differences over time, two pioneer leadtime interaction terms are added to the model specification.

$$S'_{nc} = \alpha_1 E'_{nc} + \alpha_2 LT'_{nc} + \alpha_3 LTI1'_{nc} + \alpha_4 LTI2'_{nc} + \alpha_5 MA'_{nc} + \alpha_6 P'_{nc} + \alpha_7 A'_{nc} \quad (3)$$

LT' continues to be the log of the pioneer's leadtime, as it was in equation 2. Since interaction terms are used for the other two time periods, α_2 represents the total leadtime impact for pioneers who entered prior to World War II.

LTI1' is the first interaction term. It equals the log of pioneer's leadtime if the market started between 1944 to 1956, 0 otherwise. Since the product life cycle is speeding up, α_3 should be negative. $\alpha_2 + \alpha_3$ equals the pioneer leadtime impact for markets that started between 1944 and 1956.

LTI2' is the second interaction term. It equals the log of pioneer's leadtime if the market started between 1960 to 1974, 0 otherwise. Since the product life cycle is continuing to speed up, α_4 should be negative. $\alpha_2 + \alpha_4$ equals the leadtime impact for markets that started between 1960 and 1974.

Since the product life cycle is speeding up, the market age impact may also differ over time. In other words, with the product life cycle speeding up, the pioneer's share advantage should decline faster in 1975 than in 1925. Thus, market age interaction terms are also added to the model for 1944-1956 and 1960-1974. Because market share is the late entrant's share relative to the pioneer's share, the expected sign is positive.

While both pioneer leadtime and market age interactions should be important, the simple Pearson correlation between the 1940-1956 interactions equals .99. It equals .91 for the 1960-1974 interactions. Given this high degree of multicollinearity, the model can not support both sets of interactions. Thus, the fourth column in Table 1 provides the market age interactions only. The fifth column provides the pioneer leadtime interactions only.

In both sets of results the order of entry, pioneer leadtime, and market age variables all have the expected sign and are statistically significant. Also, the pioneer leadtime and market age interaction terms yield similar results. Estimates for the 1944-1956 interaction terms are both near zero and are not even close to being statistically significant. This nonresult is probably influenced by the fact that 1944-1956 only accounts for 6 of the 34 product categories. Estimates for the 1960-1974 interaction terms are both negative and statistically significant.

Overall, these results point to the robustness of the order of entry impact. Also, the pioneer leadtime and market age variables both have the expected sign and are statistically significant. Because of the interaction terms, these results are for the pre-World War II subsample.

The main puzzle in the results is which dummy variable interaction term for the 1960-1974 markets is most valid? This is because both the pioneer leadtime and the market age interactions terms are statistically significant. As mentioned above, because of multicollinearity, the question can not resolved by including both variables in the same model.

The theoretical evidence supports the pioneer leadtime interaction. Recall that the predicted sign for the 1960-1974 pioneer leadtime interaction is negative. Since the estimate equals -.13, it has the predicted sign. The predicted sign for the 1960-1974 market age interaction is positive. The estimate though is negative (-.09). Thus, the market age 1960-1974 interaction does not have the expected sign. If the negative estimate is correct, it indicates that pioneer market share advantages were <u>not</u> deteriorating as fast in markets pioneered in the 1960's and 1970's relative to pre-World War II markets. This is not consistent though with product life cycles speeding up.

Because of the significance of the 1960-1974 market age interaction term, we must be cautious in interpreting the causal nature of the 1960-1974 leadtime

interaction term. Even so, the pioneer leadtime interaction term receives the strongest theoretical support. Thus, the results discussed below focus on Table 1's final equation.

In Table 1's final equation, the estimate for the pre-World War II interaction term is -.15. The 1944 to 1956 interaction term is positive rather than negative, but at .03, it is close to zero. The pioneer leadtime impact for 1944 to 1956 is the sum of these two coefficients. The sum equals -.12, which is statistically significant at the 14% level.

The pioneer leadtime interaction for 1960 to 1974 is -.13. It has the expected negative sign and is statistically significant at the 5% level. The total pioneer leadtime estimate for 1960 to 1974 equals -.28, which is statistically significant at the 5% level.

Overall, these model changes increase the adjusted R^2 value relative to the replicated Urban et al. (1986) model from 75% to 78%. This increase in explained variation is modest. Even so, the main research objective is not to maximize adjusted R^2. Instead, it is to estimate the impact of pioneer leadtime and market age on market share relative to the pioneering brand. These coefficient estimates have the expected sign and are statistically significant. Even so, these results are not useful unless they are also managerially significant.

Managerial Significance

Managerial significance evaluates the order of entry penalty, pioneer leadtime penalty, and market age benefit. It is initially evaluated for each individual variable. Various combinations of order of entry penalties, pioneer leadtime penalties, and market age benefits are also examined.

To estimate the order of market entry penalty for later entrants, Table 1's estimated impact is -.49. (Note, the -.49 estimate is identical to the estimated

impact in Urban et al. 1986). This means that, ceterius paribus, the second entrant's share relative to the pioneer's share in the multiplicative model equals $2^{-.49}$ or .71. The third entrant's share relative to the pioneer's share equals $3^{-.49}$ or .58. These results are shown in Table 2.

Table 3 shows the estimated pioneer leadtime penalty. It relates the pioneer leadtime to the three time periods. For example, if a pioneer had a one year leadtime in a pre-World War II market, the leadtime estimate is $(1+1)^{-.15}$ or .90. A one year leadtime in a 1960 - 1974 market is $(1+1)^{-.28}$ or .82.

How do pioneer leadtime penalties compare in pre-World War II markets versus 1960 to 1974 markets? As mentioned above, a one year pioneer leadtime penalty for a market started between 1960 to 1974 market is .82. In Table 3, this essentially equals a three year leadtime penalty (.81) in a pre-World War II market. A four year leadtime penalty in a 1960 to 1974 market (.64) equals a twenty year leadtime penalty in a pre-World War II market (.64).

While order of market entry and the pioneer leadtime both decrease relative market share levels, market age increases relative share. The market age increase, or benefits, are shown in Table 4. For a 10 year old market, which is the youngest market in the sample, the market age benefit is $10^{.19}$ or 1.55. For a 70 year old market, the benefit is $70^{.19}$ or 2.24.

Values from these three tables can predict the combined order of entry, pioneer leadtime, and market age impact on relative market share. Since the market share model is multiplicative, the three variables are multiplied to estimate the combined order of entry impact.

For example, assume a market was pioneered in 1914 and the second entrant followed in 1915. With the passing of 70 years and this short pioneer leadtime, the second entrant's market share should be roughly equal to the pioneer's share. In other words, holding positioning and advertising constant,

the second entrant's share relative to the pioneer's share should be close to 1.00. Taking the first value from tables 3 to 5, predicted relative share for the second entrant equals .71 times .90 times 2.24 or 1.43.

Why is the second entrant's predicted share roughly 43% higher than the pioneer's share? Recall from Figure 1 the mean pioneer leadtime relative to second entrants in pre-World War II markets is 20 years. Since a one year pioneer leadtime is atypical in pre-World War II markets, this share prediction is outside the normal data range.

Predictions based on more realistic data combinations are more realistic. Since a 20 year pioneer leadtime is the mean leadtime for second entrants in pre-World War II markets, the corresponding prediction equals .71 times .64 times 2.18 or .99. This suggests that with the passing of 60 years, second entrants have in fact caught the market pioneer.

This approach is extended in Table 5. It uses the mean market age for each time period along with the mean pioneer leadtime for each order of entry category. This yields predicted values that represent realistic data combinations. These predictions hold positioning quality ($P_{nc} = 1$) and advertising ($A_{nc} = 1$) constant. Following Urban et al. (1986, p. 654), Table 5 also shows the estimated market share levels for two to six market competitors.

In Table 5, the second entrant's market share essentially equals the pioneer's share in pre - World War II markets and in markets started between 1944 and 1956. Since the average age for markets pioneered between 1944 and 1956 equals 33 years, this indicates that with the passing of three decades or more, second entrants have often caught the market pioneer. Even so, the model predicts that third and fourth entrants in these relatively old markets have typically <u>not</u> caught the pioneer. Also, second entrants in markets pioneered from 1960 to 1974 have typically <u>not</u> caught the pioneer.

IV. Summary & Conclusions

When attempting to pioneer a new market, the short-term costs and risks associated with this attempt are often high and certain to occur. The long-term benefits associated with a successful pioneering attempt though are highly uncertain. Highly uncertain long-term benefits arise because market pioneers can self-destruct, be crushed by an established giant in a related market, or be worn down by an onslaught of later entrants. Of course, a profitable decision requires that high and certain short-term costs be traded off versus uncertain long-term benefits. Research insights into sustainable market pioneer advantages helps reduce, but cannot eliminate the uncertainty associated with these potential long-term benefits.

The empirical results above continue to support the general tendency reported in earlier research that market pioneers tend to develop sustainable market share advantages. For example, the Urban et al. (1986) order of market entry results are supported for each of the numerous model specifications examined above. This highlights the robustness of the market pioneering and market share relationship.

Extensions to the Urban et al. (1986) model demonstrate that the length of a pioneer's leadtime does matter, that a year of lead time appears to be worth more today than in the past, and the pioneer market share advantages slowly deteriorate over time. While pioneer market share advantages tend to be sustainable, the empirical results suggest that after roughly three decades or more, second entrants have caught the market pioneer. Third and later entrants though continued to trail both the pioneer and the second entrant. Also, in markets that were pioneered since 1960, even second entrants tend to trail the market pioneer.

In conclusion, the empirical results indicate that order of market entry has the primary impact on sustainable share advantages for market pioneers. While the pioneer's leadtime and market age have a secondary impact, these factors are both statistically and managerially significant. Future research needs to examine other issues such as pioneer share advantages across international markets and order of entry implications for markets pioneered in the 1980's and 1990's. Since the product life cycle is speeding up, it is probably not adequate in the 1990's to measure pioneer leadtime in terms of years. The 1990's probably require monthly or even weekly data.

TABLE 1

Regression Results for Market Share Relative to the Pioneering Brand

Variable & Expected Sign	Urban et al. (1986) Replication	Variable Definition Changed	Extending the Urban et al. (1986) Model: Market Age	Market Age Interactions	Pioneer Leadtime Interactions
Order of Entry (-)	-.45[a] (-5.50)***	-.60 (-3.95)***	-.66 (-4.37)***	-.49 (-2.82)***	-.49 (-2.90)***
Pioneer Leadtime (-)		.10 (1.53)	-.08 (-.78)	-.20 (-1.74)**	-.15 (-1.49)*
Pioneer Leadtime Interaction 1944 - 1956 (-)					.03 (.51)
Pioneer Leadtime Interaction 1960 - 1974 (-)					-.13 (-2.20)**
Market Age (+)			.17 (2.34)***	.23 (2.89)***	.19 (2.64)***
Market Age Interaction 1944 - 1956 (+)				.02 (.41)	
Market Age Interaction 1960 - 1974 (+)				-.09 (-1.88)**	
Lag Between Entry (-)	.05 (1.05)				
Positioning (+)	1.12 (9.34)***	1.12 (9.42)***	1.16 (9.88)***	1.15 (9.72)***	1.15 (9.77)***
Advertising (+)	.28 (7.13)***	.29 (7.25)***	.29 (7.49)***	.28 (7.39)***	.28 (7.49)***
Adjusted R^2	.75	.76	.77	.78	.78

a) The values in parentheses are z-statistics. Since each coefficient estimate has an expected sign, the tests are one-tailed with * = 10%, ** = 5%, and *** = 1% significance.

TABLE 2

*Order of Entry Penalty**

Entry Order	Share Relative to Pioneering Brand
First	1.00
Second	.71
Third	.58
Fourth	.51
Fifth	.45

*Note: The order of entry penalties are based on Table 1's order of entry estimate. For example, the second entrant is penalized by $2^{-.49}$ or .71.

TABLE 3

*Pioneer Lead Time Penalty**

Share Adjustment Relative to Pioneering Brand

Pioneer Lead Time in Years	Pre-World War II	1944 - 1956	1960 - 1974
1	.91	.92	.82
2	.85	.88	.74
3	.81	.84	.68
4	.79	.82	.64
5	.77	.80	.61
10	.70	.75	.51
15	.66	.71	.46
20	.64	.69	.43
25	.62	.67	.40

*Note: The pioneer lead time penalties are based on Table 1's pioneer lead time estimates. For example, a one year pioneer lead time in the pre-World War II sample penalizes estimated market share by $(1 + 1)^{-.15}$ or by .91.

TABLE 4

*Market Age Benefits**

Market Age (Years)	Share Adjustment Relative to Pioneering Brand
10	1.55
20	1.77
30	1.91
40	2.02
50	2.10
60	2.18
70	2.24

*Note: Market age benefits are based on Table 1's market age estimate of .19. For example, the share adjustments for a 10 year old market is $10^{.19}$ or 1.55.

TABLE 5

*Combined Influence of Pioneer Lead Time and Market Age on the Order of Entry Penalty**

Sample	Share Relative to Pioneering Brand	Shares (%) 1st	2nd	3rd	4th
I. Pre-World War II					
Entry Order					
First	1.00	100	-	-	-
Second	1.00	50	50	-	-
Third	.76	36	36	28	-
Fourth	.62	30	30	23	18
II. 1944 - 1956					
Entry Order					
First	1.00	100	-	-	-
Second	1.02	49	51	-	-
Third	.79	36	36	28	-
Fourth	.67	29	29	23	19
III. 1960 - 1974					
Entry Order					
First	1.00	100	-	-	-
Second	.78	56	44	-	-
Third	.53	43	34	23	-
Fourth	.39	37	29	20	14

*Note: These values are based on the Table 1's final model specification. To hold positioning quality and advertising constant, $P_{NC} = 1$ and $A_{NC} = 1$. Pioneer leadtime is the average leadtime over each order of entry category in each time period. Market age equals the average age for each time period.

FIGURE 1

Average Pioneer Lead Time Over Second Entrants

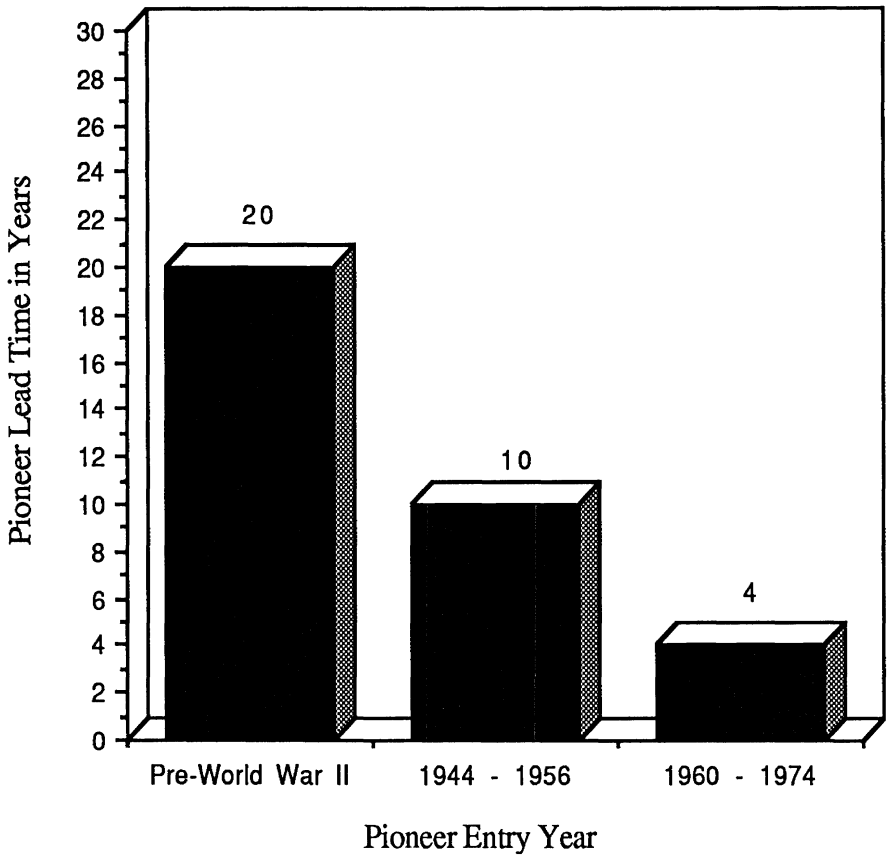
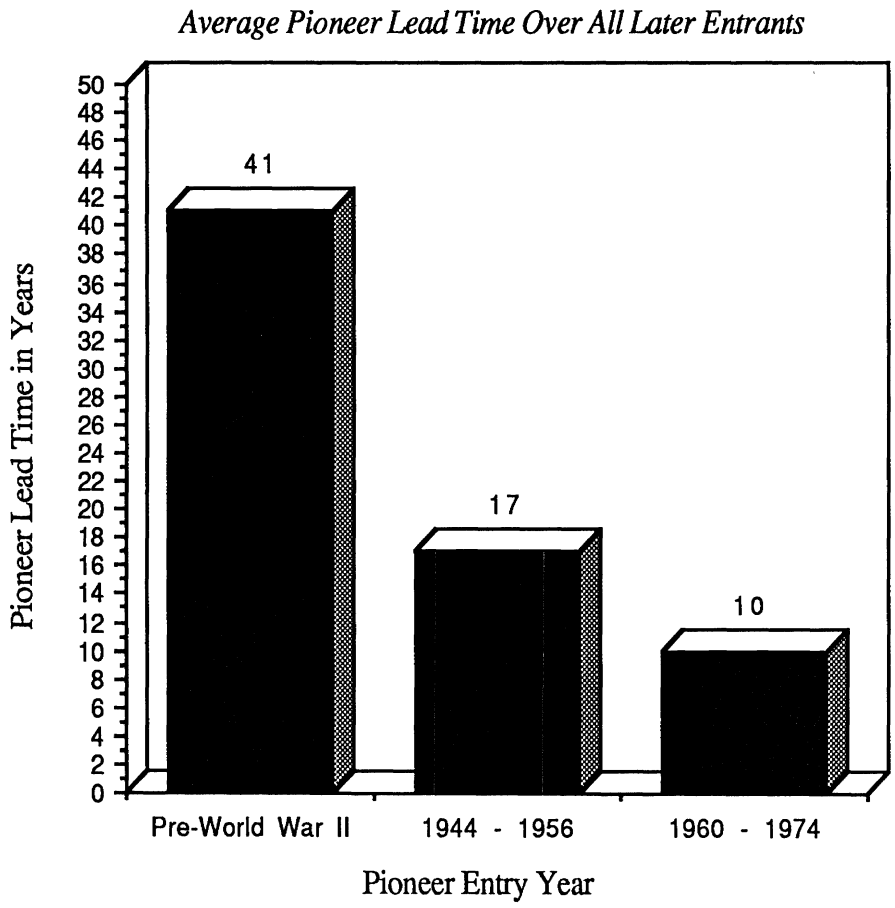


FIGURE 1 (Cont.)



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