A SURVIVOR ANALYSIS OF CALIFORNIA WINE PRODUCERS

by

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CHAPTER I

INTRODUCTION - THE NATURE OF THE PROBLEM

This thesis has two main objectives. The first is to review the creation and use of, as well as objections and alternatives to the survivor method, an empirical method of evaluating the optimal size firm (plant) introduced by George Stigler (1958). A revised methodology for the survivor technique is suggested; and a reappraisal of the results obtained by various current techniques is made. The techniques considered are the survivor method, businessman survey, technical approach, use of rates of return, and the static measures TOP50 (the mean size of firms that produce the upper 50% of the industry total) and MED (the smallest firm size in the upper 50% of the industry total). The second objective is an application of the revised survivor technique to the California wine industry using firm-by-firm data covering the period 1948 - 1984. The two static methods, TOP50 and MED, are also used on the data and the results compared with those of the survivor method for consistency and predictive content. The results of this analysis are then examined for the presence of trends and to better understand the outlook for this unique and growing segment of the economy.

The methodology used in this thesis is a modified form of the survivor survey. The method is modified by the use of firm by firm data rather than data that has been previously put in aggregate form with regard to size categories. This allows the creation of size categories by the grouping together of all contiguous sizes of firms that have similar changes in their aggregate market share. The focus of this survivor survey is upon one industry, covering a span of almost 40 years, rather than an analysis of numerous industries over a a few years. This allows not only the observation of the optimal size firm at any one time, but also the behavior of this optimal size firm over a time period in which a substantial shift in demand for the product has occurred. Using the same data, the changes and trends in numbers of firms, industry concentration, and total industry size will also be considered. The data used comes from directory issues of Wines and Vines. It consists of fermenting and storage capacity figures used as a proxy for firm output.

The question of optimal firm (plant) size and the related question of optimal plant size have both practical and theoretical consequences. In the domain of theoretical economic concerns there is the need for a valid empirical measure of optimal firm size. The use of the survivor method as this measure, has been the subject of a continuing controversy. Although there have been numerous survivor studies on various industries there are features of the wine industry that make it somewhat unique. These include its being comprised of firms of vastly different size, its complex product differentiation, and its great concern with the somewhat nebulous concept of a nonquantifiable and yet not wholly subjective question of product quality (Amerine 1972). Rather than aggregate data, this paper will use discrete firm data to compute the firm classes. This gives greater flexibility in firm size groupings and therefore a possible increase in the accuracy of the results.

In the practical sphere, optimum firm size is a valuable datum in the constant entrepreneurial search for profit. The recent problems of low commodity prices, high farm debt, and increasing bankruptcies in the agricultural sector have fostered a search for alternative crops. The wine grape has been often mentioned in this context as a possibility in agricultural areas as diverse and geographically separated as the states of South Carolina and Washington (Mathia et al. 1977)(Wood 1981). There is an approximate lag time of 5 years from vine planting until full-scale harvesting. This delay makes imperative the planting of the appropriate varieties of grapes, which depends on where and to whom both the wine grapes and the resultant wines are to be marketed. Many factors, including considerations of freshness and therefore quality, transportation costs, content and labeling issues, make the decision to begin wine production in a new area a double one. The prospects are poor for a winery without the proper local production of wine grapes, as the prospects for wine grape sales are diminished if there is not a local winery to process them. The question of optimal firm size is therefore an integral part of the agricultural decision to plant wine grapes. Such issues as capital requirements, ease of entry, and the expectation of profitability in the wine-producing sector of the industry are all related to the question of optimal firm size.

There are also practical questions of governmental regulation including industry protection at the state level (Boddewyn 1964). As of yet, there has been little evidence of concern in governmental circles as to monopoly powers in the wine industry. Since wine is an alcoholic product, there has been a great deal of industry regulation from prohibition and its repeal on the national level, to the county-by-county laws still in effect in some states regulating sales and production. The laws are encyclopedic in scope and cover not only such features as alcoholic content and where and to whom sales may take place, but such items as in-store promotional restrictions, distributor ownership, method and manner of wholesale shipments (Wine Institute Legislative Bulletin), and recently the beginnings of a more elaborate statement of contents based on geographic region (Gay and Hutchison 1984). A firmer understanding of the industry composition and structure of the wine industry will help in the evaluation of both existing and proposed legislation in the future.

The wine industry is an important as well as a fascinating industry. In 1983, California wine production accounted for more than 92 per cent of domestic production. (Wines and Vines 1984) In the same year, the California grape crop accounted for 637,210 acres and was valued at over $1.1 billion of which more than one-half was utilized for the production of wine. This is in comparison to the total California farm crop of that year being valued at $15 billion (California Farmer 1983). Total domestic consumption of wine in 1984 came to 542 million gallons with California consumption constituting 117 million gallons of the total. Using the estimates of average retail price of $2.95 for a 750 ml. bottle, the value of the total U.S. retail market for wine in that year can be estimated to be approximately $8 billion dollars.

Per capita wine consumption in the U.S. is still very low by European standards. The 1982 per-capita figures finds the U.S. ranked 30th world-wide with a 2.2 gallon per year consumption rate, compared to Italy's 24.15 gal. and France's 22.72 gal. America's relative per-capita consumption levels are much higher in distilled spirits and beer with 1.94 gals and 24.31 gals which ranked 10th and 12th respectively. There would appear to be much room for growth in the area of domestic wine consumption.

The United States is a net wine importer, with 1984 imports amounting to over 142 million gallons. This wine comes from Italy, France, Germany, Portugal, and Spain in order of importance. Exports for 1984 were only 1 million gallons, the majority going to Canada and the rest to Japan and the United Kingdom.

Chapter II is a brief history of the California wine industry with some economic considerations. Chapter III is a review of the literature concerning the empirical measurement of optimal firm (plant) size with an emphasis on the survivor method and objections to its use. Chapter IV begins with a discussion of the source and aptness of the data used in the present study. Next, the data is analyzed using the modified survivor technique as well as the TOP50 and MED methods. Comparisons and contrasts are then made between the methods. Chapter VI is a summary and conclusion of the findings of the thesis.

CHAPTER II

A BRIEF HISTORY OF THE CALIFORNIA WINE INDUSTRY

While the primary purpose of this thesis is not to provide an economic history of the California wine industry, it is necessary to briefly review some of the features, both technical and historical, that have affected and continue to affect this industry. The major sources for this review are Fisher (1962), Hutchinson (1969) and Adams (1985).

Wine is the fermented liquid produced using fruit juice and solids as the primary inputs. The present study will be limited to the wine that is produced using grapes as the main ingredient. The vineyard is the "farm" where the grapes are grown, and the winery is the "plant" that first crushes the grapes and then ferments, ages, and bottles the wine.

In actuality, there is not a convenient boundary between vineyard and winery in the grape-wine industry in general nor in the California grape-wine industry in particular. There do exist discrete vineyards that merely grow the grapes and then sell them at market. There are also wineries that purchase all their grapes for their wine production. Many vineyards produce some wine and many wineries grow some of their own grapes. Complete vertical integration is also present, especially among the small to middle-size firms. For the purposes of this thesis, a wine firm will be defined as a firm or portion of a firm whose product is the fermentation and storage of wine. This division, while not unduly artificial, is admittedly arbitrary and caused by the form of the data available.

One of the most pervasive features of the wine industry is its overwhelming product differentiation. This is interesting in economic terms precisely because it is not the classical ideal of competition between many firms with an undifferentiated product, nor the standard oligopolistic scenario of a few firms competing with a few differentiated products. At present, the California wine industry consists of more than 500 firms, each normally offering at least 3 to 4 types of wine. There is also some differentiation of the product from year to year (though this is generally less true in California than in the wine producing regions of France.) In order to understand the diversity in the wine trade, the diversity in the types of wine grape must be considered.

There are three main divisions in the types (varietals) of grapes grown: 1) The table varietals, 2) the raisin varietals, and 3) the wine varietals. This nomenclature is somewhat misleading since a table varietal (e.g., Thompson Seedless) can be used not only as a table grape, but also dried to produce raisins. In addition, table varietals are used extensively to produce wine. The nomenclature merely denotes the predominant use of the varietal, and does not exclude its usage in the other categories. The table grapes vines are vigorous and heavy yielding. The varietals that are used predominantly for raisin production also have vigorous and heavy yielding vines whose fruit may also be used for table consumption and wine production. In general, the wine varietals are not well- suited for other uses. In addition, they come from vines that are neither as vigorous nor as heavy yielding as either the table or the raisin grape varietals. The extent of the variety, at this lowest level of the wine production process, can be seen from the planting figures. In 1976, the California Farm Bureau listed acreage planted in 6 different raisin varietals, 24 different table varietals, and 64 different wine varietals. The fact that most wine is blended from different grapes means that there is an almost endless amount of differentiation in the final product.

There are four major types of wine produced in California: table, dessert, sparkling, and other special natural wine. A table wine is a wine with an alcohol level below 14%; it may be either red, white, or rose and may vary from very dry to slightly sweet. A dessert wine is a wine that has an alcohol level from 17% - 21%; it may be red, white, or nutty brown, and may vary from very dry to very sweet. Sparkling wines are wines that are carbonated either from natural fermentation or with injected carbon dioxide. The "other special natural wine" is a fairly new category that has lately acquired great importance. It includes mixed wine and juice concoctions such as sangria and the newest wine product, the wine cooler.

The first three types of wine can be further divided into two broad categories of quality: 1) standard and 2) premium. The fourth category has been produced only in standard quality, but it is not inconceivable that a premium cooler might be produced in the future.

The California grape-wine industry had its beginnings in the late eigththeenth century with the growth of grapes and the production of wine by the Franciscan friars in the California missions. Although there are native American grapes, the European varietals have been found to produce a higher quality wine, and the Spanish friars imported a European varietal which came to be known as the Mission grape. The Mission grape was not grown extensively nor for commercial production, but the Franciscans did demonstrate the suitability of the California soil and climate for grape production.

The next stage of the industry's growth occurred as a result of the California gold rush. The demand for alcoholic drink increased markedly with the swelling of the population resulting from the arrival of thousands of prospectors and adventurers. Grape cultivation and wine production sprang up almost overnight as supply rushed to answer demand. This was the beginning of the northern California vineyards and wineries. Besides the large scale production of wine from existing grape stocks, there began some serious experimentation with a number of imported European varietals. The grape and wine industries continued to prosper in California until the onset of prohibition which caused the almost complete destruction of the wine industry.

To understand prohibition's impact fully, it must be remembered that the wine varietals are poorly suited to any other use. Even though there was some legal wine production for religious ceremonies, the majority of the wine varietals were destroyed in favor of table and raisin varietals or other cash crops. When prohibition was repealed, the industry began again, but with an emphasis on the use of table and raisin varietals since they were already planted and ready to use. The industry enjoyed a 30 year period of steady growth accompanied with the renewed efforts to import and test various European varietals. During this period, the number of firms steadily declined and firm size increased slowly with the shift from family owned firms to corporate entities.

In the late 1960's the wine industry encountered a substantial increase in demand. This was a very dramatic increase which would find domestic wine production experiencing a fourfold increase in the 1967 - 1984 period. Explanations for this substantial increase are as numerous as they are vague. The consensus is that in some way this increase was connected to the reaching of maturity of the baby boomers, and/or the changes of lifestyles associated with the social upheavals of the 1960's. In addition to the sizable increase in quantity, there were other significant changes in the wine industry. The number of firms reversed its decline and began to increase. There was an increase in plantings of wine varietals and the use of table and raisin varietals in wine making fell from favor.

Historically, throughout the world, wine has been labeled using a regional name. This might be a relatively large area such as the Cote Rotie or Bordeaux wine growing regions in France, or as small as a single vineyard as in Chateau Margaux which itself is but one small part of the Bordeaux region in France. The California industry deviated from this tradition by naming its wine for its character; thus, if a winery thought that its product mostly resembled the German wines from the Rhine Valley it was called a Rhine Wine. The generic labeling of wines began a gradual decline in the 1960's with the increased emphasis on the production of wine using predominantly wine varietals. The use of the name of the varietal grape to name the wine then came into vogue. A wine that was made using the Pinot Noir grape (the varietal that is predominant in the red wine produced in the Burgundy region) which formerly might have been labeled simply as Burgundy, now might be labeled as Pinot Noir (the law requires that if a varietal name is used then a minimum of 51% of the juice must be from the varietal). In addition to the rise of varietal labeling, there began in the early 1970's the addition of regional place names to the wine labels. The regulation of place name use has been conducted by the Bureau of Alcohol Tobacco and Firearms.

Another feature of the period between the late 1960's and the early 1980's resulted from the vast increase in the demand for wine during this period. The increased demand sparked an interest in wine production in many regions of the state in which there had not been any prior production.

CHAPTER III

LITERATURE REVIEW OF EMPIRICAL MEASURES OF OPTIMUM FIRM SIZE

The concept of optimal firm size is derived directly from the idea of economies of scale. The empirical evidence of the increased efficiencies associated with mass production was overwhelming during the industrial revolution with the advent of interchangeable parts and the division of work. The question of whether there was an end to the increasing economies of scale or even the possibility of diseconomies of scale at some higher level of output was not as empirically obvious but had intuitive appeal. Economies of scale first increasing and then decreasing give rise to the familiar U-shaped long run average cost curve (LAC). The other two reasonable possibilities are the ever downward sloping LAC resulting from always increasing returns to scale and the L-shaped LAC which results from first increasing and then constant returns to scale. If by "optimal plant size" is meant the plant size which achieves the lowest long run average cost, then these three models of returns to scale will result in three quite different optimal plant size designations. There is one unique size of optimal firm on the U-shaped curve (i.e., the size corresponding to the minimum point on the curve), no point at all on the ever increasing returns to scale, and an infinite number of points on the L-shaped curve corresponding to the entire horizontal leg of the L. Conversely, the empirical results obtained from industry studies might tell us the most likely model for returns to scale.

There are several theoretical and practical considerations that contribute to the need to determine the size of optimal size firms in the various industries. The first is to determine the normal shape of the LAC. In general, the finding has been that the L-shaped is the predominant form (Bain 1969). The second is to provide economists with some basis to advise policy makers in questions of monopoly, concentration, regulation, and efficiency. The third is to provide information on efficient scales of production to possible entrants to the industry.

The first problem that one encounters in trying to arrive at an estimate of optimal firm size by whatever method is that of isolating the industry in question. The primary difficulties here are caused by the extent of firm diversification and product differentiation. It may be quite difficult to completely separate the distinct product cost curves in a diversified firm which is in part vertically integrated and therefore supplies itself with some of the inputs to the production of the product under investigation. There are also separation problems associated with economies of scope. If a railroad line handles both freight and passengers, how might the capital cost of the rails be figured in the context of solely the freight industry? Beside capital assets, economies of scope may be encountered in multiproduct firms in terms of their goodwill and/or company name recognition from a different product. There is also the question of product differentiation. In the classical models of supply and demand there are distinct and undifferentiated products such as red winter wheat, or bales of cotton. Even when there is some difference in these products, there is normally an agreed upon method of grading the products such as staple in cotton, or sulfur content in coal. In the case of wine however, there is not one simple undifferentiated product, but potentially at least as many as there are firms. There is a strong case for the validity of this product differentiation. It would seem that there is little real difference between such "differentiated" products such as Post Toasties and Kellog's Corn Flakes except for packaging. This is apparently true for the beer industry as well. Customers, when given choices in blind tastings, could not distinguish their favorite brands (Greer, 1981). Studies conducted with novice wine drinkers, however, found that with a minimum of training they could distinguish between various wines with little trouble (Schmidt, 1981).

Another choice that must be made is between optimal firm size and optimal plant size. Theoretically, the production function might lead one to concentrate on plant size as the main object of the analysis. The fact that most firms in the wine industry have only one plant would seem to offer additional weight to this decision. However, the economies of scale and scope of which a multiplant firm can avail itself speak strongly in favor of the optimal firm size decision. Finally, in practical terms, the investigator is most probably left with the form in which the available data presents itself since there are few practical methods of converting plant data to firm data and vice versa.

Once the industry has been isolated and the decision of plant versus firm has been decided, there appears the problem of the parameters to be used in measuring firm or plant size. There have been almost as many parameters used as there have been studies. The parameters that have been used have included such diverse items as numbers of employees, total assets, physical output, use of a specific input, and plant capacity. The fact that these diverse types of measurements have been used points to one of the primary problems in empirical work, namely the availability of data. The primary sources for data have been government publications, corporation reports, and industry publication reports.

There have been five main methods that have attempted to deal with these difficulties in the empirical determination of optimal size plant/firm. These are 1) the survey approach, 2) the technical approach, 3) use of rates of return, 4) static measures, and 5) the survivor approach. All five methods can still be found in current usage in the literature, and they are reviewed herein one by one with some analysis of their strengths and weaknesses. Special attention will be paid to the survivor approach and two of the static measures, TOP50 and MED since these probably have the highest current usage (Allen 1983).

The survey approach was pioneered and used most extensively by Joe S. Bain (Bain 1956). It involves trying to ascertain the optimal plant size by taking a survey of firm owners as to their estimates of the most efficient plant size in their industry. This approach has the appeal of bringing in the ideas of the people with an in-depth knowledge of the various methods of production and marketing. The chief objection to this approach is that, in spite of whatever objective truth it may contain, it must also contain the subjective beliefs of those who answer the survey. This would be least objectionable in an industry that was mature, stable and which had experienced little in the way of change in methods of production, growth, or firm turnover. In this type of industry, the common wisdom might bear a close resemblance to fact. On the other hand, in an industry that was in the throes of expansive rivalry, the opinions of some of the firm owners might reasonably be expected not only to be wrong, but might lead to their own failure in the future. Other considerations such as prestige, regulatory issues, or the urge to be less than candid might also tend to make the responses depend not solely on factors of pure economic efficiency.

The second method in current usage is the technical approach (For an example see Mathia et al. 1977). This technique is simply the calculation of the chances for success from alternative sizes of manufacturing plants. In this basic form, this technique has quite probably been used by businessmen since there have been numbering systems and economic enterprise. In current practice, the technique calls for an engineering feasibility study of various sizes of plants in order to find the optimal size. The factors of construction costs, production costs, input costs and predicted product selling price are all worked into a "what if" scenario. This method is quite appealing and it is commonly used in both small and large businesses alike. The advent of microcomputer spreadsheets such as Visacalc, Lotus, and Multimate have made the process far less laborious then when the calculations had to be made by hand. The use of these programs is now part of the required curriculum at such prestigious MBA programs as the Harvard Business School. As useful as this method may be, it has problems in terms of the economic analysis of optimal firm size. Saving (1961) makes the objection that the technical approach is based on the assumption that all factor supply curves are completely elastic as well as the assumption that the demand for the product is completely elastic. Another type of objection is brought out by Stigler (1958). He reasons that although the technical approach may be able to compute the optimal size plant at the present time, it would only be the optimal size plant if the plant were built de novo and therefore does not reflect the optimal plant size of plants already in existence. He also reasons that although the technological studies may contain fairly precise technological parameters, they must involve fairly imprecise nontechnical parameters such as marketing costs, transportation rate changes, labor relations, etc.

The third type of approach is the use of actual cost or rate of return data from different size firms in an industry, the idea being that the average cost curves could be plotted from the cost data or calculated from the profit levels of the firms doing business. In this case, there would not be the subjective opinions of the surveys or the assumptions of the technical studies; the actual figures in black and white would tell their own story. However, there is a problem with this method. The costs and profit figures that are commonly available are accounting costs and profits. As such, they may bear little resemblance to economic costs and profits (Fisher and McGowan 1983). Since different firms may follow different accounting procedures (e.g., the capitalization of goodwill, depreciation rates), not only will the accounting figures be different from the economic figures, they can also not be used as a proxy for the economic figures. This is indeed a shame since this type of data, at least for corporations, is some of the most easily obtained in the form of corporate reports.

The fourth approach to the empirical determination of optimal firm size is the survivor survey. It was developed by George Stigler in the late 1950's in response to the objections he had to the other techniques (1958, pp. 72.) Stigler proposed that a simple technique could be applied across many industries to quickly determine the optimal firm size based on the change in market share of different size firms in those industries. This technique is based on the simple idea that efficient firms will tend to stay in business and that inefficient firms will tend to go out of business. Stigler reasoned that if this were so, a comparison between two points in time as to the relative market shares of various size firms would reveal which size firms were increasing their market share and which were losing it. The gain of market share could then be taken to indicate firm sizes that were efficient and the loss of market share to indicate inefficient firm sizes.

Stigler asserts that the efficient firm is the firm that manages to face and overcome any and all the business problems that it encounters. These include but are not limited to problems with labor relations, rapid innovation, government regulation, and unstable foreign markets. He stresses however that this efficiency is not social efficiency since it does not necessarily deal with externalities.

To illustrate Stigler's technique the author has reproduced table 1 adapted from a table published by Stigler resulting from his survivor survey of the steel industry (1958 pp. 76). In this particular study, Stigler first delimited the industry by including those firms that used the open-hearth or Bessemer processes and by not including crucible steel which he regarded as a closely related but separate industry. He used capacity as the parameter for size since the output data was not available by individual firm. Using this data for the years 1930, 1938, and 1951, he selected the size groups. In this case, he divided the industry into seven groups, but this is a somewhat arbitrary number that depends on the fit of the data. In some studies he used as few as four and as many as eleven different subdivisions. He next expressed the size of each of the subdivisions as a percentage of the total industry capacity for that year. Stigler would switch from the representation of firm size as a percentage of total

TABLE 1

STIGLER'S DISTRIBUTION OF STEEL INGOT CAPACITY

Company Size (Percent of Industry Total)	Percent of Industry Capacity 1930	1938	1951	Number of Companies 1930	1938	1951
Under 1/2.......	7.16	6.11	4.65	39	29	22
1/2 to 1........	5.94	5.08	5.37	9	7	7
1 to 2 1/2......	13.17	8.30	9.07	9	6	6
2 1/2 to 5......	10.64	16.59	22.21	3	4	5
5 to 10.........	11.18	14.03	8.12	2	2	1
10 to 25........	13.24	13.99	16.10	1	1	1
25 and over.....	38.67	35.91	34.50	1	1	1

source: George Stigler (1958 p. 76)

industry to absolute firm size in different instances. He maintained that the use of size as a percentage of total industry size "would eliminate the influence of the secular growth of industry and company size." Then for each year of the data (e.g., 1930, 1938, and 1951 in table 1), he summed the capacities for each size subdivision and found the percentage of total industry capacity for that year. Interpreting the results shown in table 1, Stigler noted that there was a loss of share in the size categories of $< 2\ 1/2\%$, and $> 25\%$. Hence he concluded that the optimal firm size is the entire range $2\ 1/2\% < X < 25\%$. Using this table, Stigler deduced the LAC depicted in fig. 1. Stigler did not place a scale on the vertical axis of this graph, maintaining that although the survivor method could differentiate between optimal and nonoptimal size firms based on private cost, it could not give the difference in costs between them.

In the same paper, Stigler analyzed 50 different industries. Of the industries studied only steel and passenger automobiles were analyzed at both the firm and plant level. The other 48 industries were analyzed only by firm due to the form of the data.

The various objections to Stigler's methods raised by other economists will be considered in the subsequent review of the literature. However, there is a point that should be addressed at this time. Stigler's sometime use

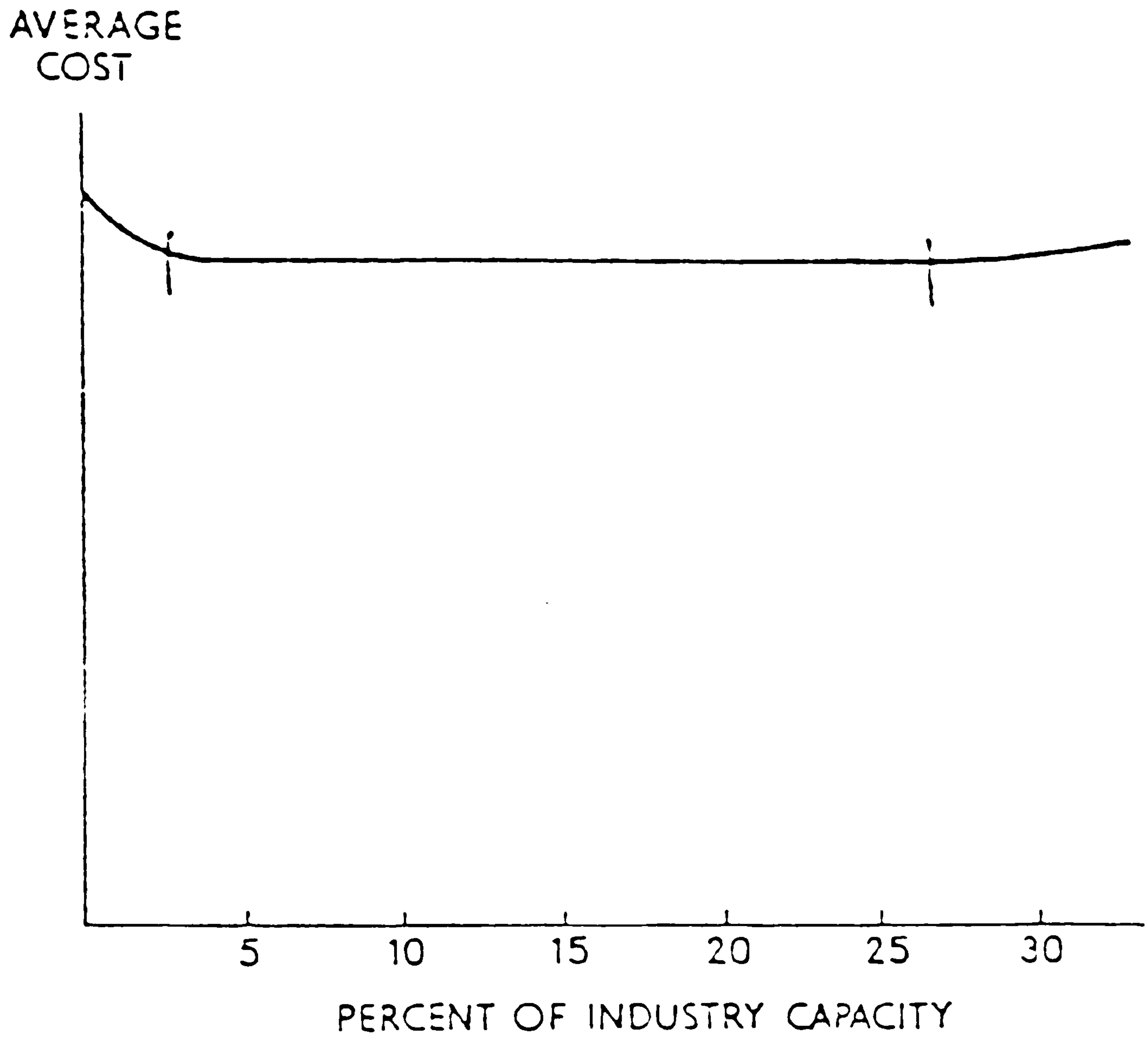

Figure 1. Stigler's LAC curve for steel ingot production (1958 p. 76).

of the size categories expressed as a percentage of industry total rather than the use of the absolute size of the firms leads to an obvious contradiction. This may be seen by considering a hypothetical industry at time 1 in a long-run equilibrium condition with a total output of 1000 units. If firms in this industry have a steeply concave LAC with a long run optimal plant size of 100 units, then a long-run equilibrium situation would be expected in which the industry would consist of 10 plants each producing 100 units. Assume a shift in the demand curve to the 2000 unit level. At time 2, after a change to the new long-run equilibrium position, the industry should be expected to consist of 20 plants each producing 100 units. Of course, this is assuming perfectly elastic input supplies and an absence of technological change. If a survivor study were made comparing time 1 and time 2 using the size stated as a percentage of industry total then it would show the size category of 10% going from 100% to 0% and the size category of 5% going from 0% to 100%. Since the optimal size plant has remained exactly the same, any conclusion based on the apparent shift in optimal size shown in the survivor survey must obviously be extremely questionable. The use of percentage size categories makes somewhat more sense when plant size is measured in terms of output. The output from a single plant might well have a year to year fluctuation even when the size of the plant has not changed. If total industry output from the same size plants varies, then the use of percentage size categories would tend to filter out this secular variation. It would seem, however, that the absolute size would be preferable over a longer period of time. This would be true even if the conditions of perfectly elastic inputs and unchanging technology of the hypothetical illustration were relaxed. This would result in different absolute size plants being optimal and being reflected in the survivor survey's results.

The most notable result from Stigler's work was the finding of a fairly wide range of optimal sizes across many industries. This range was open-ended in 20 of the industries with some evidence of declining economies of scale in the other 30. This then results in a picture of the LAC much different than the familiar U shape of theory. It would appear to be L-shaped in the 20 industries and somewhat flat bottomed in the remainder. Stigler explains this partially by noting that a single optimum firm size should be expected only in an industry in which all the firms have access to identical resources. Since various firms will have access to different resources and in addition may use different processes a frequency distribution of optimum firm sizes should normally be expected.

In 1961 T.R. Saving, using Stigler's survivor method, published a study on 89 U.S. industries. He made use of U.S. Bureau of the Census four-digit manufacturing data classified by size of plant. The data used was for the two years 1947 and 1954. He began with data on 200 industries but had to pare the number due to incomplete data resulting from disclosure rules in industries, and ambiguous results in 53 industries (Saving 1961 p. 575). Agreeing completely with Stigler's analysis and methods, Saving concentrated on an analysis of the range of optimal plant sizes across his group of industries and an investigation of the probable causes of the distribution in terms of other economic variables. Some of his results are reproduced as table 2. To explain this variation in the range of optimal plant size, Saving used the technique of multiple regression to test for the importance of the factors of industry size, labor-capital, rate of industry growth in explaining optimal size. He concluded that the primary determinants of optimum size are the total size and capital intensiveness of the industry.

One notable problem with this study is the higher level of excluded industries, especially with regard to conclusions based on noncompetitive industry behavior. Since disclosure rules would most often affect industries which feature 1 or 2 large firms, these very industries would be of very high interest in looking at industries that might have noncompetitive aspects. In addition to this serious flaw, his throwing out of industries with ambiguous results casts a deeper shadow on any

TABLE 2

SAVING'S DISTRIBUTION OF OPTIMAL FIRM RANGES

Range in Percentage of Industry Terms	Number of Industries	Percentage	Cumulative Percentage
0.0 < X < 0.1	1	1.2	1.2
0.1 <= X < 0.5	9	10.8	12.0
0.5 <= X < 1.0	9	10.8	22.8
1.0 <= X < 1.5	12	14.5	37.3
1.5 <= X < 2.5	10	12.0	49.3
2.5 <= X < 5.0	27	32.6	81.9
5.0 <= X < 10.0	12	14.5	95.4
10.0 <= X < 15.0	3	3.6	100.0

source: T.R. Saving (1961 p. 581)

cross-industry conclusions made. Being that the essential goal of his study was a cross-industry analysis, his study must be viewed as a failure. Should this failure be considered as an indictment of the survivor technique itself, or perhaps of Saving's methodology? The primary problem here is probably with the form of the data itself. Stigler proposed this technique as a faster method able to utilize readily available data such as that published by various governmental agencies. One major difficulty is that this data has already been aggregated into arbitrary size categories by the reporting agency. These pre-determined categories can be added together to make larger categories, but they cannot be divided to reveal possible boundaries that might be somewhere within them. To properly select category sizes it may well be necessary to use sliding size scales to find unambiguous results. If the data is in the form of individual firm (or plant) data, this seemingly herculean task may be easily accomplished using any one of several commercially available data base programs (e.g., dBase III, Rbase, Appleworks.)

Leonard Weiss entered into the discussion with a paper on the survivor technique in 1964. Weiss's chief concern was whether or not the resulting optimal size plants obtained from a survivor survey were synonymous with socially efficient firms. He noted, as did Stigler, that the Stiglerian efficient firm may survive through monopoly action, monopsony in the labor market, or other factors that would not minimize social cost. His emphasis was on plants rather than firms since he wanted to compare his results with those obtained from businessman surveys or the technical approach, and these methods used plant data. He was concerned with the smallest optimal plant rather than the range of optimal size plants. This smallest optimal plant he denoted the minimum efficient scale abbreviated as MES. His study consisted of five industries for which industry directories with individual plant data were available. This data covered the period from the late 1920's to the early 1960's. In addition to the directory data, the industries selected also had been the subject of earlier businessman surveys and/or technical surveys made by Bain (1956). Weiss selected his size categories so that several plants would fall in each. In order to accomplish this he chose an approximately geometrical progression for the class sizes. In calculating the results, Weiss noticed that sometimes the shift of a plant or two on the borderline between two size classes would cause an "erratic change" in the importance of the bordering size classes. To overcome this problem he employed a three class size moving average to calculate his final results. He found that in the five industries considered, there was a close match between Bain's estimates and his own results with the exception of the period during and shortly after World

War II. An additional item of importance which was just touched upon by Weiss was the question of the extent of suboptimal capacity which will be covered at great length in the discussion of the work of Bruce T. Allen. Weiss explained the amount of suboptimal capacity which he found as due in part to small industries having a relatively large MES, and regional markets where local plants might have some protection from national competition in transportation costs. He found, however, that the extent of the suboptimal capacity rather than the 20% - 30% as reported by Bain, ranged as high as 80% in some of the industries.

One aspect of Weiss's work points up a specific problem in the use of the survivor method. This is the problem of choosing specific size categories. The theoretical results would show at small plant sizes a decreasing market share, then a relatively long period of increasing share which may or may not lead to a decrease in market share at the largest size plants. Both Saving and Weiss ran into the difficulty of erratic changes in the results that did not give this clearly defined outcome. Saving dealt with the problem by throwing out those industries that gave this ambiguous result. Weiss followed a more desirable course by smoothing out the results using a sliding average. The question is why do these erratic changes appear in the data, and what would be the best method to deal with them? It would be well to remember that the method is working with data from a relatively small finite number of discrete plants or firms rather than an infinite number of firms. This means that there may well arise an apparent problem as a plant or small group of plants experience normal growth. As this segment of the industry grows, it may increase to a size which was not populated by any firms in the base year and yet still be smaller than the largest firms. Assuming that neither this new size nor the original size are optimum, the survivor study would show that the new size had been growing and hence should be part of the optimal range. This occurs if the original plant size is in a different size category than the new size. If both original and new sizes fall within one size category, then the optimality of the firm size would succeed or fail as its increase or decrease in market share dictates. But is this not exactly what Stigler's use of size categories as percentages was supposed to correct? The problem with Stigler's technique in dealing with secular growth has previously been discussed. The solution to this problem is to create the size categories large enough to smooth out the data, yet with the boundaries sensitive enough to correctly locate the areas of change between increasing and decreasing market share. To properly create the size categories it is necessary to have individual firm (plant) data. The researcher must not attempt to utilize data that has been previously aggregated into arbitrary size categories. The data itself should dictate the size categories, and while one might expect a quasi-log normal size distributions on stochastic grounds, this distribution of size categories should serve at most as a starting place. In industries composed of many firms this should prove to be less of a problem as the number of firms (plants) cause the size distribution to more closely approximate a smooth curve. In industries composed of a few firms this process must be closely evaluated. Due to the fact that there are fewer firms, this should not prove to be that difficult to accomplish.

In 1967, William G. Shepherd presented eight major objections to the survivor method. These were: 1) that the survivor method gives descriptive rather than normative results, 2) that external factors rather than just internal costs were reflected in the results, 3) that the degree of scale economies or diseconomies were not shown, 4) that the range of optimal size has been interpreted as a range of constant cost, 5) that all plants either one-plant or multi-plant firms are treated alike, 6) that the application of newer technology might exaggerate the survival quality of small plants, 7) that the technique ignores the static distribution of plants, 8) that freakish estimates can and do result. In addition to the theoretical objections, Shepherd also compared the survivor technique results that he obtained to those of Weiss and Saving and found some discrepancies.

Shepherd's first objection to the survivor method, namely its descriptive rather than normative content, is perhaps his strongest. Even though Stigler, Saving and Weiss all maintain that the results obtained are not normative, as Shepherd points out, "...the temptation to endow the estimates with normative virtues verges on the irresistible." (Shepherd 1967 p.115) This is due to the terms used such as "optimal" in the case of Stigler and Saving and "efficient" in the case of Weiss. What is meant by these terms? In what sense are the survivors in this studies optimal or efficient? For that matter, what is shown by these studies if anything at all?

How might this objection to the survivor method be answered? It is scarcely surprising to suggest that a survivor survey reveals those that survive. Yet this tautology holds some features of economic interest. Even its critics will allow that the survivor technique indicates not only those that survive, but if they are maintaining, increasing, or decreasing their market share. It conversely reveals by their absence the size classes of firms (plants) that have either not survived or have not been tried. Consider a hypothetical industry that varies significantly from the ideal industry in perfect competition. Assume that its product is not homogeneous, or that its market is in part regional, or perhaps that some of its firms are sufficiently large so that they face a demand curve that is not perfectly elastic. If the researcher, in using the survivor method on this industry, expects the results to uncover the optimal firm (plant) size, as if the industry were in perfect competition, then he is bound to encounter disappointment. The survivor method will disclose what is, not what theoretically should be. But far from being its undoing, this is the very heart of its strength. Properly undertaken, the survivor technique will reveal what size firms (plants) are succeeding in the actual industries with all factors taken into account. If an industry existed in a state of perfect competition, then a survivor survey might logically be expected to yield the optimal size firm, at least in terms of private costs. The results in an industry that is not perfectly competitive should be expected to approach the theoretically optimal size as the industry more closely approaches the ideal of perfect competition. Therefore the fact that the method yields a result different from the optimal is itself a revealing piece of information about the conditions that exist in the industry. In cases of normative evaluation, the survivor method might be used in conjunction with another method, perhaps the technological method, to both evaluate the normative optimal size and evaluate the degree to which the industry differs from it. In cases primarily concerned with the feasibility of entry into an industry or expansion of an existing plant, the survey technique should be regarded as the primary indicator. In this aspect it surpasses even the widely used technological method since it does not rely on assumptions about how various factors in the industry might affect the success of a particular firm size. It deals with all the factors in the industry as they do affect the success of a particular firm size. The survivor method is surely not the ultimate measure of optimal firm size as Stigler originally proposed, but it remains a very effective and valuable analytical tool of the economist.

Shepherd's next objection, that the survivor method is affected by external factors rather than just strictly internal costs, is both true and inconsequential as a result of accepting the survivor study as a valuable descriptive tool of what is rather than a normative tool of what should be.

Another of Shepherd's objections is that the survivor method does not show the degree of economies or diseconomies of scale. This is correct and might well be a problem. Shepherd used as an example anti-trust considerations in which it would be desirable to know the trade-offs between a firm's scale economies and the probability of preventing collusive action. At best, the survivor method only implies different degrees of economies or diseconomies of scale by the results in the long run. Slight differences might allow survival over long periods of time whereas great differences would make there effects felt in a shorter time frame. The survivor method should not be expected to yield absolute clear cut results in the short run. In addition, there may even be a problem with the results in the long run. First of all, even the size categories that have a decreasing market share are still in the main populated by firms (plants) that have survived. Not only have they survived, but they may very well have increased their absolute size. The fact that their share of the total market has diminished is not an indication that they face imminent failure. A more in-depth discussion of the extent of this suboptimal capacity and the reasons for its continued existence will be forthcoming in the following section on Bain's work.

Shepherd's fourth objection is that the optimal range of the survivor survey has been treated as a range of equal cost. Even though the survivor method's results provide value data as to what size firms are increasing their market share, it would be erroneous to assume that this is solely due to cost factors. Economies of scale most certainly have cost effects, but there may well be other factors such as product differentiation, brand name recognition, economies of scope in multi-product firms, monopoly power, product quality and advertising. Trying to limit all the production and market factors that influence the survivor results solely to cost considerations is an oversimplification apt to lead to fallacious conclusions.

Shepherd's objection to the use of both single plant firm data along with multi-plant data misses the point. The treatment of the data should be a consideration of the results sought. There are several ways to conduct a survivor study, depending on the emphasis of the researcher. Stigler began his study using firm by firm data. He followed this up on two of the industries with a plant by plant study. If the data is rich enough for this to be done, then a comparison could be made to see if the optimal size plant of the single plant firms was different than the optimal size plant of the multi-plant firms. If there was no difference, then there would be some evidence against economies of multi-plant operation and vice versa. If a choice must be made between plant and firm data, Stigler advocated firm data, while Saving and Weiss preferred plant data. If the survivor method dealt solely with cost factors, then Weiss and Saving would have been on firmer ground. Since there is not any practical way to filter out the multi-plant from the single plant firm data, the most meaningful form of the survey would be that of a firm based approach.

Shepherd's sixth objection is that newer technology might give undue emphasis to smaller sized plants. "Undue" in what sense? If the rise of a new technology did indeed make smaller plants more efficient then it is only fitting that this should be reflected in the results. In fact, it would be a more valid objection if the change in technology did not reflect itself in the results. It is just this total reflection of all the factors in the industry that is the survivor studies greatest asset.

Shepherd also objects to the survivor method's failure to consider the static distribution of plants. While the survivor method is based upon a concept of change, it of necessity involves the use not of a single static distribution of plants, but at least two. Therefore, from the survivor technique we have both the static results of the present plant distribution and the dynamic results of how it got there. This certainly does not taint the ending static result, indeed, it allows the research a certain amount of predictive content as well. This predictive feature of the work should be applied with caution especially if there are but two periods with which to work. The optimal result would be a long term multi-period approach from which long range patterns could be expected to be delineated much more clearly.

Shepherd's last objection is that freakish results can and do result and that therefore the survivor method is more of an art than a science. This is a serious objection and one that Shepherd supports by conducting his own survival study and contrasting his results to those obtained by

Saving and Weiss. If it is true that the study will not result in reproducible findings then it would be of little interest except as a historical curiosity. This type of failure is caused by the apparent ease by which a survivor study may be conducted. To be rigorous, it has been demonstrated that the data must be accessible on a firm by firm or a plant by plant basis and furthermore be carefully analyzed so as to determine the appropriate size category boundaries. The hasty application of data that has lost meaningful content by prior grouping will only give valid results by mere happenstance. The necessity of careful handling may certainly lessen the value of the tool as a quick technique, but not the validity when it is applied correctly.

A notable objection to the rationale behind the survivor technique was published in 1969 by Joe S. Bain. In this paper Bain concentrated on the question of survivalability rather than the survivor technique itself. He questioned whether the mere survival of two firms should lead to the assumption of equal cost curves, either private or social, for the two firms. Bain was correct in this matter as has been previously mentioned in the discussion of the work of Shepherd. However, in his analysis of the problem Bain concerned himself in the main with the extent and the perseverance of suboptimal firms. To give Stigler his due, he would not call these suboptimal firms survivors since their cumulative market share is not increasing. It is the very fact that their share is not increasing that makes them suboptimal. However, their existence in every study that Stigler, Saving, Weiss, and Shepherd conducted, and their existence in the cost studies of Bain raises an interesting question. Theoretically, a suboptimal firm with higher private costs would in a competitive market soon be forced out of business. Is their pervasiveness a indication of the lack of competition, and if so, what can be said of their social and private costs? Bain gave the extent of suboptimal output in one sample of industries to be between 10 and 30 percent and to be supplied by a fringe of firms that suffer significant diseconomies of small scale plants. Bain began by offering two types of false or misleading circumstances which do not actually involve suboptimal plants. The first case is the grouping together of two industries that are significantly different so as to warrant their separation. If the small firms are supplying a product that is sufficiently differentiated so as not to be a good substitute for that of the larger firms, then the apparent suboptimal capacity does not truly exist. The small firms may indeed have a much higher private cost and yet not be privately or socially inefficient. The second case involves production costs that are meaningfully greater in a smaller firm but combined with other cost factors that countervail them. Bain gave as examples industries separated geographically where high product shipping cost is involved, and an industry where a smaller firm with higher production cost may offset their disadvantage with a lower sales promotion cost per unit than their larger rivals.

The six models given by Bain to explain true suboptimal capacity were: 1) survival beneath a price umbrella, 2) surviving with large rival support, 3) securing hired pròductive factors at lower money prices, 4) entrepreneurial absorption of losses, 5) favored treatment or subsidy by governmental bodies, and 6) holding a market through unfair trade practices.

Bain found that the price umbrella model contributed to suboptimal firm existence in 40 percent of a sample of twenty manufacturing industries that he investigated. In an industry that has a single dominant firm or a small group of dominant firms, the leader(s) of the industry can set up a price based not on costs nor on monopoly profits, but somewhere in between thus allowing the continued existence of low efficiency firms. These smaller firms could survive at a suboptimal size while the leader enjoyed higher than competitive profits. Fear of anti-trust action could well inspire the larger firm to set the price high enough so that the smaller firms could survive maintaining the appearance of competition within the industry.

Bain's second model of suboptimal firm survival is similar to the first since it involves the leader(s) in the industry assisting the smaller firms. In this case, the support given to smaller rivals to avoid governmental intervention is in the form of lower costs by the sharing of information or the the favorable pricing of materials to the smaller firms by the larger.

In his third model, Bain asserted that the smaller firms might lower their costs by utilizing labor or other factors at lower rates than those of the larger firms. This might be accomplished by favored union treatment due to labor immobility in a declining area. This possibility seems especially weak. If the small inefficient firms are able to survive due to their ability to secure lower input costs, this could account for their survival in the short run. In the long run, there is no reason for the larger firms not to avail themselves of these same factors and lower their own costs. If this occurred and the larger firms did not lower their prices so as not to destroy the smaller firms, then this result in the model of a price umbrella. If the larger firms lowered their prices, then the smaller firms would have no basis for their survival in this model.

Bain's fourth model of suboptimal firm existence considers the role of entrepreneurial absorption of losses. He asserted that there is a persistent willingness for owner-entrepreneurs to accept profits that yield subnormal returns for their investments. As an example he cited the gasoline retailing business where it has been continually observed that owner-operators have remained in business with earnings equal to the market rental values of the self-owned lands on which they stand. Thus the owner-operators are in effect working zero wages. It might be thought that this "working for nothing" could not be a long run phenomenon, but in the case of self-employment there is a more complex psychological motivation than the simple profit motive upon which the majority of Western economics is based. The persistence of the phenomenon is perhaps best summed up by Bain (1969 p. 102):

> In some instances, the same inefficient firms survive for long periods of time. In others, such firms periodically go bankrupt, but their plants remain in operation as another wave of entrepreneurial cannon fodder assumes ownership with the same odds against it.

Bain's last two explanations for suboptimal capacity are rather straightforward, namely 5) favored treatment or subsidy by governmental bodies, and 6) holding a market through unfair trade practices.

In conclusion, Bain maintained that the social and private costs of these surviving suboptimal firms will be different from the larger more efficient firms and so the fact of survival should not be used in either a normative nor a descriptive analysis of an industry.

The chief problem with Bain's analysis is that he did not deal firmly with the very heart of the survivor method, the emphasis on growth or decline in market share. Stigler and Bain would both agree that these suboptimal firms do not have the same cost curves. The question should be whether or not the technique can be used to identify the portions of the industry that have lower social or private costs.

Faced with the list of objections on theoretical grounds to the survivor method and the need for an empirical measure of optimal size, several investigators developed their own measures of optimal firm size based on the distribution of plant sizes in a single year. Since only one year's data is needed, these "static" measures are necessarily easier to calculate than the survivor method. Weiss (1964) arranged the plants in size order from largest to smallest and then added the outputs, size category by size category, until 50 percent of the industry output was reached. Weiss named the smallest size category in this group MED, denoting the median size plant. This size was then used as a proxy for optimal size. Comanor and Wilson (1967), and then subsequently Esposito and Esposito (1971) found the mean size of the largest firms that accounted for 50 percent of industry output. This measure called TOP50 was then likewise used as a proxy for optimal size firms. The chief support for these two alternative measures of optimal plant size comes from high correlations to direct estimates of optimal plant size in Bain's previous studies. What is the rationale for this correlation? in brief, both Weiss and Comanor and Wilson assumed that whatever economies of scale are possible will be taken advantage of by the largest plants in the industry. While intuitively appealing, this assumption lacks rigor. Would not all the other-than-cost factors that caused such vigorous objections to the survivor method not also be at work here? Might not market imperfections affect which firms make up the top fifty percent of the industry output from which these two methods draw their data? Caves rejected the survivor method deferring to Shepherd's analysis, and then gave support to the static techniques with the following cryptic explanation (1975 p.135):

> One might say that the Weiss-Comanor-Wilson method places its emphasis on all those plants whose owners have chosen to place them in a given size class, the survivor technique only on those plants whose owners have chosen to change their scales in some recent period. The latter focus is preferable only under restrictive assumptions about the difficulty of changing a plant's scale once it is built.

This is naive. Merely because the static analysis is concerned with plants at one point in time, the dynamic processes that may be in progress cannot be disregarded. The plants that were "chosen" by their owners to be placed in a given size were not all necessarily chosen at the present time. In all likelihood, most of the size categories in the industry would contain both older and newer plants. On the other hand, plants that were recently planned and built would certainly be expected to affect the results of the two static methods.

One definite advantage that the static measures possess in common is the ability to give an empirical optimal size proxy with only 1/2 the amount of data needed by the survivor survey. However, this advantage is not gained without a concomitant loss. The static measures cannot contain any predictive substance. The results of the TOP50 and MED methods may give us a proxy for optimal plant size that may be used in concentration studies across industries, but they do not give much meaningful information about the individual industries unless they are quite stable and not in some process of change. Of course, the static methods could be used on a period of several years to track the changes in the industry, but in this regard they would be much inferior to the survivor method. The static methods by their very nature are confined to giving a single result. This result is not optimum firm size, but a proxy that is only postulated to vary with it. The survivor technique, while also only giving some proxy for optimal firm (plant) size, also provides other interesting information. It not only gives the optimal size proxy, but it also shows what is happening over the entire range of firm sizes in the industry.

How does the survivor technique results compare with the results obtained by the static techniques? B. T. Allen's (1983) comparisons between MES, TOP50, and the survivor method in three instances gave very similar results for all three methods. Since MES and TOP50 were developed in response to the objections to the survivor method, these similar results would seem to either exonerate the survivor method or damn the alternative results by association.

The review of the literature would indicate the following points. The survivor method is not a miracle tool to give quick answers to the request for an empirical measure of the optimal firm or plant size. The survivor method does give a proxy for this optimal firm or plant size that is at least as good as the other statistical methods available. It requires at least twice as much data as the static methods (i.e., two years) but yields more information as to trends in the industry. All of these techniques give descriptive rather than normative results, especially in industries in which there is a substantial departure from the ideal of perfect competition.

While there is a growing body of work on both the wine industry and the question of optimal firm size, there are not many studies which consider the question of optimal firm size in the wine industry. A brief survey on the studies that do exist follows.

It is perhaps ironic that the wine industry was one of the 50 industries that Stigler himself considered in his original paper (1958). He used total asset data for the years 1948 and 1951 as the measure of firm size. Stigler computed the optimum company size to be one with total assets of $1,304,000 and that the range of optimum size ran from a low of $500,000 to a high of $5,000,000. His failure to present the amount of change and/or the number of firms involved is distressing in the present context. This particular study was made using governmental data that was presented in predetermined size categories, and hence questionable on those grounds. Perhaps the most interesting result was the existence of a upper bound. This does not agree with the results of the present study in the long run. The changes in the size categories (as will be seen in the next chapter) during this relatively short period of time were slight and in a direction contrary to the long run trend. The wine industry during the 1948 to 1951 period was fairly stable. This lack of growth resulted in giving whatever changes that did occur during this period a heavier weighting and therefore distorting the results. This period will be examined in more depth in Chapter IV of this thesis.

In the absence of any comprehensive studies of the wine industry, there have been a few small scale feasibility studies of small scale wineries using the survey approach (Moulton 1981) and the technical approach (Bree and Witzke 1975). Both of these methods found relatively small scale operations to be feasible.

CHAPTER IV

DATA AND RESULTS

The data that is used in this investigation is derived from the directory issues of <u>Wines and Vines</u>, a wine industry publication. It is in the form of total storage and fermentation capacity by firm. The information is obtained by <u>Wines and Vines</u> as voluntary submissions from the firms in response to periodic surveys that have been conducted by the magazine since World War II. Prior to 1948, many firms submitted incomplete information. Even in more recent years, there is a small minority of firms (4.3 percent of the total firms in 1985) that fails to include the storage and fermenting information. The data was collected from the directories for the following years: 1948, 1954, 1959, 1963, 1968, 1973, 1981, and 1985. This data was entered by firm and year into an IBM microcomputer using the dBase III database program.

In this paper the fermenting and storage capacity is hereafter designated FSC. The FSC of all firms was entered into the database in a straightforward manner with the following exceptions. All data was entered on the basis of firms rather than plants. Wineries that did not use grapes as their primary input were excluded (e.g., apples, rice).

Firms whose sole business was warehousing were excluded. In the very few instances of firms reporting only output levels, their FSC was estimated using averages from firms that reported both FSC and output levels.

There are several possible objections to the methodology used. The first objection is that the industry is not well defined. Even though the data is very complete and is available on a firm by firm basis, it might be too inclusive. There might be several distinct California wine industries based on the type of wine produced. The state's wine production can be divided into the categories of table wine, dessert wine, sparkling wine, and the recently created segment of pop wines, the so-called "wine coolers." The FSC data does not distinguish between firms that produce one, two, three, or all four of the types. Another possible distinction that cannot be resolved with this data is the division between premium and standard wine production. The data covers wineries producing wine that sells for as little as $1.00 to as much as $50.00 a bottle. A final objection to this data is that it covers parts of firms. There is no distinction between firms that are primarily vineyards, but do some fermenting and those firms that are primarily wineries but have some vineyards. In one sense, the form of the data has defined the industry. In other words, the industry that might be examined using this data is the industry consisting of those firm and/or parts of firms that ferment and store wine.

These objections are certainly valid, but they are more the result of having to work with actual firms producing a tangible product under real-world conditions. While possessing great powers of explanation, the idea of an "industry" remains an artificial simplification. Therefore, it is not surprising to find that the available data may be sullied by real world problems of industry separation.

Another objection to the data is whether or not it is reasonable to use FSC as a proxy for firm size. The rationale is a technical one. In the process of producing wine, there must be a certain amount of cooperage in which to ferment and age the wine produced (Gould 1962). The aging requirements will vary with each wine type with white wines needing the least time and reds the longest. Therefore, if the majority of wineries specialized in exclusively red or white, the data might be expected to be somewhat distorted. A brief perusal of the literature indicates that this is not the case (Joslyn 1974) (Moulton 1981). Most wineries produce a range of products including both reds and whites. This overview can be substantiated by performing a regression over the entire industry using total industry FSC as the independent variable to explain total industry wine output in terms of volume. This regression was run using the FSC totals computed from Wines and Vines data and California wine output data obtain from an independent source (Wine Institute Economic Research Reports). The corrected R squared for the eight data pairs corresponding to the production dates used in this paper was .98. As an additional test for suitability, the reverse regression of total output on FSC was run. This also resulted in a corrected R squared value of .98. The high value of the corrected R square indicates that the use of FSC is appropriate on the industry wide level. However, this does not fully validate its aptness at the firm level. A good test for this would be a regression of FSC to output on the firm level, but it is the very absence of the output figures by firm that led to the use of FSC as its proxy. The question is whether the different types of wine (red, white, dessert, sweet, premium, or standard) which may be produced vary significantly from firm to firm in a manner that is not reflected in the industry as a whole. For example, If a large percentage of firms produced only red wines, then they would have a relatively higher FSC due to the longer storage requirements of this type of wine. This would tend to overstate the size of these firms. If the various firms tend to produce wines in roughly the same proportions as the industry as a whole, then no such overstatement would occur. How might this be inferred from the data? One possibility is to examine the change in product mix over time. If a significant change has occurred in product mix and there has been a sizable difference in firm specialization, then this should result in a systematic deterioration of the predictive value of industry output by FSC. As this has not occurred, it is only necessary to determine if there has indeed been a significant shift in product mix. In 1955, dessert wine (still wine over 14% alcohol) accounted for 76.9 percent of the shipments of California wine into all markets. By 1980 it accounted for only 11.8 percent (California Grape, Raisin, and Wine Production and Marketing 1969 - 1981). There has been a similarly dramatic shift in production by color types. Estimated California wine shipments by color for the period 1974 - 1984 are presented in table 3. During the ten year period, red wine has fallen from 40.9% to 15.2% as white wine has risen from 31.6% to 66.6%. Since there have been large shifts in product mix and total industry FSC is highly correlated with total industry production, FSC is a good proxy for output on the firm level.

Hutchison specifically raised an objection to the use of storage capacity as a measure of firm size (1969). He asserted that this measure is distorted by the use of leased storage facilities of the larger firms by the smaller wineries. This would lead to a systematic understatement of the market share of the smaller firms. This understatement may be illusory. Since the leasing of

TABLE 3

ESTIMATED CALIFORNIA WINE SHIPPED
BY COLOR (IN PERCENT)

Year	Red	Rose	White
1974	40.9	27.5	31.6
1975	39.0	27.0	34.0
1976	34.1	29.5	36.4
1977	29.7	28.0	42.3
1978	26.3	26.0	47.7
1979	22.7	24.5	52.8
1980	20.3	23.0	56.7
1981	18.2	21.3	60.5
1982	16.5	20.5	63.0
1983	15.4	19.3	65.3
1984	15.2	18.2	66.6

source: <u>Wines and Vines</u> July 1985.

storage capacity would be a source of income to the larger firms and a cost to the smaller firms, it might logically be inferred that this method of doing business accurately reflects the "size" of the firms involved. Moreover, the extent of this type of arrangement is open to question. The evidence that is available is of a negative nature. A perusal of seminar proceedings concerning the start-up and operation of small wineries revealed no mention of this practice whatsoever (Moulton 1981). Additional research would be needed to clarify this point, perhaps a survey of small wineries as to the extent of this practice both past and present.

After the data were entered into the database program, a series of programs were written to separate and collect the data in a usable form. Initially, the number of firms in each of the study's target years was calculated. The results are presented in tabular form in table 4, and plotted in figure 2. This gives a background against which the subsequent survivor study is more easily understood. The plot of figure 2 clearly shows that the industry underwent a fundamental shift in or about 1968. Prior to 1968, the industry had a moderate and steady decrease in the total number of firms. The decline during this period is almost exclusively in the small-firm category. This is the type of plot that would be expected in a maturing industry that is slowly shaking out the less efficient producers.

TABLE 4

NUMBERS OF FIRMS

Year	*Small	*Medium	*Large	Total Firms
1948	259	29	1	289
1954	232	29	1	262
1959	176	29	2	207
1963	155	30	2	187
1968	130	22	2	154
1973	157	25	4	186
1981	338	25	10	373
1985	493	26	12	531

Calculated from data in Wines and Vines directory issues for the respective years.

* Small Firm = 0 < FSC <= 3,000,000
Medium Firm = 3,000,000 < FSC <= 29,000,000
Large Firm = 29,000,000 < FSC

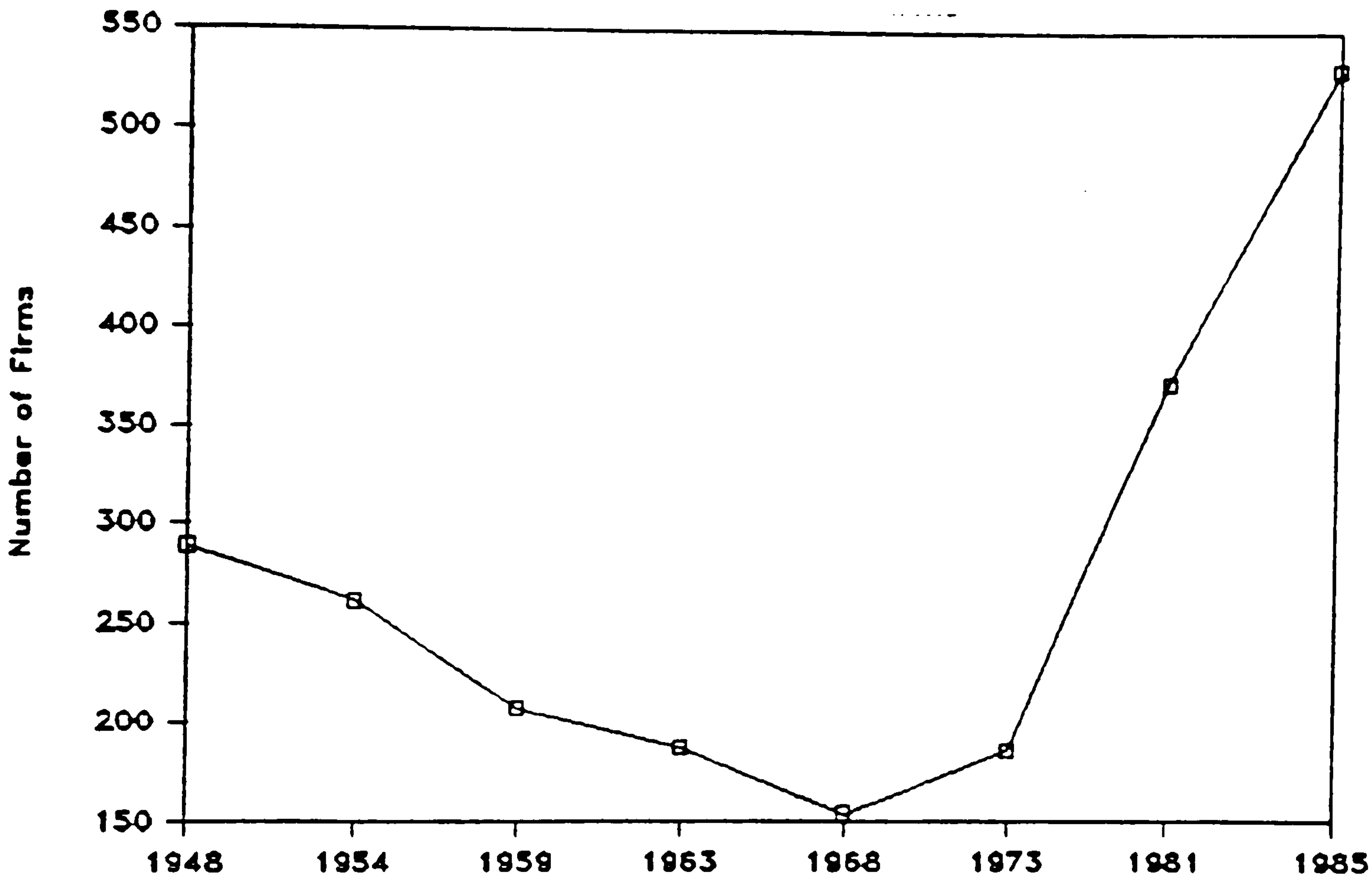

Figure 2. Total Number of Firms

Economies of scale would cause many of the less efficient firms to be small. The number of firms would decrease by firms exiting the industry and/or their merging with other firms. This concurs with the history of the industry that features a large increase in demand with the repeal of prohibition and then slow growth until the late 1960's. Sometime around 1968 there is a sudden change of direction in the industry with the number of firms increasing at a high rate up to 1985, the last year plotted. This is the type of plot that would be expected in a competitive industry in response to a substantial shift to the right of the demand curve for its product. With the increase in demand and the higher profits realized or anticipated, not only do the existing firms expand production, but a large number of new firms rush to enter the industry.

The sizes of the individual firms were then examined. There was a vast difference in the sizes, particularly in the later years. In 1985, for example, the smallest firm had the almost incredibly low FSC of 300 gallons compared with the largest firm's FSC of 430,000,000. The sizes formed a remarkably smooth curve from the smallest to the largest firm. Since there was not an obvious set of size categories dictated by a natural bunching in the sizes of the firms, the next step was to determine the appropriate size categories. Absolute size categories were used, rather than Stigler's relative sizes, since the time span of the study would cover a period of substantial growth in the industry. As previously discussed, the use of relative sizes during times of considerable growth would distort the results. The firm sizes existing in the final year of the study (1985) were divided into 6 categories based on powers of 10. This division was arbitrary and merely gave a starting point from which to analyze the data. Ultimately, the same results should be obtained using a larger number of divisions and/or an arithmetic rather than a geometric increment in category sizes. Using the six size categories, the market shares were calculated for each of the eight years. In order to more easily see trends, the results were plotted on a graph with the eight years on the X axis and the percentage of the respective year's total on the Y axis. This result would be the final product in the normal use of a survivor study which is conducted using data in predetermined size categories. It would be naive to assume, however, that any arbitrary selection of size categories would be optimal. To locate the best groupings, it is necessary to examine the trends throughout the arbitrary size categories with special consideration to the firm sizes on or near the boundaries. Three of the size categories, that gave ambiguous results, were divided in half. The data were calculated using the new size categories and the results plotted. There were three distinct trends among the nine size categories. The first trend covered the smallest five categories with an overall range of size of 0 < FSC <= 3,000,000 gallons. This was designated the small firm size. The next grouping covered two categories, was designated the medium firm size and consisted of all firms with 3,000,000 < FSC <= 29,000,000. The final trend group consisted of the two largest categories. It was designated the large firm size and consisted of all firms with 29,000,000 < FSC <= 500,000,000. The results from this final grouping are given in table 5 and in figure 3.

The small firms declined steadily in market share from a high of 27.22 percent in 1948 to a low of 7.07 percent in 1985. The medium firms declined at an even greater rate from 64.18 percent in 1948 to 17.43 percent in 1985. Only the large firms had an increase in market share over the entire period, rising from 8.60 percent in 1948 to 75.50 percent in 1985.

The survivor analysis of the data in table 5 gave the optimal firm size range to be that of 29,000,000 FSC or greater. One striking feature of the data was the consistent trends in the three size categories over the entire time period. This argued strongly for the absence of technological changes that have vastly affected economies of scale. It would appear that similar economies of scale have existed in the California wine industry during the past forty years. Using the survivor method over a relatively short period would not necessarily reveal this long

TABLE 5

INDUSTRY SHARES IN PERCENT OF INDUSTRY
TOTAL FOR THE YEAR

Year	*Small	*Medium	*Large
1948	27.22	64.18	8.60
1954	24.95	67.22	7.83
1959	20.27	52.03	27.70
1963	18.37	54.95	26.68
1968	14.99	41.03	43.98
1973	10.39	34.19	55.43
1981	7.18	18.88	73.94
1985	7.07	17.43	75.50

Calculated from data in *Wines and Vines* directory issues for the respective years.

* Small Firm = 0 < FSC <= 3,000,000
Medium Firm = 3,000,000 < FSC <= 29,000,000
Large Firm = 29,000,000 < FSC

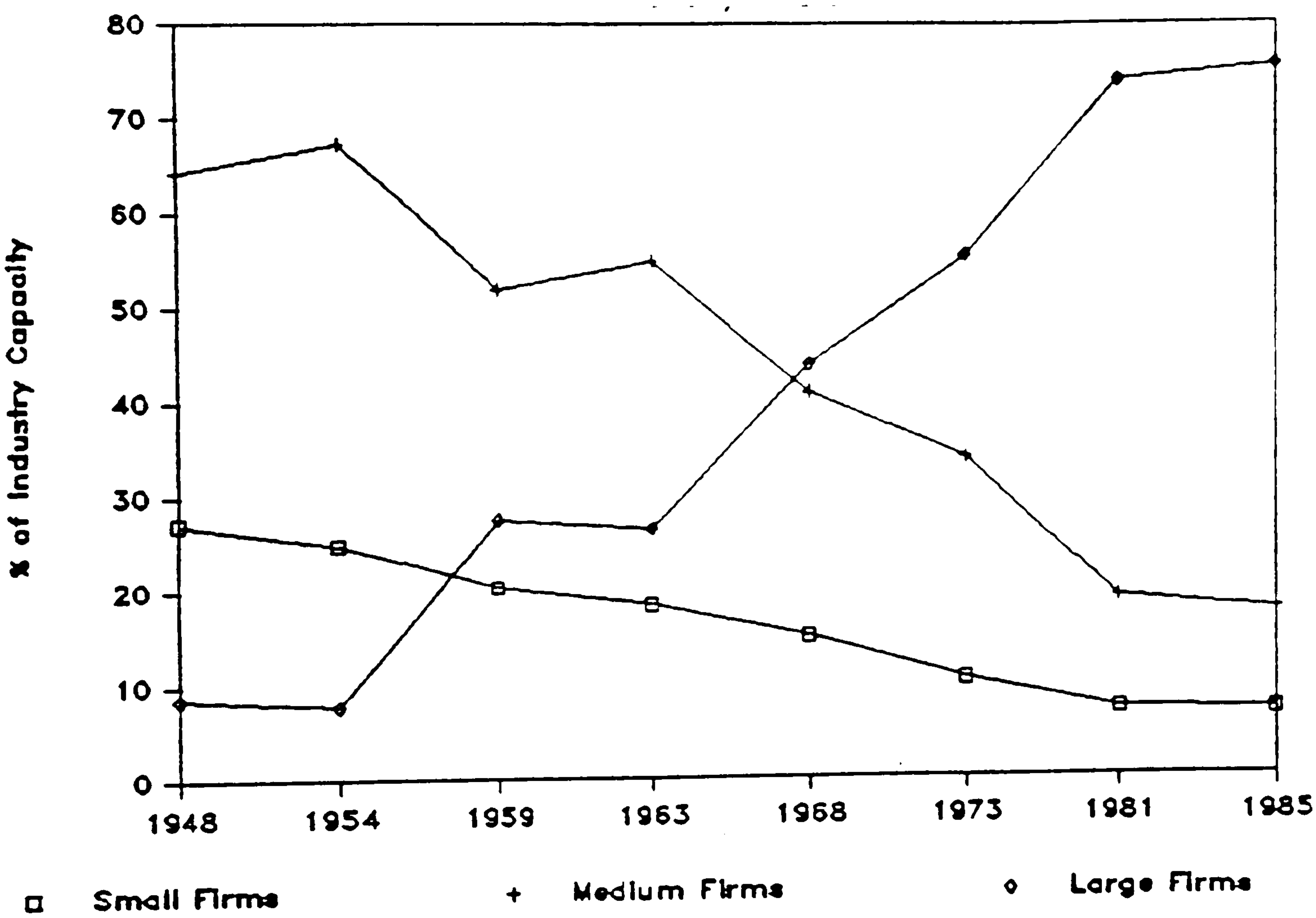

Figure 3. Industry share

run trend. For example, note the difference if only a single set of the following data points is used: 1) 1948 - 1954, 2) 1959 - 1963, or 3) 1981 - 1985. Without the rest of the data, they do not clearly indicate the long run movement. Far worse, the first two examples show a movement counter to the direction of the long run movement. It was probably this effect that led Stigler to conclude that there was an upper limit to scale economies in the wine industry as discussed in Chapter III.

These short run aberrations are due to two chief causes. Firstly, the data are collected from a finite number of discrete firms. Secondly, there is to be expected a stochastic element to the creation, growth, and failure of firms in the industry. Economies of scale may be quite important in determining the success of a firm, ceteris paribus, but in the short run many other factors (e.g., quality of management, labor relations, availability of capital) may cause movements either in concert with or counter to the effects of scale economies alone. It is only in the context of a long period that the data show strong trends. Since there are no fixed costs in the long run, Caves' concern with existing firms versus new firms is a short run objection. The long run trends in figure 3 most correctly show the size categories in which the owners have chosen to place their firms.

For comparison, MED and TOP50 were calculated using the same FSC data for each of the eight years. These results are displayed in table 6 and plotted in figure 4 and figure 5. These two static measures should not be expected to give the same results. Their respective results are asserted to be only proxies for optimal firm size and could be quite different from the survivor result as well as from one another. The question was whether or not they showed the same trends as the survivor method. The results for MED over the time span of the study started at 7,400,000 FSC in 1948 and rose to 54,000,000 FSC in 1985. TOP50 will be larger than MED, since it is the average of MED and the largest firm. The results for TOP50 started with 19,900,000 FSC for 1948 and rose to 242,437,500 FSC for 1985. The MES value of 29,000,000 FSC lay within the ranges of both TOP50 and MED, but there was an obvious conflict among these three proxies. The value of MED had increased by a factor of more than 7, the value of TOP50 had increased by a multiple of more than 12, while the MES had remained fairly constant over the entire period. This showed a definite disagreement between the three measures rather than the agreement found by Allen. Allen's findings were based on a time period of five years. This relatively short term may have masked a fundamental disagreement between the static measures and the survivor technique.

TABLE 6

STATIC PROXIES OF OPTIMAL FIRM SIZE
(MEASURED IN FSC)

Year	MED	TOP50
1948	7,400,000	19,900,000
1954	7,500,000	18,702,500
1959	9,700,000	47,100,000
1963	9,800,000	46,601,500
1968	22,025,000	74,012,500
1973	34,639,973	124,819,986
1981	50,800,000	200,837,500
1985	54,000,000	242,437,500

Calculated from data in _Wines and Vines_ directory issues for the respective years.

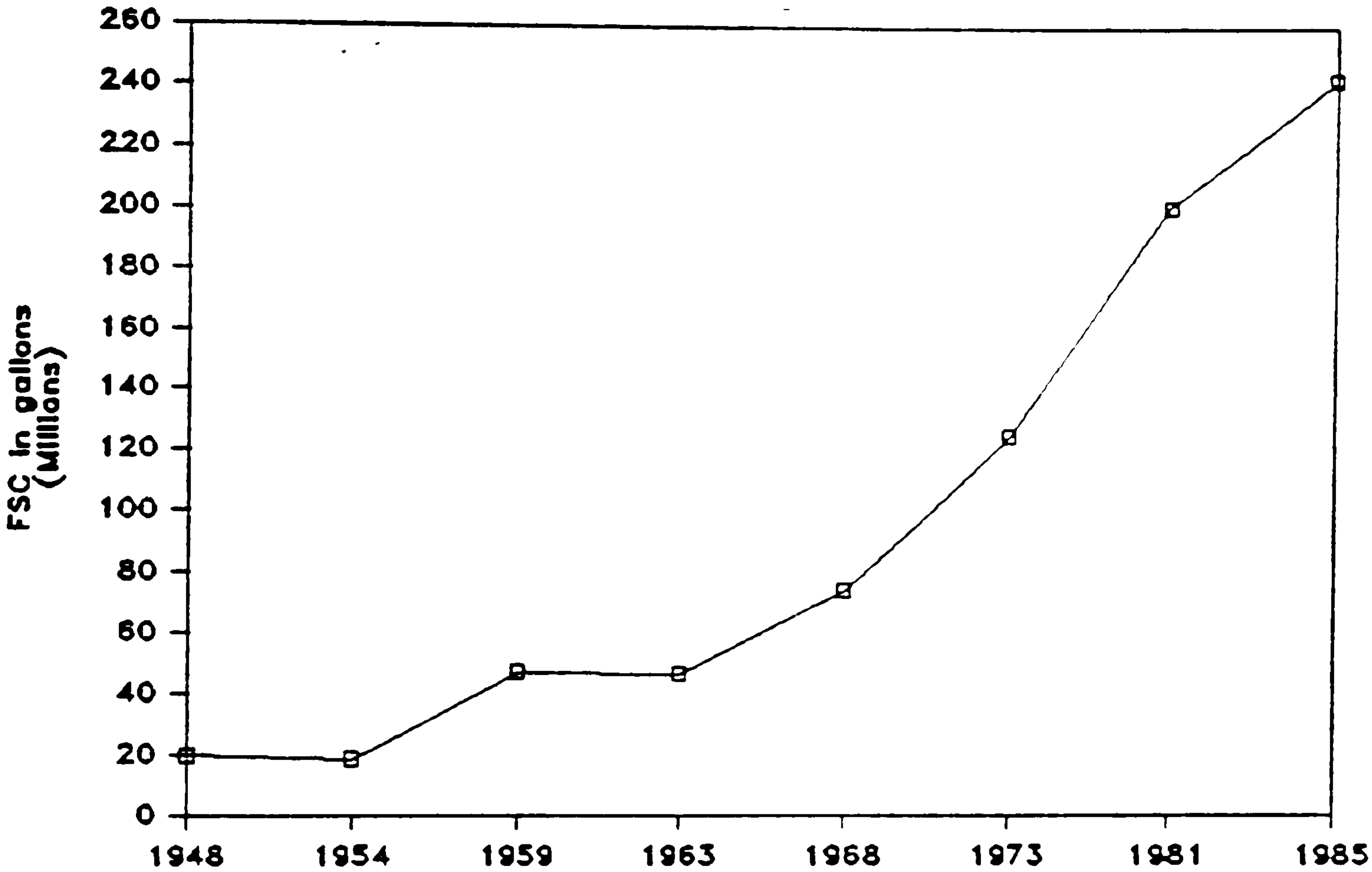

Figure 4. MED Proxy for Optimal Firm Size

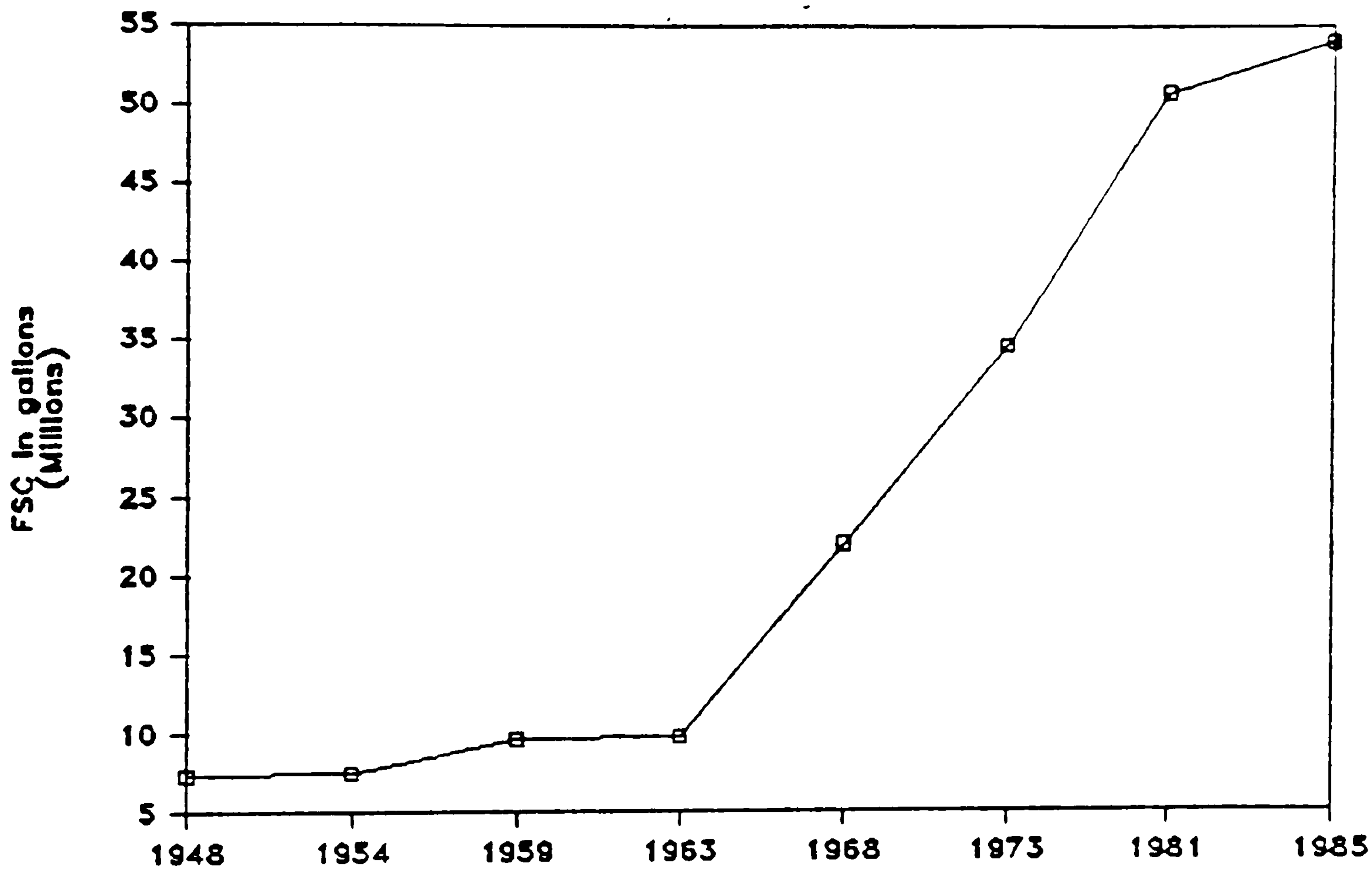

Figure 5. TOP50 Proxy for Optimal Firm Size

Another interesting feature of the data was the extent of suboptimal production. If the survey's result of 29,000,000 gals. FSC is optimal, then everything smaller than this must be, in some sense, suboptimal. Even though this suboptimal capacity had been in almost continuous decline from over 90 percent of the total capacity in 1948, it still accounted for almost 25 percent in 1985. The absolute values of FSC for the small, medium and large firms over the time period 1948 - 1985 are displayed in table 7. Figure 6 is the plot of the optimal and suboptimal firms' absolute FSC. It appears that the absolute level of suboptimal production had not changed very much over this time period. This did not take into account the increase in the numbers of firms involved in this suboptimal production. Table 4 shows that most of the increase in firm numbers since 1968 had been in the small firm category. Since 1968, the relatively constant amount of suboptimal production has been produced by a rising number of the smallest size firms, whose average absolute production must have decreased. What might be said of these firms in regard to their increase in numbers coupled with their decline in relative market share? Were these smallest firms 1) in the same industry as the larger firms, 2) inefficient or 3) likely to survive and/or to increase their market share?

TABLE 7

ABSOLUTE FSC
(IN GALLONS)

Year	*Small	*Medium	*Large	Total
1948	102,608,319	241,904,000	32,400,000	376,912,319
1954	95,236,489	256,627,729	29,905,000	381,769,218
1959	83,689,370	214,861,141	114,405,000	412,955,511
1963	83,907,967	251,074,985	121,903,000	456,885,952
1968	73,619,317	201,545,662	216,000,000	491,164,979
1973	74,090,398	243,914,000	395,427,973	713,432,371
1981	75,805,647	199,192,170	780,178,443	1,055,176,260
1985	93,056,686	229,527,959	994,161,087	1,316,745,732

Calculated from data in *Wines and Vines* directory issues for the respective years.

* Small Firm = 0 < FSC <= 3,000,000
Medium Firm = 3,000,000 < FSC <= 29,000,000
Large Firm = 29,000,000 < FSC

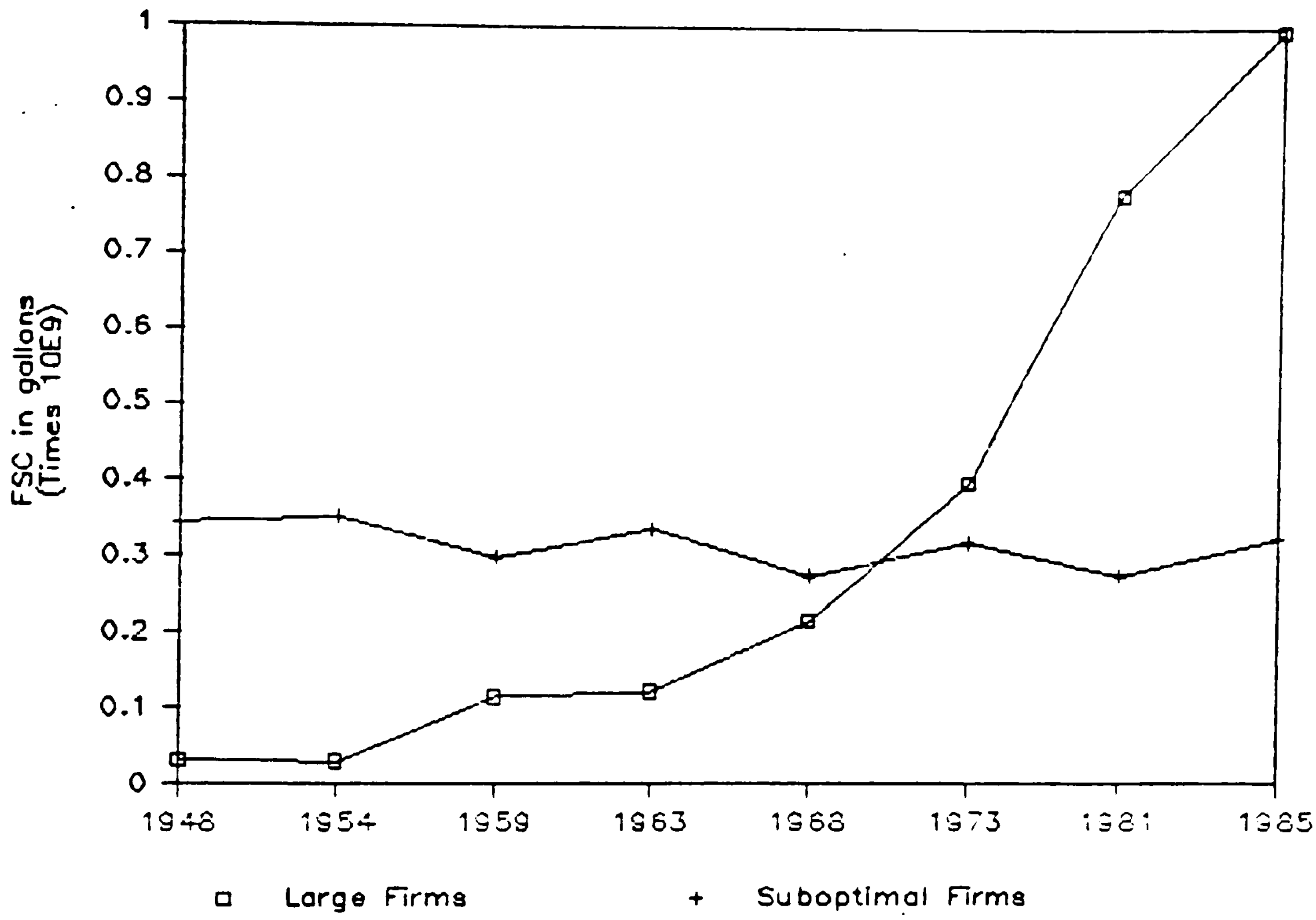

Figure 6. Optimal and Suboptimal Absolute FSC

The small firms should be regarded as in the same industry as the larger firms if their products are good substitutes one for the other and all the firms compete within the same markets. The extreme product differentiation in the wine industry is an indication that more than one industry may be involved. However, this product differentiation takes place among all the firms so that there may be less difference between a premium Chenin Blanc from a large firm and one from a small firm than between either of these and a third wine from either firm. The University of California at Davis provides a force for the standardization of the wine producing techniques through the large scale dissemination of information on the factors in wine quality and varietal characteristics (Joslyn 1974). These techniques do not favor either the small, medium, or large wine producer. The smaller wineries might wish for preeminence in the production of quality wines, but as the results of numerous wine tastings have affirmed, the larger producers can and do produce wines of increasing sophistication and quality. Therefore on product differentiation grounds, there is little basis for considering the small firms in a different industry than the larger firms. There is also no clear difference in the question of markets. The larger firms have an ability to market their wines over a wider region of the United States and abroad, but this is just an aspect of their economies of scale and scope.

These economies derive from their size and not from some fundamental difference between the firms. If and when there is substantial regional production throughout the domestic market, there might be a case of national versus regional markets with the additional complication of transportation costs. The factor of increased tranportation costs might then be an added cost for the national firm which the local firms would not have. In the present case however, since the large firms are located in the same local market as the smaller firms there is little basis for the assumption of differing industries based on different markets.

If the small firms are regarded as in the same industry as the larger firms, are they in some sense inefficient? Perhaps the better question in this regard is whether or not the market is inefficient in this industry? The paradox is that the larger firms rather than providing a price umbrella have lower pricing than the smaller firms. This can be observed by visiting any local retailer where the lowest priced premium varietal will be from one of the top 12 producers and the highest priced premium varietal will be from a small or medium size firm. Bain (1969 p. 102) touched upon a cause of suboptimal capacity that does a lot to explain this paradox of pricing in the context of the wine industry:

> In some product-differentiated industries, of course, it is possible that some small sellers

> with both social and private inefficiency do not need a price umbrella in order to survive. Without the benefit of having the product prices of their major rivals held above average costs, they can or could command minor market shares at superior selling prices sufficiently high to offset their diseconomies of small scale. To the extent that such sellers could survive in this way, they might be considered to have at least adequate allocational efficiency, by virtue of supplying the wants of buyer minorities with distinctive products which would otherwise be unavailable. But 'pure' cases of this phenomenon, unalloyed with price umbrellas, are hard to find.

The California wine industry may be an example of suboptimal production in a product-differentiated industry without a price umbrella.

What is the future of these suboptimal firms? If product differentiation allows their existence at higher prices than their larger competitors, can they maintain or even increase their absolute market share? After all, it is the absolute size of output, costs and profits which determine firm survival. The situation is made clearer by reference to figure 7 which tracks the absolute size of small firm FSC. It is evident that in the period prior to 1968 the small firms were in constant decline even though figure 8 shows that the industry itself was experiencing steady growth. Only in the period after 1968 did the small firms rapidly expand their absolute production. The same trends are apparent in the number of small firms shown in figure 9 compared with the number of medium and large firms shown in figure 10. This occurred during a period of increased domestic consumption of wine and the general

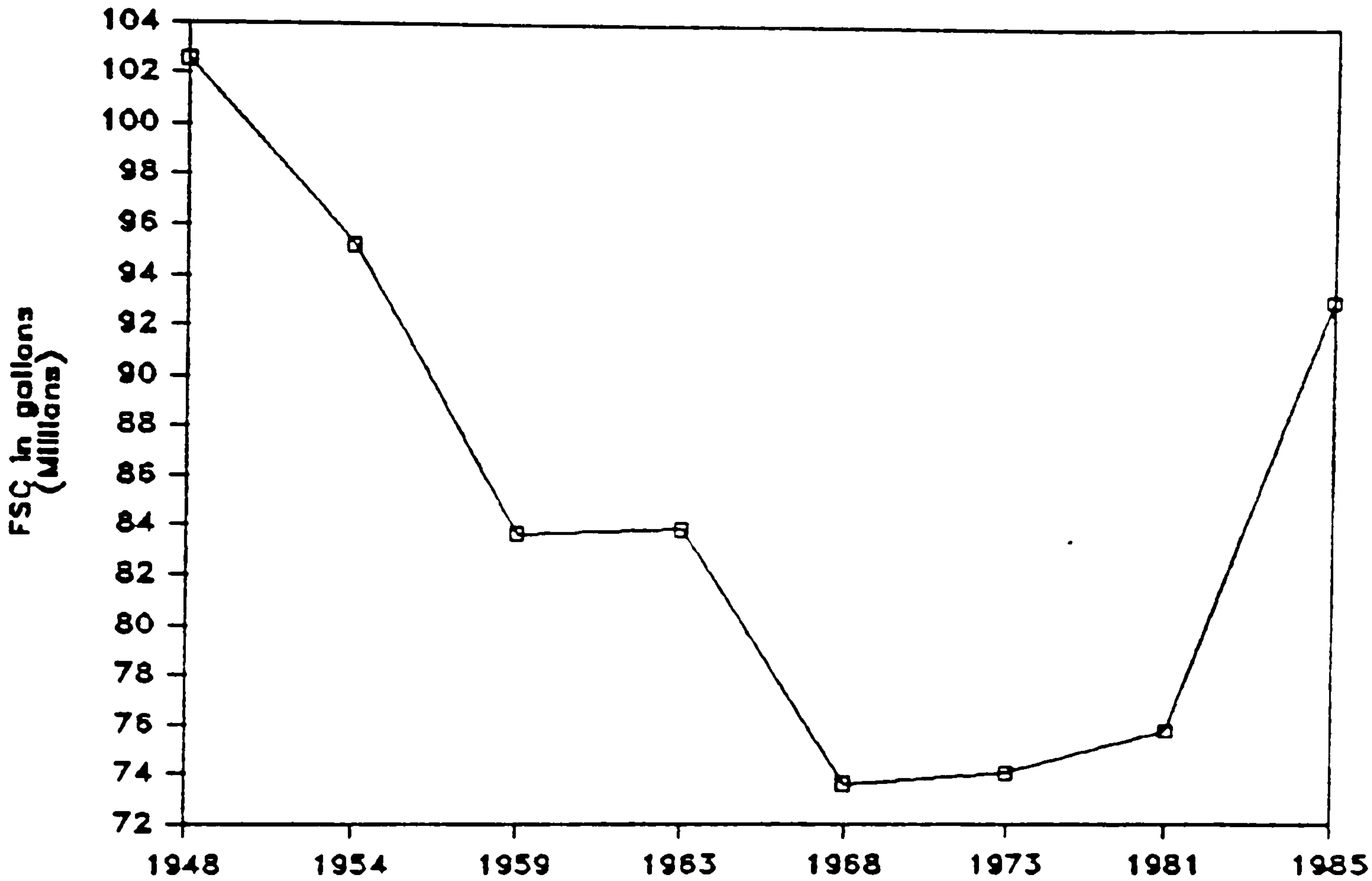

Figure 7. Small Firm Absolute FSC

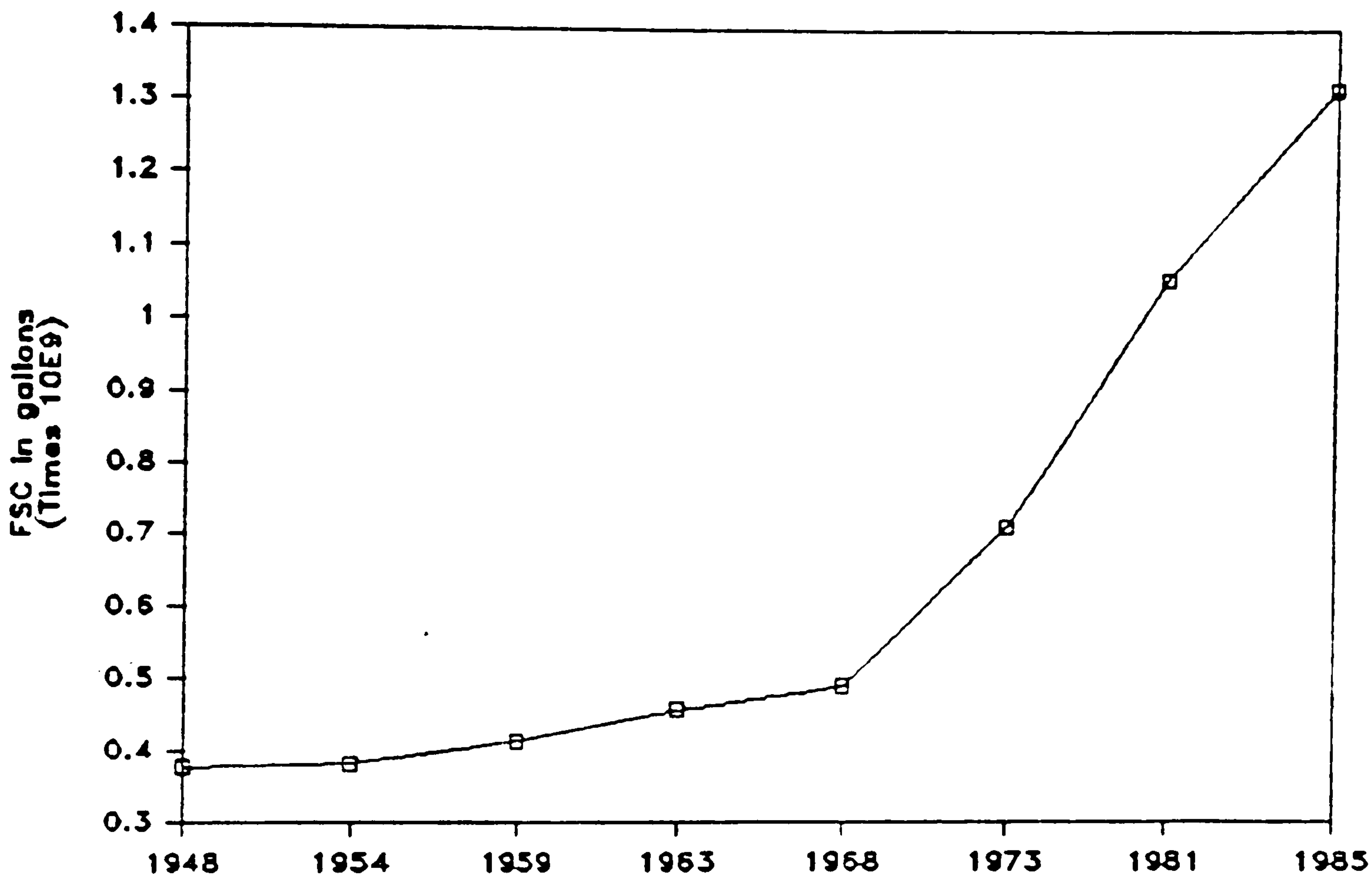

Figure 8. Total Industry Capacity

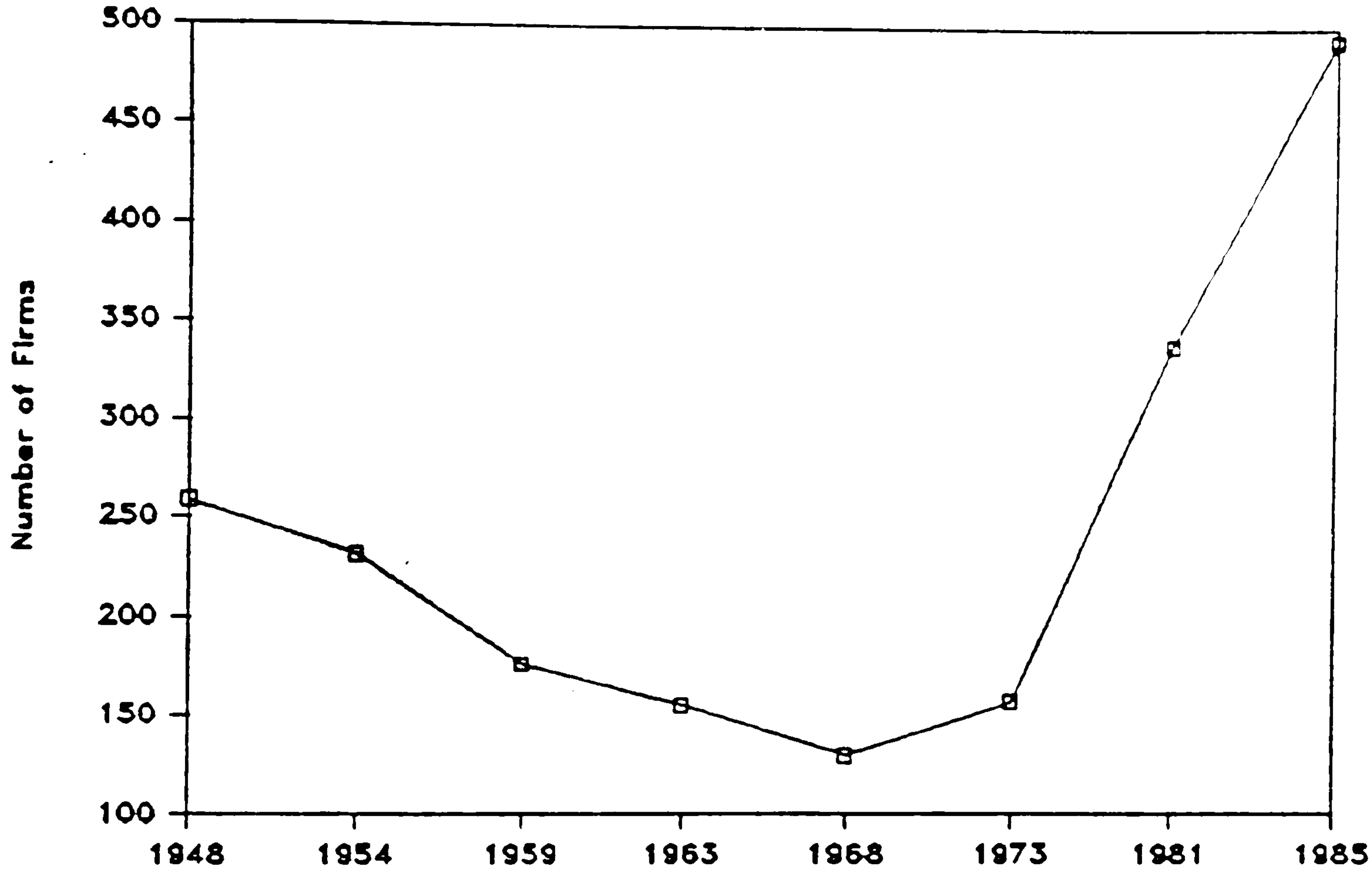

Figure 9. Number of Small Firms

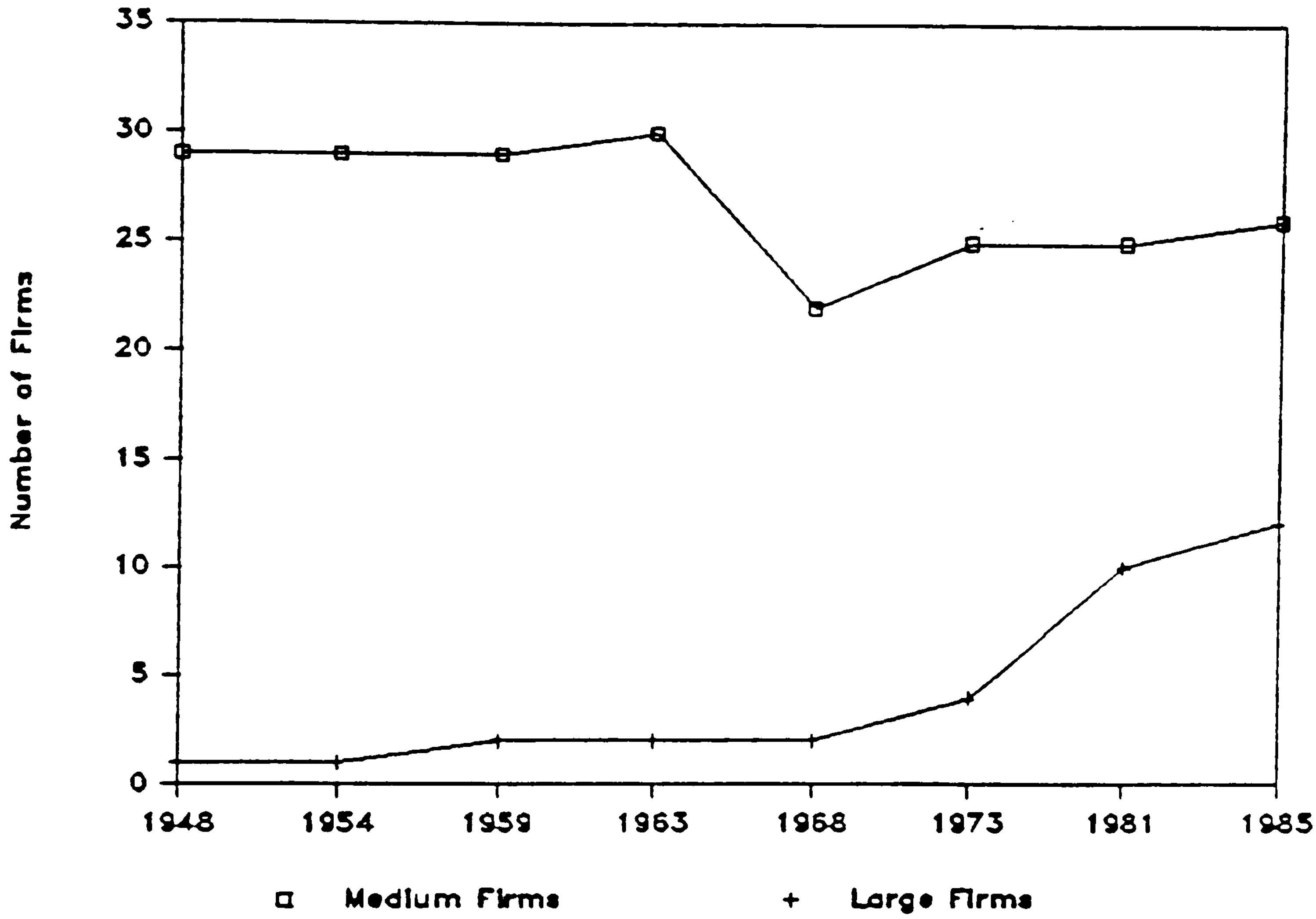

Figure 10. Number of Medium and Large Firms

expansion of the California wine industry. Can this substantial growth in wine consumption can be sustained? Recent evidence suggests that it cannot. Wine consumption for the mid-1980's has been almost flat. If wine-cooler sales are excluded, there has been a slight decrease in the domestic consumption of wine. Since only larger firms have produced wine-coolers, the smaller firms have seen an absolute decline in their market size. The smaller firms may well be able to compete at higher prices than their larger rivals by virtue of their product differentiation, but they must still compete. If wine consumption continues to decline or rise at the pre-1968 rate or less, then a steady decrease in both absolute numbers and FSC of the small firms should be expected. Medium firms would remain relatively constant or decline slightly as they did in the 1948 - 1968 period. Another factor which weighs against the smaller firms is the question of ability to compete in the retail arena. There is only a limited amount of space in each retail store with such a plethora of different firms each with several products, there is simply not enough shelf space for most retail stores to carry all of the existing products. Another factor that will work against the small wineries is the tendency of the small businessman to work for less than standard economic profits over a long period of time. As the competition for the available shelf space intensifies, there will be increased price competition all the firms. The increased competition coupled with the tendency of owner/operators to work for less than competitive wages suggests low returns to this segment of the industry. The economies of scale enjoyed by the medium firms over the small firms might enable the medium firms to provide sufficient product diversity to satisfy the market at a lower price than is possible for the smaller firms.

CHAPTER V

SUMMARY AND CONCLUSIONS

The two objectives of this thesis were 1) to reappraise the survivor survey and its alternatives as empirical measures of of optimal firm (plant) size, and 2) to analyze the California wine industry using a modified survivor method. The following conclusions were reached based upon this investigation.

The survivor survey is not a good empirical measure of the theoretically optimal firm size which would exists under perfect competition. It fails because its results are not based solely on cost, but on all the variables in the economic environment. These variables include monopoly power, labor relations, governmental regulations, and fortuitous circumstances of all types. All of the alternative measures have serious limitations to their use. The businessman survey involves subjective judgement; the technical approach uses assumptions of inelasticity of inputs and demand for output; the use of rates of return fails when accounting practices are not uniform; the static measures lack theoretical basis and are also affected by economic variables other than cost. The general agreement that was found by Allen (1983) between the results of the survivor survey and the static measures was not found in this study.

The survivor survey is a good descriptive measure of optimal firm size. If properly modified it has the advantage of showing the cumulative practical effects of all relevant economic variables. Since it is based on practice rather than theory, it has a strong predictive content. The modifications necessary to the standard usage of the survivor method are the following: 1) it should only be used over a relatively long period of time, 2) it should not be used with data that has already been aggregated into size categories, and 3) the size categories must be carefully chosen so as to combine all sizes of firms with similar trends.

The survival survey of the California wine industry yielded the following results. The optimal firm size is an FSC of 29,000,000 gals. or greater. There has been a large increase in the number of small firms since 1968. If demand for wine remains level or declines, the number of small firms will probably decline as in the period prior to 1968. Successful entry into the wine industry requires a winery with an FSC of 29,000,000 gals. or greater.

Additional study is required for clarification in the following areas: 1) to find a good empirical measurement of normative optimal firm size; 2) to resolve the question of the disagreement between the results of the survivor survey and those of the static measures; 3) to verify the predictive powers of the survivor technique by studies of small firm profits, failure, and turnover; 4)to convert the present results in FSC to measures of output and capital; and 5) to determine long term prospects for the demand for wine.

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