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# • Income and Cost Analysis

## • Cooperative Cotton Gins and Cooperative Supply • Associations of Texas, Season 1949-50

in cooperation with the
UNITED STATES DEPARTMENT OF AGRICULTURE

TEXAS AGRICULTURAL EXPERIMENT STATION
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## DIGEST

There were significant changes in ginning incomes and ginning costs from the period 1932-38 to the season 1949-50. For like volumes of ginning, costs increased by 300 percent; ginning income increased by 220 percent.

The greater increase in costs than in income explains the advance in break-even volume from 900 to 1,530 bales.

Assuming ginning income to remain unchanged for a considerable period, break-even volume will soon advance to something like 1,800 bales as the older low investment gins either pass out of the business or reequip at current high prices of replacements.

Rising ginning costs have been caused by greatly increased investments in the ginning plant and by higher prices for the principal cost inputs.

The derivation of cost estimating equations enables the gin manager to evaluate his own total cost and items of cost in terms of average performance of the whole industry.

The gin manager who compares his own costs with standard costs over a period of years can evaluate more fully his cost behavior in terms of average behavior as well as gain a picture of the trends of his own actual cost behavior.

A gin manager in knowing his own volume and per bale income and costs and in knowing standard income and costs can evaluate his own net margin situation as to additions or deductions as income is higher or lower than standard and as costs are lower or higher than standard.

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# *Income and Cost Analysis*

## *Cooperative Cotton Gins and Cooperative Supply Associations of Texas, Season 1949-50*

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THE CURRENT ECONOMIC STATUS OF AN industry may be ascertained through an analysis of its income and cost. The economic status of an individual firm may be established through a comparison of its income and cost situation with the standard, or average, performance of the industry of which it is a part. An economic appraisal of the Texas ginning industry and farm supply business calls for consideration of their incomes and costs.

### "BREAK-EVEN" VOLUME—A CONCEPT OF LONG STANDING WITH TEXAS GINNERS

For many years the term "break-even" volume has been current coin with Texas ginners. There has been general agreement that about 1,000 bales represented break-even volume. Evidence from several sources has shown that break-even volume has been a controlling factor in fitting ginning capacity to cotton production. For at least 40 years ginning capacity in Texas has been such that, on an average, the annual crop could have been ginned in 26 days of a full 12-hour run. One cannot assume this relationship to be coincidental.

A study of the income and cost of the Texas ginning industry during 1932-38 revealed the average break-even volume to be 900 bales. This corresponded with the average volume of Texas gins other than the farmer cooperatives during that period. Governmental control of cotton acreages showed that break-even volume fits ginning capacity to the size of the crop. An annual average Texas production of 4.49 million bales during the 10-year period 1923-32 subsided to an average of 2.89 million bales during the 15-year period 1933-47, a decline of 36 percent; the number of gins in Texas as reported by the Census Bureau dropped from 3,695 in 1933 to 2,430 in 1947, a decrease of 35 percent.

The expansion of ginning capacity during the years of upward trends in cotton production can be explained by the optimism of ginners as to profit possibilities of the industry and by the relative ease of entering the ginning business. Financing of gin plants has been greatly facilitated by favorable credit terms offered by manufacturers of gin machinery. The contraction of ginning capacity with the advent of governmental control was hesitating and painful. During 1933-40, the number of gins declined by an average of 69 per year. It would seem that ginners in general were optimistic as to the ending of controls. During 1941-47, however, the decrease in the number of gins was accelerated to an average of 113 per year. Many of the ginners going out of business in the latter stages of their operations counted only their out-of-pocket expense. Their investments were salvaged, in part, by "wearing out" their plants. Some ginners went out of business because cotton production ceased in their area.

Texas had 2,041 gins in 1953, a decrease of 45 percent from the number in 1933. Does this greater decline in ginning capacity than the decrease in the cotton crop since the institution of acreage controls presage an adjustment of ginning capacity to a higher break-even volume than the 900 bales obtaining during the period 1932-38?

### UPWARD TREND IN GINNING COSTS

Over the years ginning costs in Texas have been on an upswing. This has been caused largely by the growing complexity of the gin plant. Hand snapping or pulling called for seed cotton cleaners and burr extractors; a demand for better ginning, especially of the longer staple cottons, encouraged the addition of drying equipment; and finally mechanical harvesting focused attention on the need of equipment to clean the lint which has resulted in the installation of lint-cleaning machinery. This additional cleaning and drying equipment has greatly increased the investment in the gin plant. A pronounced rise in the general price level has been a contributing factor of increasing dollar costs, especially in more recent years.

Increasing ginning income has largely paralleled rising ginning cost. This has meant higher gin tolls and wider margins on cotton seed and on bagging and ties. In 1949-50 the correlation between income and cost for the 130 cooperative gins was .34. The correlation between income and cost over the 10-year period 1941-50 undoubtedly was much higher as this was the time in which a transition was made to much higher levels both of incomes and costs.

The rise in break-even volume from 900 bales as of 1932-38 to 1,530 bales as of 1949-50 may indicate either a lag in income or a stabilization of

break-even at a higher volume. The present number of gins in Texas means an average volume of 1,500 bales for a 3 million bale crop. On an average, ginning costs per bale in 1949-50 were 23 percent higher at a volume of 900 bales than at a volume of 1,530 bales. Both ginners and cotton growers have much at stake in the volume of ginning at which break-even approaches stability.

## INCOME AND COST DATA FROM AUDITS

The income and cost data analyzed in this study were obtained from annual audits of Texas cooperative associations. These associations included 130 one-function gins, 20 one-function supply cooperatives and 25 two-function gin-supply firms. The audits were greatly lacking in standardization. In many instances costs were entered in the wrong audit category as: interest paid in the operating expense section; and depreciation in the nonoperating expense section. Misplaced costs as well as other audit items were moved to the proper audit category. Some auditors prorated parts of the operating expense as a charge against items in the revenue section. Such procedure misrepresents both operating expense and gross margins. All prorated expenses were eliminated. In one section of the State, trucking income was consistently entered as a negative item in the expense section. Such entries were moved to the revenue section as service income.

Through editing and regrouping of items each audit insofar as possible and practicable was reshaped to comply with an adopted standard audit for all the associations.

## TOTAL UNIT COSTS AND COST ITEMS AS RELATED TO COST ANALYSIS

Cost analysis may be approached from the standpoint of total costs or total unit cost. Total cost and total unit cost are not given. Costs are an accumulation of the numerous expenditures and charges from day to day. An important task of the bookkeeper is that of classifying these cost fragments into consistent cost items.

Managers cannot control or influence total costs as such. Whatever controls are exercised take form with respect to items of cost. The possibilities of managerial control vary greatly among the various items of cost. This situation is most important in gaining an understanding of cost behavior. In this presentation items of cost play a significant role.

The theory of cost as discussed in the economic textbooks embraces much too completely the total unit cost approach. Such consideration as is given to items of cost finds expression in the mental exercise of holding several cost inputs constant while a single cost input is varied as the means of measuring its contribution to output. So long as such procedures remain in the realm of speculation rather than in the field of actualities the conclusions drawn are not convincing.

One of the main problems of the cost analyst is that of isolating variables and measuring their influence. Cost theory assumes volume to be the one and only significant cost variable. Everything else is assumed to remain equal. The classification of costs into fixed and variable is predicated on the assumption that volume is the only variable.

If volume be the only variable then arithmetic average costs whether overall or by volume groupings should be entirely satisfactory. The average cost per bale of the 130 gins in 1949-50 was $7.88; the average cost per sale of $130 of the 20 supply associations was $14.21. Anyone with any experience in cost analysis realizes that arithmetic average costs are not satisfactory; such costs cover and conceal quite as much as they reveal.

Volume influence may be measured through a correlation of volume with cost. In such procedure an estimating equation results with two main features: a variable cost per unit of volume and a residual cost. The estimating equation for ginning cost according to the cost pattern of 1949-50 was:

Total ginning cost = $4,784 + $7.14 per bale ginned.

The estimating equation for the supply business was:

Total supply cost = $3,277 + $10.03 per unit of sales ($130).

The assumption that the residual cost represents fixed cost is erroneous. The residual cost to a limited extent indicates a misfit between volume and cost. Such misfit may in large part be explained by variable costs other than those due to volume.

Volume and investment in depreciable fixed assets may be correlated with cost. This is a recognition that investment which largely reflects scale of operation is also a factor in explaining cost. Such analysis results in an estimating equation with three features: a variable cost per unit of volume, a variable cost per unit of investment and a residual cost. The estimating equations for ginning and supply costs of 1949-50 were:

Total ginning cost = $3,922 + $0.0368 per dollar invested + $6.85 per bale ginned.

Total supply cost = $1,074 + $0.3832 per dollar invested + $8.14 per unit sales.

## OVERHEAD AND OPERATING COSTS IN COST ANALYSIS

Finally cost analysis may be approached from the standpoint of the overhead and operating costs of the accountant. In such instance each item of cost may be tested for volume influence. A four-way classification of costs may result: overhead costs influenced by volume, overhead costs not influenced by volume, operating costs influenced by volume and operating costs not influenced by volume. In the main, however, two classes of costs emerge: those reflecting volume influence and those not reflecting volume influence. The latter costs are called "common" costs

in this presentation. Such cost items are taken in full from actual costs into estimated costs. Thus these costs are common both to actual costs and to estimated costs. The only part that common cost plays in the derivation of relative cost is that of being a constant addition to the numerator and denominator of the cost fraction from which relative cost is discovered.

The result of a cost analysis in terms of overhead and operating cost items tested for volume influence is an estimating equation with three features: a variable cost per unit of volume for each item influenced by volume, a residual cost for each item influenced by volume and common costs including all items not influenced by volume. The term "fixed" cost is avoided in this discussion since a truly fixed cost is one entirely free from variable costs of all kinds. The combination of residual and common costs is called "nonvolume" cost because this combination remains constant in the total through the normal range of volume.

Eight items of cost reflected volume influence. The estimating equations for these items are given in Table 1. The item with the highest correlation between volume and cost was labor with .89; the item with the lowest correlation was miscellaneous with .32. The correlation between volume and the total cost of the eight items influenced by volume was .92; the correlation between volume and total cost was also .92. The differences among the correlation of volume to total cost and of volume to the various items of cost may have several explanations. Inconsistencies and errors in the classification of items of cost may have disturbing consequences; in the total cost such disturbances are totally absent. The different items of cost vary greatly as to relative weight in total cost. Inter-correlations may exist among some items of cost which could influence correlations in the total; to the extent that such inter-correlation may exist, the ratio obtained by correlating volume with total cost would be inflated and would fail to reflect true relations between volume and total cost.

## OVERHEAD COSTS NOT INFLUENCED BY VOLUME OR COMMON COSTS

Common costs from the overhead category included the following items: depreciation, taxes, office expense, good will and supplies.

TABLE 1. ESTIMATING EQUATIONS FOR ITEMS OF COSTS OF COTTON GINS

| Item of cost | Residual cost | | Volume cost |
|---|---|---|---|
| Management | $1,357 | + | $0.36V[1] |
| Office salaries | — 367 | + | 0.44V |
| Labor | 1,007 | + | 2.56V |
| Repairs | — 452 | + | 1.03V |
| Power | 1,190 | + | 0.41V |
| Insurance | 631 | + | 0.42V |
| Trucking | 558 | + | 0.69V |
| Miscellaneous | 10 | + | 0.19V |
| Total items | $3,934 | + | $6.10V |

V[1] Volumes in bales.

### Depreciation

Depreciation is related to the investments in buildings, machinery and equipment. The amount of the depreciation is governed by the investment and the rate of charge. Several factors determine the amount of investment: the completeness of installation of machinery and equipment, the type of power, the price level at the time the plant was acquired, the price level at the time major replacements were made and whether the plant was built new or purchased secondhand as a temporary factor. The amount of the depreciation charge differed greatly among the various gin plants. Nine of the 130 gin associations considered in this analysis made no depreciation charge; this included the cooperative gin with the highest investment of the 130 associations.

An expedient in making depreciation charges comparable is the adoption of standard rates for the various kinds of fixed assets and substituting the charges thus obtained for the actual as reported in the audit. This introduces complications as between the operating statement and the balance sheet of the audit. If no adjustments are made and if investment is taken as a variable, the gins with low investments, or low depreciation rates, or with no depreciation charge appear relatively more efficient cost-wise than is warranted. The advantage of viewing depreciation as a common cost is that the investment and the rate of charge have minor bearing on computations measuring relative cost efficiency. Furthermore the depreciation charge is beyond managerial control.

### Taxes

The amount of property taxes depends on the appraised valuations for tax purposes and the rate of the tax. Appraisals in terms of investments in fixed assets and the tax rate vary greatly among political divisions. Taxes also vary as to the location of the firm, whether within or outside city limits. The tax cost presumably cannot be influenced by management. Disturbances in relative cost efficiency as a result of variability in tax costs can be minimized by classifying taxes as common cost.

### Office Expense

Office expense included items such as: office supplies, postage, telephone and telegraph and auditing service. This cost exhibited no trace of volume influence, and was classified as a common cost.

### Good Will

Expenditures classified as good will usually would be included in miscellaneous cost. Outlays incurred for maintaining the good will of the association members and of the general public also were included. Advertising, donations and the cost of annual meetings are examples of good-will cost. As this cost was in no way influenced by volume it was classified as a common cost.

### Supplies

Supplies represented a nondescript item of cost. This item included costs from office supplies to repair parts. This item was not influenced by volume, and was classified as a common cost.

## OVERHEAD COSTS INFLUENCED BY VOLUME

The overhead cost items influenced by volume included management, office salaries and insurance.

### Management

Cost of management included the manager's salary, bonuses and commissions, car and travel allowances and directors' fees and travel allowances. Cost of management is an overhead cost influenced by volume. One of the variable costs contained in the residual after the volume influence has been removed is that of investment. The correlation between management cost and investment in the gin plants of the 130 gin associations in 1949-50 was .43. This relationship suggests that directors in employing managers consider increasing investment as adding to managerial responsibility.

### Office Salaries

Office salaries were influenced by volume to a greater degree than management costs. The necessary paper work of the office personnel increases as the volume of business increases, particularly in the ginning business in which the identity of the processed unit—the bale—is maintained. The service of weighing the loads of seed cotton is performed by the office personnel. If the daily volume of ginning runs low the bookkeeper can perform this service with minor interruptions from his main assignment. With full-run ginning, however, weighing becomes a full-time job. If the gin operates on a 24-hour basis a second member is added. A 24-hour run does not necessitate the employment of a second manager. It would be more consistent perhaps to classify the full-time weighers as members of the gin crew. But the standard practice in Texas is to attach the weighers to the office staff.

### Insurance

Cost of insurance depends on such factors as: the investment in buildings, machinery and equipment; the replacement value of these assets; the degree of coverage and the rate. An important feature as to rate is whether the plant is located within the city limits with adequate fire protection or outside the city limits without adequate fire protection. The accepted practice in Texas in the ginning business is to include workmen's compensation and social security as insurance costs. As a rule, audits report insurance as a single item in the operating expense statement. Workmen's compensation and social security are aspects of payroll cost and should be so handled. The inclusion of the latter two items gives the volume influence to insurance cost.

## OPERATING COSTS INFLUENCED BY VOLUME

Items in operating costs influenced by volume were: labor, repairs, power, trucking and miscellaneous.

### Labor

Labor cost as of 1949-50 was the most important item. Labor cost on an average accounted for 34 percent of total costs and 41 percent of the total of the eight items influenced by volume. Analysis of labor cost in terms of dollar costs alone is unsatisfactory. The hours or man-days of labor are essential ingredients of an adequate treatment of this cost. Residual labor cost, in dollars or hours, encompasses at least three situations:

The cost of the gin crew on days of no ginning. By well-established custom if members of the gin crew report for work in the morning they are entitled to a day's wage whether there is any ginning or not. An early morning rain or an early morning breakdown may prevent any ginning for the day.

On days of low-volume ginning the gin remains idle a considerable part of the day. Members of the gin crew are not docked for the idle time. On such days a smaller crew and slower ginning would result in better utilization of labor. The gin manager, however, is keenly aware of the possibility of losing a customer waiting in line, even briefly, if he sees a chance of immediate service at a nearby competing gin. A customer lost today may mean a customer lost for the remainder of the season. Hence the urgency of prompt service even on days of low-volume ginning.

Even on days of full-run ginning, misfits occur between the size of the gin crew and the volume of ginning. If the volume influence is taken out, this misfit appears in the residual cost. Efficient use of labor is largely a managerial problem.

### Repairs

Many factors other than volume play a part in repair costs. In the ginning business repair costs are usually a charge against the following year. A heavy volume the preceding season may force extensive repairs even though the prospects are for a short crop. An anticipated short crop may call for a small repair job. Extensive repairs may be made at regular intervals of 4 or 5 years with much lighter repairs during the years between. In years of heavy volume and high net margins like 1949-50, replacements may be charged off as repair expense in the operating statement rather than as additions to fixed assets in the balance sheet.

### Power

Power costs as entered in the expense section of Texas gins may be classified under three headings:

TABLE 2. RELATIONS OF NONVOLUME AND COMMON COSTS TO DEPRECIATION AND TAXES

| Nonvolume cost (00 dol.) | No. of gins | Average cost (dol.) | Percentages of total nonvolume cost | | | Percentages of total common cost | | | Av. investment (dol.) | Rate of depr. (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Depr. | Taxes | Total | Depr. | Taxes | Total | | |
| - 75 | 25 | 6,437 | 27.9 | 6.4 | 34.3 | 71.8 | 16.5 | 88.3 | 35,777 | 5.0 |
| 100-119 | 15 | 10,901 | 42.2 | 4.3 | 46.5 | 66.1 | 6.7 | 72.8 | 70,124 | 6.6 |
| 150- | 15 | 18,403 | 50.0 | 4.8 | 54.8 | 63.6 | 6.2 | 69.8 | 115,349 | 8.0 |

Power fuel such as natural gas, butane, distillate, number of kilowatts of electric current or others.

Lubricants and grease.

Utilities such as electricity for lighting buildings, gas or coal for heating and water. In the case of steam power a large part of water cost is a power cost for the water used in the boilers; with internal combustion engines considerable water is used in the cooling system.

Actual power costs not included are: depreciation of the investment in the power plant; repairs of the power plant; labor used in operating the power plant, especially with steam power; and such items as taxes and insurance on the investment represented in the power plant.

### Trucking

Trucking costs include the cost of operating trucks if the association has its own trucks, the cost of trucking service if commercial trucks are employed and such miscellaneous items as freight and express costs. With the associations owning trucks, no consistent practice is followed in obtaining full trucking costs by including such items as depreciation, repairs, insurance and wages of the truck operators.

### Miscellaneous

Miscellaneous cost is a catchall item. This item should be reasonably small in amount as a relatively high miscellaneous cost indicates carelessness in record keeping. On an average the 130 gin associations for the season 1949-50 had a miscellaneous cost accounting for 2.3 percent of total costs and for 2.7 percent of the total costs of the items influenced by volume.

## NONVOLUME COST

Costs included under the category of nonvolume cost have two sources: the total of all common costs and the total residual costs of the items influenced by volume. Nonvolume costs ranged from $4,200 to $27,360. Table 2 shows, in part, the components of nonvolume cost. The nonvolume cost increased as the relative importance of depreciation increased. Depreciation reflects investments which ranged from an average of $35,777 for the low nonvolume cost group to an average of $115,349 for the high cost group. Common costs accounted for the variations in nonvolume costs as the residual costs remained constant in all groups. Of total common costs, depreciation and taxes accounted for 88 percent in the low nonvolume cost group and for 70 percent in the high cost group.

There is considerable difference in rates of depreciation of the various groups. With a full depreciation reserve at the end of 20 years, gin associations in the low nonvolume cost group will not be able to replace machinery and equipment at a cost of $35,000. Present day costs of replacement approach the $100,000 mark. This group of gins will have reserve funds which cover only one-third the cost of replacement. Especially significant is the depreciation rate of 8 percent by the high investment group. Many of these gin associations have made replacements at the present high price level. Is this high rate an aftermath of painful experience with depreciation reserves covering only a fraction of replacement costs?

## ESTIMATING STANDARD COST

One of the purposes of this analysis is to develop procedures enabling the individual gin manager to rate his own costs in terms of standards for the whole industry. Table 3 is a guide for

TABLE 3. DATA FOR ESTIMATING TOTAL COSTS OF ITEMS INFLUENCED BY VOLUME OF GINNING

| Bales ginned | Management | Office sal. | Labor | Repairs | Power | Insurance | Trucking | Misc. | Total cost 8 items |
|---|---|---|---|---|---|---|---|---|---|
| 100 | $ 36 | $ 44 | $ 256 | $ 103 | $ 41 | $ 42 | $ 69 | $ 19 | $ 610 |
| 200 | 72 | 88 | 512 | 206 | 82 | 84 | 138 | 38 | 1,220 |
| 300 | 108 | 132 | 768 | 309 | 123 | 126 | 207 | 57 | 1,830 |
| 400 | 144 | 176 | 1,024 | 412 | 164 | 168 | 276 | 76 | 2,440 |
| 500 | 180 | 220 | 1,280 | 515 | 205 | 210 | 345 | 95 | 3,050 |
| 600 | 216 | 264 | 1,536 | 618 | 246 | 252 | 414 | 114 | 3,660 |
| 700 | 252 | 308 | 1,792 | 721 | 287 | 294 | 483 | 133 | 4,270 |
| 800 | 288 | 352 | 2,048 | 824 | 328 | 336 | 552 | 152 | 4,880 |
| 900 | 324 | 396 | 2,304 | 927 | 369 | 378 | 621 | 171 | 5,490 |
| 1000 | 360 | 440 | 2,560 | 1,030 | 410 | 420 | 690 | 190 | 6,100 |
| Residuals | $1,357 | $—367 | $1,007 | $—452 | $1,190 | $631 | $558 | $ 10 | $3,934 |
| Bale vari. | 36¢ | 44¢ | $ 2.56 | $ 1.03 | 41¢ | 42¢ | 69¢ | 19¢ | $ 6.10 |

TABLE 4. CLASSIFICATION OF COSTS OF A SPECIFIC GIN

| Cost item | Costs influenced by volume | Common costs |
|---|---|---|
| Management | $ 4,960 | |
| Office salaries | 1,790 | |
| Labor | 15,818 | |
| Repairs | 2,971 | |
| Depreciation | | $3,565 |
| Office expense | | 339 |
| Power | 4,866 | |
| Supplies | | 1,150 |
| Insurance | 2,951 | |
| Taxes | | 350 |
| Trucking | 5,573 | |
| Good will | | 55 |
| Miscellaneous | 367 | |
| Total[1] | $39,296 | $5,459 |

Total[1] The total cost of the gin was the sum of the volume and common costs or $44,755.

estimating cost. The estimated volume cost of a specific volume is a matter of manipulating decimal points. The total volume cost of 100 bales is $610; of 10 bales $61; of 1 bale $6.10; of 1,000 bales $6,100 and of 10,000 bales $61,000. The estimated item cost is the total of its volume and residual costs; the estimated total cost is the sum of the estimated volume costs, the residual costs and the common costs.

As a means of illustrating the use of Table 3 in estimating costs, Table 4 was derived. The information in Table 4 was taken from the cost section of the audit of one of the gin associations. The essential separation of cost items into those influenced by volume and those not influenced is indicated in the table. This gin had a volume of 6,459 bales. Sufficient accuracy is attained by rounding volume to the nearest 10 bales. Thus volume costs in Table 3 are read in terms of 6,000, 400 and 60 bales. The estimated volume costs are recorded in Table 5.

The final steps in completing the estimating job and in determining relative cost efficiencies are shown in Table 6. As to relative efficiency the actual cost in all cases is taken as the denominator. Thus relative costs below 100 percent indicate gins with actual costs higher than standard; relative costs above 100 percent indicate gins with actual costs lower than standard. The variability in cost efficiencies of the different items of cost is pronounced, ranging from 78.2 percent for cost of management to 337.1 percent for miscellaneous cost.

## PROFIT CHART

As a means of estimating standard costs and of picturing actual and estimated costs and actual and standard incomes Figure 1 was developed. This chart consists of three parts: the perpendicular axes to right and left scaled for total costs and incomes, the horizontal axes upper and lower scaled for bales ginned and the arc scaled for reading costs and incomes per bale.

Cost information of a specific gin was taken as recorded in Table 7 to illustrate the use of the chart. This gin had a total common cost of $6,637 (Table 7); the total residual cost was $3,934 (Table 1). The total nonvolume cost is the sum of these two, or $10,573. This nonvolume cost was plotted in the cost axes to right and left. The connecting line represents nonvolume costs for this specific gin according to the cost pattern current in 1949-50. Total volume cost at 8,000 bales was $48,800 (Table 3). The total estimated cost at 8,000 bales was the sum of the volume and nonvolume costs, or $59,373. This estimated cost was plotted in the cost axis to the right and connected with total nonvolume cost in the cost axis to the left. This connecting line represents total standard or estimated costs from lowest volume to 8,000 bales for this specific gin according to the cost pattern of the ginning industry in 1949-50. The estimated cost at actual volume of 6,150 bales is found with a straight edge determined by this volume in the estimated cost line in such

TABLE 5. ESTIMATION OF VOLUME COSTS

| | R/B ginned | Items of cost | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Management | Office sal. | Labor | Repairs | Power | Insurance | Trucking | Miscellaneous | Total |
| | 6,000 | $2,160 | $2,640 | $15,360 | $6,180 | $2,460 | $2,520 | $4,140 | $1,140 | $36,600 |
| | 400 | 144 | 176 | 1,024 | 412 | 164 | 168 | 276 | 76 | 2,440 |
| | 60 | 22 | 26 | 154 | 62 | 25 | 25 | 41 | 11 | 366 |
| Total | 6,460 | $2,326 | $2,842 | $16,538 | $6,654 | $2,649 | $2,713 | $4,457 | $1,227 | $39,406 |

TABLE 6. ESTIMATION OF ITEMS OF COSTS AND TOTAL COSTS

| Cost items | Est. vol. cost | Residual cost | Common cost | Total estimated cost | Total actual cost | Relative cost |
|---|---|---|---|---|---|---|
| Management | $2,326 | $1,357 | | $3,683 | $ 4,960 | 78.2% |
| Office salaries | 2,842 | — 367 | | 2,475 | 1,790 | 138.2 |
| Labor | 16,538 | 1,007 | | 17,545 | 15,818 | 110.9 |
| Repairs | 6,654 | — 452 | | 6,202 | 2,971 | 208.8 |
| Power | 2,649 | 1,190 | | 3,839 | 4,866 | 78.9 |
| Insurance | 2,713 | 631 | | 3,344 | 2,951 | 113.3 |
| Trucking | 4,457 | 558 | | 5,015 | 5,573 | 90.0 |
| Miscellaneous | 1,227 | 10 | | 1,237 | 367 | 337.1 |
| Total | $39,406 | $3,934 | $5,459 | 48,799 | $44,755 | 109.0 |

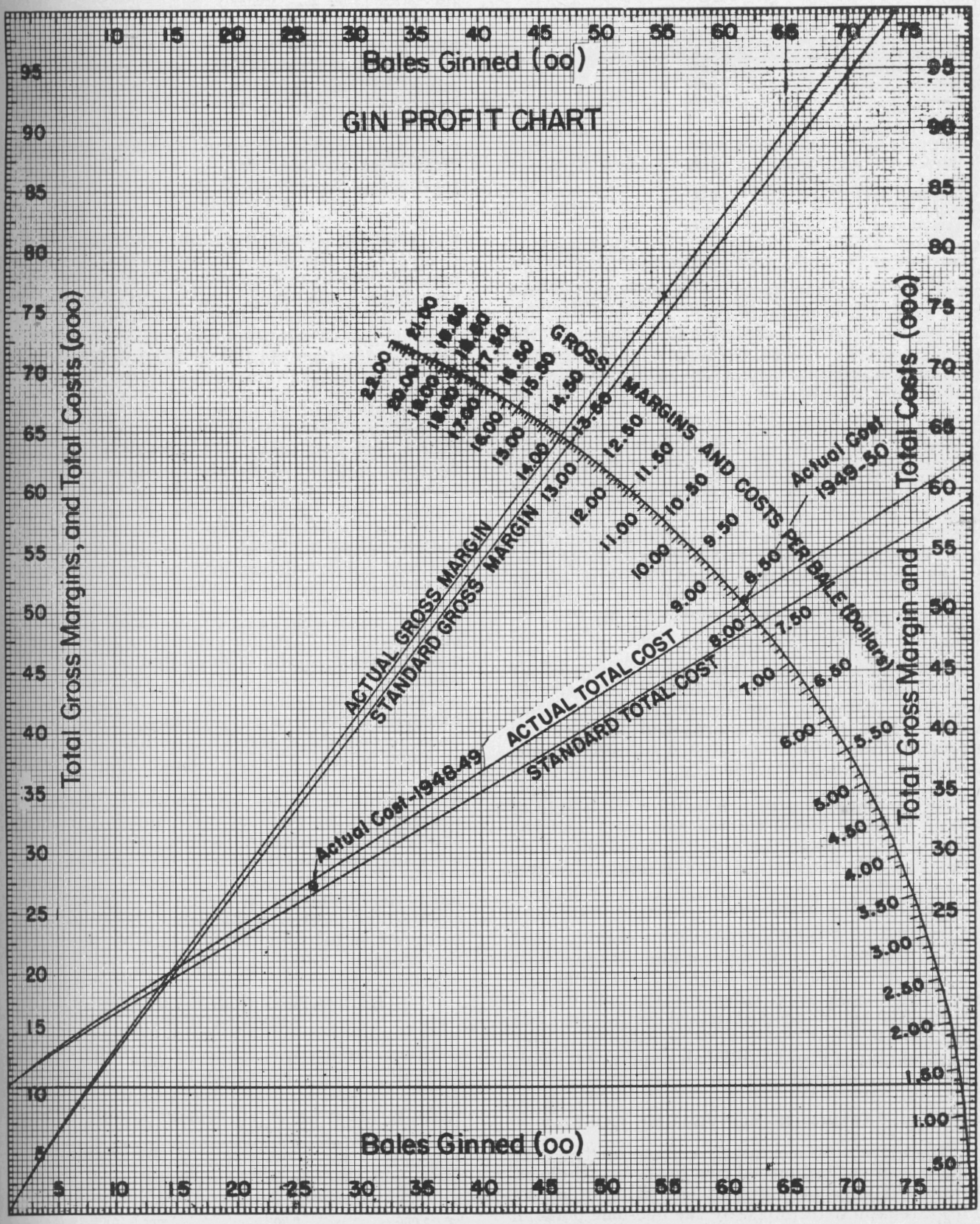


Figure 1. Income and cost chart—totals and per bale.

TABLE 7. CLASSIFICATION OF COSTS OF A SPECIFIC GIN

| Cost item | Costs influenced by volume | Common costs |
|---|---|---|
| Management | $ 6,913 | |
| Office salaries | 3,008 | |
| Labor | 20,883 | |
| Repairs | 5,013 | |
| Depreciation | | $3,798 |
| Office expense | | 1,409 |
| Power | 3,461 | |
| Insurance | 3,119 | |
| Taxes | | 704 |
| Trucking | 1,514 | |
| Good will | | 728 |
| Miscellaneous | 120 | |
| Total | $44,031 | $$6,639 |

a way as to obtain the same reading in the two cost axes. The estimated cost is about $48,100. A straight edge with direction determined by the point of origin and estimated cost at 6,150 bales gives a reading of about $7.80 in the arc as the estimated cost per bale.

The actual total cost of $50,700 for 1949-50 was plotted at actual volume of 6,150 bales. Total nonvolume cost in the cost axis to the left and this cost point determined the total cost line according to the cost pattern of this gin for that season.

The actual total cost of this gin in 1948-49 at a volume of 2,640 bales was $27,250. As plotted in the chart, this cost was slightly lower than the actual and slightly higher than the estimated costs as determined by the cost patterns of 1949-50.

The standard gross income of $13.50 per bale was the average income of the 130 cooperative gins for 1949-50. This income included items such as: gin tolls; gross margins on bagging and ties, cotton seed for planting and lint cotton; and service income such as trucking charges and cotton seed sterilization. The standard total income line in the chart was determined by the points of origin (0 bales and 0 income and cost) and the reading of $13.50 in the arc; the total actual income line was determined by the point of origin and the total income, that is, of 6,000 bales at a rate of $13.82 a bale.

The lines for total actual income and standard income and for total actual cost and standard cost indicate four break-even volumes. At actual income the break-even volume at actual cost is about 1,450 bales and at standard cost about 1,375 bales; at standard income the break-even volume at actual cost is about 1,525 bales and at standard cost about 1,425 bales.

## SPREADING OF NONVOLUME COST

The effects of increasing volume on the nonvolume cost per bale are shown in the profit chart. A straight edge anchored at the point of origin with direction determined by the 500-bale point in the nonvolume cost line shows a reading of about $21.15 a bale. As the straight edge is moved through the points of increasing volume the costs per bale drop significantly, reaching a low of about $1.30 at a volume of 8,000 bales.

Total income and cost readings for any volume point on the cost and income lines can be made with a straight edge with position determined by this point and equal readings on the cost and income axes to right and left. For instance, at a volume of 4,000 bales the estimated cost is about $35,000; actual total cost about $36,700; total standard income about $54,000; and total actual income about $55,400.

Readings in the chart for costs per bale show the relations between volume and net margins (Table 8). The behavior of net margins is the result of an increasing net per bale with an increasing volume beyond break-even. For instance, with a 4-fold increase in volume from 2,000 bales to 8,000 bales there would be a 12-fold increase in net margins from $4,140 to $48,160 for the particular gin used in illustrating the profit chart.

One of the advantageous uses of a profit chart is that of plotting total costs at actual volumes over a period of years. This would indicate cost behavior in terms of standard costs as well as picture trends in the actual costs of the gin under consideration. A strong feature of the profit chart, as shown in Figure 1, is that it becomes individualized to the gin in question. The standard cost pattern determined by the industry can be tailored to fit the specific gin.

The profit chart can be used most advantageously as a cost chart for estimating and picturing cost behavior of the various items of cost. For instance, with labor costs the first step is the plotting of the residual cost of $1,000 in the cost axes and connecting these points with a straight line. According to Table 3 total volume cost of labor at 8,000 bales is $20,480. Hence total estimated labor cost at 8,000 bales is $21,480. This total cost plotted in the cost axis to the right and connected with the residual cost point in the axis to the left yield estimated labor costs according to the cost pattern of 1949-50. A year-to-year plotting of total labor costs in the chart would picture labor cost behavior in terms of standard labor costs. The plotted actual labor costs would also picture the behavior of actual labor costs over the years.

## ESTIMATING COSTS OF SUPPLY ASSOCIATIONS

Every effort was made to deal with costs of operating supply associations in a manner simi-

TABLE 8. RELATION OF VOLUME OF GINNING TO COSTS AND MARGINS

| Ginned | Cost per bale | Net margins | |
|---|---|---|---|
| | | Per bale[1] | Total |
| 1,000 | $17.25 | $—3.43 | $—3,430 |
| 2,000 | 11.75 | 2.07 | 4,140 |
| 4,000 | 9.20 | 4.62 | 18,480 |
| 6,000 | 8.50 | 5.32 | 31,920 |
| 8,000 | 7.80 | 6.02 | 48,160 |

[1]Gross income per bale less cost per bale.

TABLE 9. ESTIMATING EQUATIONS FOR ITEMS OF COST OF SUPPLY ASSOCIATIONS

| Item of cost | Residual cost | | Volume cost |
|---|---|---|---|
| Management | $1,240 | + | $1.34V[1] |
| Office salaries | — 61 | + | 1.72V |
| Labor | 391 | + | 4.21V |
| Repairs | 185 | + | .19V |
| Power | 78 | + | .27V |
| Insurance | 30 | + | .43V |
| Trucking | 822 | + | .26V |
| Miscellaneous | 283 | + | .42V |
| Total items | $2,968 | + | $8.84V |

V[1] A unit of sales is equivalent to $130.

lar to that of the gins. As a means of increasing comparability with ginning income and cost, sales of the supply associations were divided by 130 to reduce sales to units with a value equal to about a bale of cotton in 1949-50.

The average volume of business of the 20 supply associations for the season 1949-50 was 783 units, or sales of $101,800; this average volume, unit for unit, was equivalent to 14 percent of the average volume of the gins. This difference in volume of business is important in making comparisons between ginning and supply business costs.

The segregation of items of cost in those influenced by volume and those not influenced by volume was identical with that for the gins. The estimating equations of the eight items influenced by volume are given in Table 9. To facilitate the estimating of volume costs Table 10 was developed. The necessary steps in proceeding from actual costs to estimated costs are identical with those explained for the gins.

## BREAK-EVEN VOLUME AS A TOOL FOR DEMONSTRATING INCOME AND COST BEHAVIOR

Industrial engineers for many years have been using break-even volume in their analyses. Writers of economic textbooks are adopting the concept in increasing numbers. The concept has been handled in terms of totals—total gross income and total cost. Break-even volume is determined at the point of crossing of the two curves. The main significance attached to break-even is picturing the relations of income, cost and volume of business to net profits. Any influence that may increase the slope of the total gross income curve affects profits in two ways: the break-even volume is pushed into lower volume thereby increasing the number of profit units and the steeper slope increases the profit per unit as compared with the original situation.

Any influence that may lower the nonvolume cost or lower the slope of the cost curve, or both, increases profits through adding to the number of profit units as well as increasing the profits per unit. There seems to be a general feeling that break-even has application only if variable, or volume, costs are linear. The break-even concept is applicable to curvilinear costs as well as to linear costs. With curvilinear costs diagrammatic demonstrations are somewhat awkward in contrast with those for linear costs.

Progressive mechanization adds to the significance of the break-even concept as overhead or nonvolume costs represent proportionately larger shares of total costs. Break-even volume is a more potent tool for picturing economic relations than has been assumed thus far. Break-even in terms of unit gross income and unit cost can be most revealing. Break-even demonstrations can be made only of total costs and total incomes or of total unit costs and unit incomes but not as items of costs whether total or unit. The applications of break-even made in this presentation are in terms of linear volume costs.

## RELATION OF INCOME AND COSTS AT BREAK-EVEN VOLUME

Various aspects of break-even are illustrated in Figure 2. At break-even as pictures in Diagram I, three rectangles are shown: gross margins (bales ginned times gross margin per bale), volume cost (bales ginned times volume cost per bale) and nonvolume cost (bales ginned times [gross income per bale minus volume cost per bale] ).

Diagram II pictures operations of this same gin at its actual volume of ginning. Four rectangles are involved: gross margins, volume costs, nonvolume cost and net margins. The rectangle for nonvolume cost in Diagram II is identical with that in Diagram I. At break-even volume the nonvolume cost is written off; from this point of

TABLE 10. DATA FOR ESTIMATING TOTAL COSTS OF ITEMS AS AFFECTED BY VOLUME OF SUPPLY BUSINESS

| Units handled | Management | Office salary | Labor | Repairs | Power | Insurance | Trucking | Misc. | Total cost, 8 items |
|---|---|---|---|---|---|---|---|---|---|
| 100 | $ 134 | $ 172 | $ 421 | $ 19 | $ 27 | $ 43 | $ 26 | $ 42 | $ 884 |
| 200 | 268 | 344 | 842 | 38 | 54 | 86 | 52 | 84 | 1,768 |
| 300 | 402 | 516 | 1,263 | 57 | 81 | 129 | 78 | 126 | 2,652 |
| 400 | 536 | 688 | 1,684 | 76 | 108 | 172 | 104 | 168 | 3,536 |
| 500 | 670 | 860 | 2,105 | 95 | 135 | 215 | 130 | 210 | 4,420 |
| 600 | 804 | 1,032 | 2,526 | 114 | 162 | 258 | 156 | 252 | 5,304 |
| 700 | 938 | 1,204 | 2,947 | 133 | 189 | 301 | 182 | 294 | 6,188 |
| 800 | 1,072 | 1,376 | 3,368 | 152 | 216 | 344 | 208 | 336 | 7,072 |
| 900 | 1,206 | 1,548 | 3,789 | 171 | 243 | 387 | 234 | 378 | 7,956 |
| 1000 | 1,340 | 1,720 | 4,210 | 190 | 270 | 430 | 260 | 420 | 8,840 |
| Residuals | $1,240 | $— 61 | $ 391 | $ 185 | $ 78 | $ 30 | $ 822 | $ 283 | $2,968 |
| Unit variable | $1.34 | $1.72 | $4.21 | $ .19 | $ .27 | $ .43 | $ .26 | $ .42 | $8.84 |

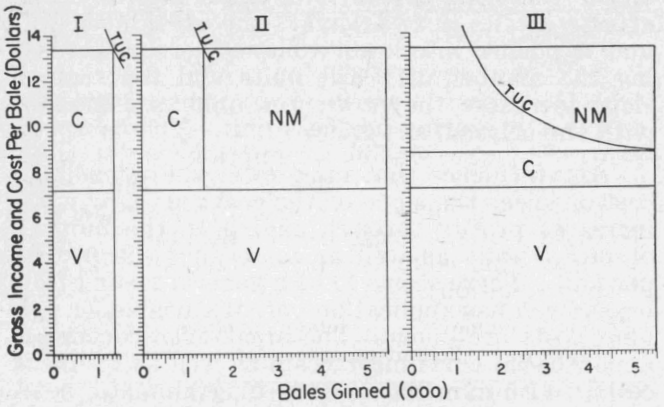


**Figure 2. Break-even concept in terms of unit gross income, unit cost and unit net margin. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

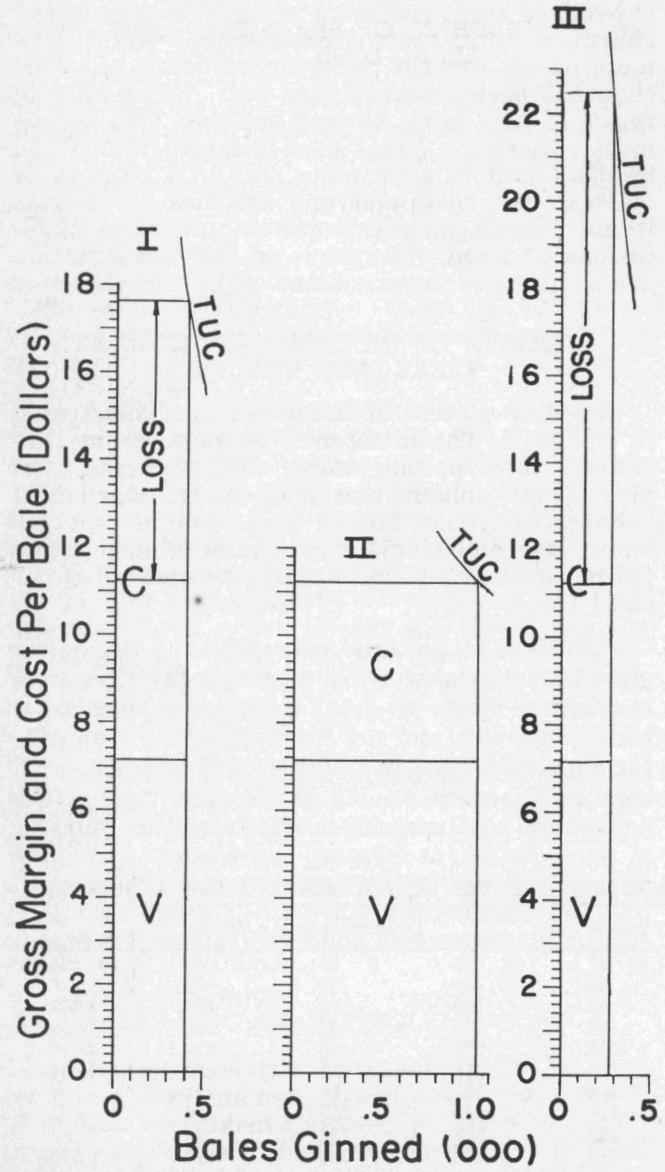


**Figure 3. Relation of cost and income at volume less than break-even and volume of least loss. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

view with volume increasing beyond break-even the only added cost is the volume cost.

In Diagram III all four rectangles have a common bale dimension. It shows what happens to the part of the gross income rectangle remaining with the volume cost rectangle subtracted. From break-even volume to full volume the unit cost curve effects divisions between unit net margins and unit nonvolume costs. The declining unit nonvolume cost dimensions per bale with increasing volume are exactly complemented by increasing unit net income dimensions. In other words Diagram III illustrates how increasing volume spreads the nonvolume cost thinner.

At volume greater than break-even as in Diagram II of Figure 2 the rectangle other than volume cost is divided vertically between nonvolume cost and net margin; each has the same per bale dimension but differs in volume dimensions. In Diagram III of Figure 2 the rectangle other than volume cost is divided horizontally between nonvolume cost and the net margin; each has the same volume dimension but differs in per bale dimensions.

Diagram III may be used as a model to demonstrate the effects of increasing cost efficiency. Reductions in unit volume costs, or in unit nonvolume costs, or both, are transformed into increases in unit net margins.

Figure 2 was made in terms of actual cost and income for the gin under consideration. Actual volume cost (variable) was determined as follows:

$$\text{Actual unit volume cost} = \frac{\text{total actual cost} - \text{total nonvolume cost}}{\text{number of bales ginned}}$$

Break-even volume for given unit gross income and unit volume cost can be solved algebraically. For actual volume cost and actual gross income the solution is:

$$\text{Break-even volume} = \frac{\text{total nonvolume cost}}{\text{actual unit gross income} - \text{actual unit volume cost}}$$

For standard volume cost and standard gross income the solution is:

$$\text{Break-even volume} = \frac{\text{total nonvolume cost}}{\text{standard unit gross income} - \text{standard unit volume cost}}$$

## RELATION OF INCOME AND COSTS AT VOLUME LESS THAN BREAK-EVEN

The relation of income and costs at volume less than break-even is shown in Figure 3. Diagram I represents an actual gin with a volume of 400 bales. Four rectangles with common bale dimensions are shown; the gross income rectangle which represents the part of costs covered by gross income, the volume cost rectangle, the rectangle representing the part of the nonvolume cost in addition to the volume cost covered by income and the part of the nonvolume cost rectangle lying outside income and hence representing

the loss. Diagram II shows the same gin at break-even volume under the assumption that the cost pattern at 400 bales continued to break-even volume.

A significant question facing many Texas ginners during seasons of abnormally low cotton production is the least loss volume. According to the Census Reports on Texas ginning during 1932-38, on an average, 7.4 percent of the gins remained idle. The situation for 1949-50 showed that with the largest cotton crop on record and with the lowest number of gins since census reporting was inaugurated, 11.2 percent of the gins did not operate. However, crop failures or bumper crops are never evenly distributed over the whole cotton producing area of Texas. Many of the 250 idle gins had undoubtedly been idle for several years and had deteriorated to a point making impractical the repair expense required to put the plants in operating condition.

Reports on idle gins gave no clue as to the least volume which induces a ginner to operate. In some 2,000 gin cost records examined since 1932, volumes below 300 bales appeared in only two or three instances. This seems to indicate that Texas ginners act on the principle that there is a least volume below which losses of no operation are less than those of operation.

## LEAST LOSS VOLUME

An important factor in the matter of the least loss volume is the relationship between gross unit income and unit volume cost. Three relationships can be assumed: unit volume cost greater than gross unit income, unit volume cost equal to gross unit income and unit volume cost less than gross unit income.

Under the first assumption nonvolume cost, through whatever volume, would constitute a constant loss while volume loss would mount proportionately with increasing volume; this situation is impossible. Under the second assumption the nonvolume cost would continue as a constant loss regardless of volume while volume cost and income would cancel each other; this situation also is impossible. Thus the assumption that the least loss volume is that at which income offsets volume or operating or variable costs is impossible. The only possible relationship is that of unit volume cost less than unit gross income.

Another factor in the determination of the least loss volume is that with a shrinking volume, of a gin for instance, the gin as a business unit begins to disintegrate. That is, with very low volume no repair expense would be incurred, a bookkeeper might not be employed, a choice might be made between the manager and the ginner to operate the business and the gin plant and the farmer customer might be required to handle the suction. Thus the gin crew might be reduced to the ginner or manager and the farmer and the ginning job might be completed before any attention would be given to the press job. Under such circumstances every effort would be made to reduce out-of-pocket expense to a minimum.

The only sound basis on which to predicate the least loss volume is to assume the gin is a normally operating business unit. The departure is taken as a reasonable assumption that the least loss volume is that at which the total loss is equal to the gross income. This calls for a cost per unit twice that of the gross income per unit. The solution of this volume can be made with the following equation:

$$\text{Least loss volume} = \frac{\text{total nonvolume cost}}{2\ (\text{unit gross income}) - \text{unit volume cost}}$$

The solution for least loss volume is shown graphically by Diagram III in Figure 3. The least loss volume is 274 bales. Increasing volume from this point would result in decreasing losses until the break-even point was reached.

## GRAPHICS OF BREAK-EVEN AND LEAST LOSS VOLUMES

The bearing that nonvolume cost and the difference between unit gross income and unit volume cost have on break-even volume are shown in Figure 4. Nonvolume costs included range from $5,000 to $19,000 and differences between gross unit income and unit volume cost range from $5 to $20.

In illustrating the use of the break-even chart a reading may be made for the gin used in explaining the profit chart (Figure 1, Table 7). This gin had a nonvolume cost of $10,600; the unit gross income was $13.82 and the unit volume cost was $6.52. The difference between income and volume cost per bale was $7.30. A reading for $10,600 nonvolume cost and volume about midway between the $7.00 and $7.50 differences per bale indicates a break-even volume of about 1,450 bales. The chart shows that the amount of the nonvolume cost is a significant factor in break-even volume. As the differences between unit gross income and unit volume cost decrease, increasing total nonvolume costs take on added importance.

Solutions for least loss volumes are facilitated by Figure 5. In explaining the use of this chart the same gin may be taken as in the preceding example. Twice the gross income per unit is $27.64; this total less the unit cost of $6.52 leaves a difference of $21.12. A reading for a nonvolume cost of $10,600 and a per bale difference of $21.12 indicates a least loss volume of about 500 bales.

## COMPARISONS OF GINNING INCOMES AND COSTS

Ginners are concerned with comparisons of income and of cost. Break-even analysis in unit income and cost is a means of making comparisons. Four situations are involved in actual and standard incomes and costs: income higher than standard with cost higher than standard and with cost lower than standard; and income lower than

standard with cost higher than standard and with cost lower than standard. A gin was selected for each of the four situations as shown in Figures 6, 7, 8 and 9. In each instance Diagram I to the left represents the gin at actual income, cost and volume; Diagram II to the right represents the gin at standard income and cost and actual volume.

Through the use of properly constructed break-even diagrams, the ginner can compare his actual situation as to income, cost and volume with what it would be if his income and cost were standard. An explanation of the method of computation suggested for preparing these break-even charts also explains the manner in which Figures 6, 7, 8 and 9 were derived. These are the essential ingredients: total nonvolume cost, actual unit volume cost, actual unit gross income, standard unit volume cost and standard unit gross income. The items of actual cost should be separated into two groups: the eight items influenced by volume and the items not influenced by volume. The total of the latter group added to the total residual cost of $3,934 gives total nonvolume cost. Total actual cost less total nonvolume cost divided by the number of bales ginned yields the actual unit volume cost. Actual break-even volume is found by dividing total nonvolume cost by actual unit income less actual unit volume cost; standard break-even volume is determined by dividing total nonvolume cost by standard unit income less standard unit volume cost.

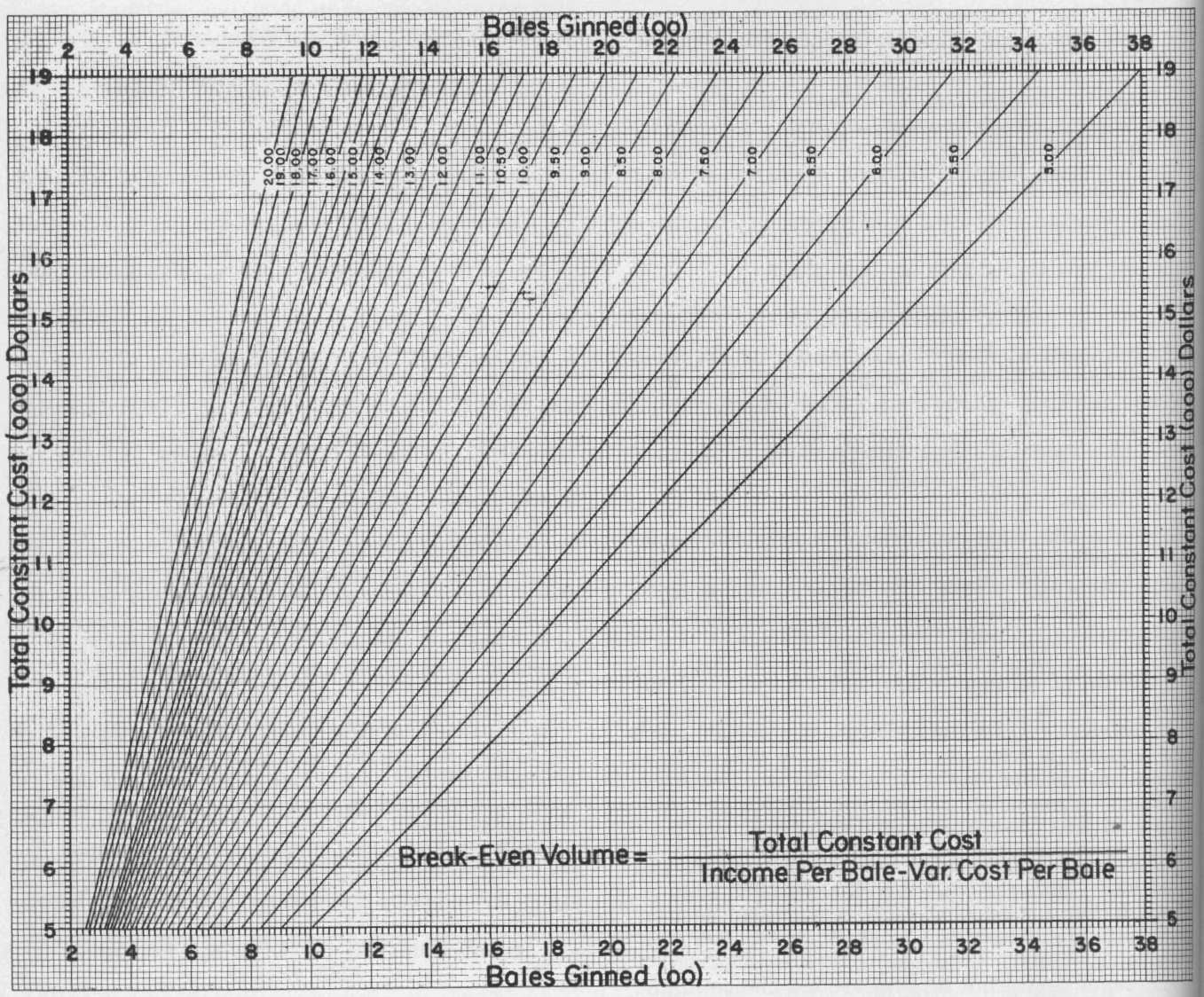


**Figure 4. Solutions for break-even volumes in terms of gross income per bale, nonvolume cost and volume cost per bale. These factors may be determined in the following manner: Gross Income Per Bale — Add such service income as gin tolls, trucking and sterilization incomes and gross margins on bagging and ties, cotton seed, lint cotton purchased from patrons and cotton planting seed; divide total income by the number of bales ginned; result, gross income per bale. Nonvolume Cost—Total all cost items other than those influenced by volume; add residual cost of $3,934; total, nonvolume cost. Volume Cost Per Bale—From total actual cost subtract total nonvolume cost; divide the remainder by the number of bales ginned; this gives volume cost per bale. Break-even volume is the intersection of nonvolume cost and the per bale gross income less volume cost per bale as read in the chart.**

The total unit cost curves are developed as follows: the total nonvolume cost is divided by volumes of 100 or 200 bale intervals from break-even to total volume ginned; the actual total unit cost curve is derived by adding the actual unit volume cost to the unit nonvolume costs; the standard total unit cost curve is developed by adding the standard unit volume cost to the unit constant costs.

All pertinent data used in constructing Figures 1, 2, 3, 6, 7, 8 and 9 are listed in Table 11. The gin with a standard volume cost of $5.91 per bale did not register a miscellaneous cost; the one with a standard volume cost of $5.66 per bale did not report office salaries. Additions to net margins or deductions from net margins accordingly as actual incomes and costs deviate from standard incomes and costs are summarized in Table 12.

## INFLUENCE ON NET MARGINS OF INCOMES AND COSTS VARYING FROM STANDARD

Total net margins are influenced by incomes higher and lower than standard and by costs higher and lower than standard. The gin shown in Figure 3 with a volume of 400 bales sustained an actual loss of $2,568; this loss was 240 percent of the loss of $1,072 which would have resulted if income and cost had been standard. Gross unit income below standard added $900 to loss, and unit volume cost higher than standard added $596 to loss.

From the standpoint of net margins, income above standard and cost below standard are most favorable (Figure 7). Of the total actual net margin of $36,745 for this gin, net margins at standard income and cost furnished 69.0 percent of the actual total net; income above standard ac-

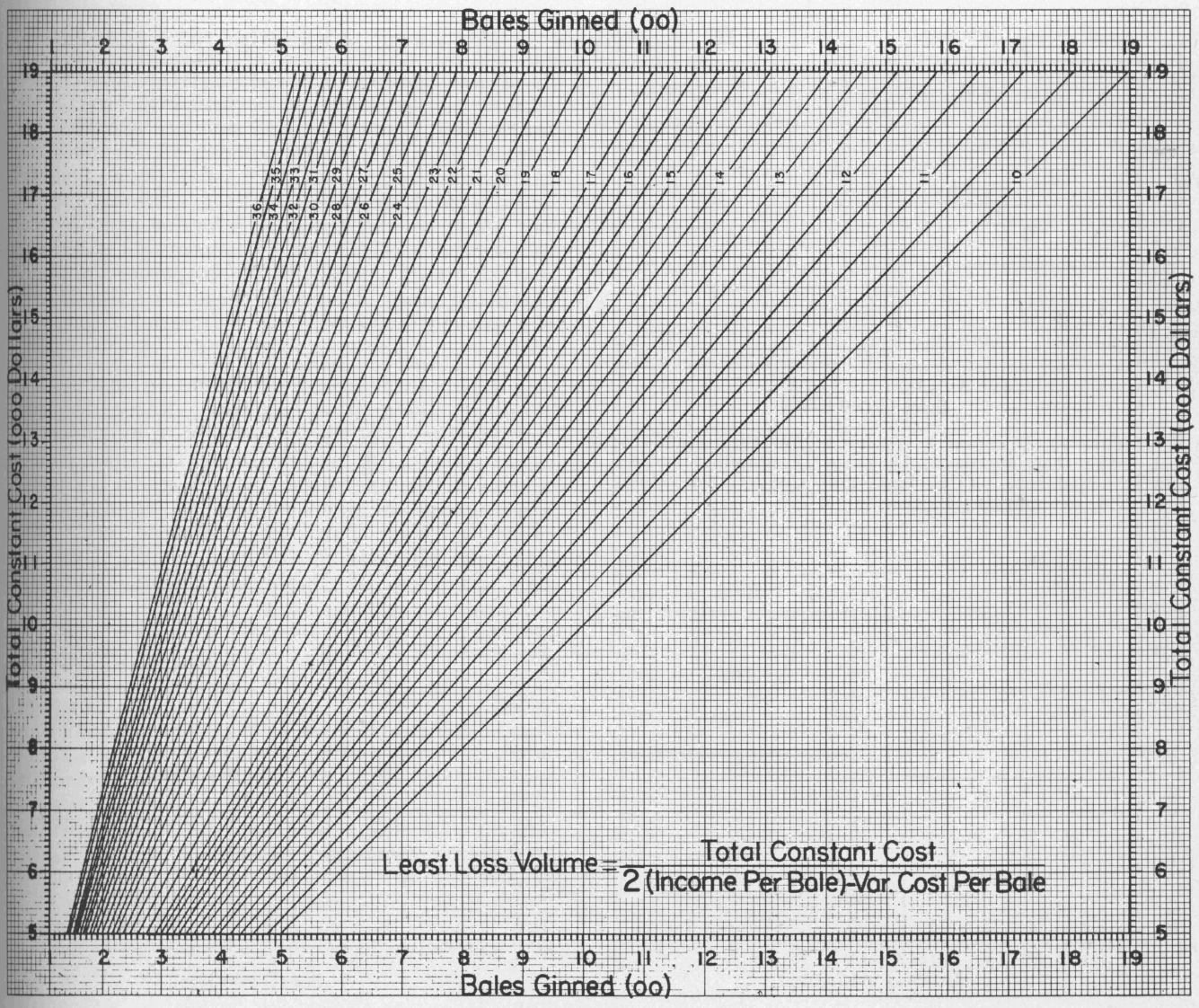


**Figure 5. Solutions for least loss volumes in terms of gross income per bale, nonvolume cost and volume cost per bale. Determination of three factors same as given under Figure 4. Least loss volume is the intersection of nonvolume cost and twice the gross income per bale less volume cost per bale as read in the chart.**

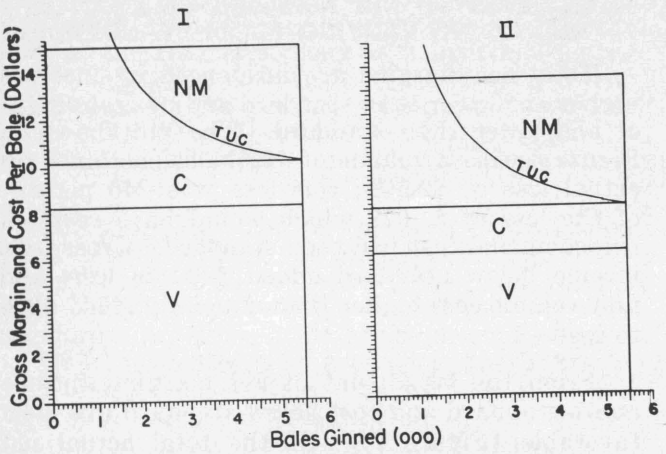


**Figure 6. Diagram I, income higher than standard; cost higher than standard; Diagram 11, standard income and standard cost. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

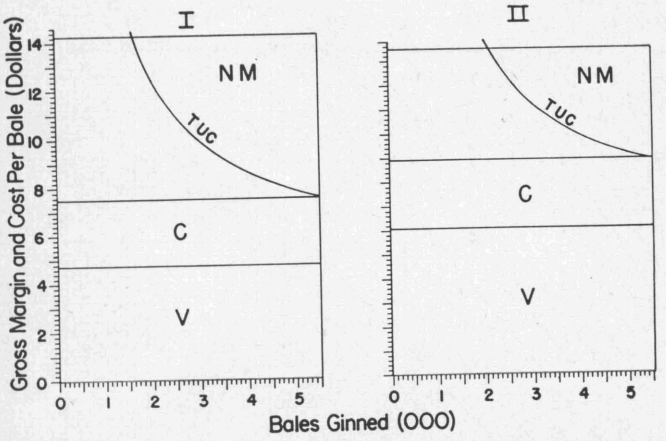


**Figure 7. Diagram I, income higher than standard; cost lower than standard; Diagram II, standard income and standard cost. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

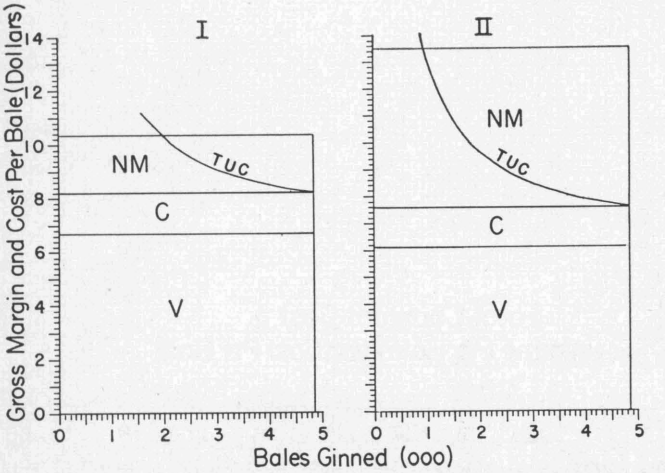


**Figure 8. Diagram I, income lower than standard; cost higher than standard; Diagram II, standard income and standard cost. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

counted for 10.8 percent and cost below standard for 20.2 percent of actual total net margins. The most unfavorable situation is that of income below standard and cost above standard as shown by the gin in Figure 8. At standard income and cost this gin would have had a total net margin of $28,759. Income below standard deducted $15,-351 from total net standard margin, and cost higher than standard deducted an additional $2,-866.

Break-even analysis applies to the supply business as it does to the ginning business. Figure 10 is based on a supply association with gross unit income higher than standard and unit volume cost higher than standard. Each unit of sales represented $130; total sales for 1949-50 were $156,000. Actual total net margin was $9,540. The net margin under standard income and cost would have been $3,360; income above standard increased net margin by $7,740; cost higher than standard reduced net margin by $1,560.

## COSTS OF MULTI-FUNCTION BUSINESS

Texas had 576 local cooperatives in 1952 which could be classified as performing functions of marketing, processing and service. Of these local associations 251, or 44 percent of the total, were multi-function. That is, associations combining ginning and elevator business, ginning and supply business and the like. As for specific kinds of cooperatives 156, or 49 percent of the 321 gins, were multi-function; 70, or 76 percent of the 95 elevators, and 227, or 80 percent of the 284 supply associations, were multi-function.

No attempt is made to compare the advantages and disadvantages of multi-function business with those of one-function business. Rather this question is asked: Is there economy in multi-function operations? For example, are the total costs of a gin-supply operation with a given volume of ginning and a given volume of supply business more or less than the combined costs of a one-unit gin and a one-unit supply firm with like volumes of business? This assumption

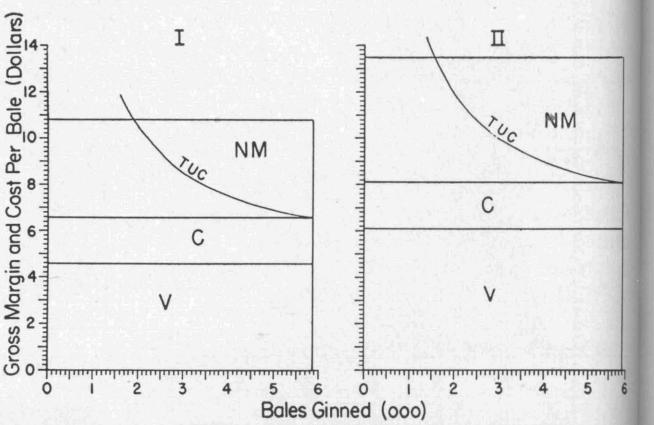


**Figure 9. Diagram I, income lower than standard; cost lower than standard; Diagram II, standard income and standard cost. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

TABLE 11. ACTUAL AND STANDARD INCOMES AND COSTS, TOTAL AND PER BALE, 1949-50

| Diagram number | 1 | 2 | 3 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|
| | | | | Total per bale | | | |
| Bales ginned | 6,149 | 5,485 | 400 | 5,506 | 5,509 | 4,858 | 5,863 |
| Nonvolume cost | $10,579 | $ 8,506 | $ 4,206 | $10,488 | $15,421 | $ 7,174 | $11,703 |
| Actual cost | 50,670 | 48,094 | 7,067 | 55,930 | 41,589 | 39,706 | 38,642 |
| Standard cost | 48,088 | 40,922 | 6,470 | 44,075 | 49,026 | 36,808 | 47,467 |
| | | | | Average per bale | | | |
| Actual volume cost | $ 6.52 | $ 7.22 | $ 7.15 | $ 8.25 | $ 4.75 | $ 6.70 | $ 4.59 |
| Standard volume cost | 6.10 | 5.91 | 5.66 | 6.10 | 6.10 | 6.10 | 6.10 |
| Actual income | 13.82 | 13.38 | 11.25 | 15.05 | 14.22 | 10.34 | 10.83 |
| Standard income | 13.50 | 13.50 | 13.50 | 13.50 | 13.50 | 13.50 | 13.50 |
| Actual average cost | 8.24 | 8.77 | 17.67 | 10.16 | 7.55 | 8.17 | 6.59 |
| Stand. average cost | 7.82 | 7.46 | 16.18 | 8.00 | 8.90 | 7.58 | 8.10 |

was made: if average actual cost is lower than average standard cost, the cost advantage lies with the diversified business. These comparisons were made of the costs of 25 gin-supply associations for their business of 1949-50. Common costs were segregated from total costs; to these common costs were added total residual costs of one-function gins and one-function supply associations. Total actual costs less total nonvolume cost yielded total volume costs. Estimated common costs were derived by adding average common costs of one-function gins and of one-function supply firms; these common costs added to total residual costs gave estimated nonvolume costs; estimated volume costs were secured by multiplying average bales ginned by standard unit volume cost and average units of supply business by standard unit volume supply cost. These computations are recorded in Table 13. Since the average estimated cost per unit was $9.27 and the average actual cost per unit was $8.44, it appears that for 1949-50 the gin-supply business had a cost advantage of 83 cents a unit over the one-function gin and one-function supply associations. This 83 cents advantage represented 9.9 percent of actual cost.

## CHANGES IN GINNING INCOMES AND COSTS

Comparisons of ginning incomes and costs for 1932-38 with those of 1949-50 are shown in Figure 11. Diagram I pictures the average gin for 1932-38; Diagram II represents the average cooperative gin for 1932-38; Diagram III shows the average gin of 1949-50; and Diagram IV pictures the average cooperative gin of 1949-50. Average gross income per bale was $6.00 for 1932-38 and $13.07 in 1949-50. (The average gross income per bale for the 275 cooperative gins for which income data were obtained was $13.07; the average for the 130 cooperatives included in this income and cost analysis was $13.50). Average break-even volume advanced from 900 bales for 1932-38 to 1,530 bales in 1949-50. At like volume, ginning costs in 1949-50 were 300 percent higher than those of the period 1932-38; ginning income the latter season was 220 percent higher than that of 1932-38. This explains the rise in break-even volume. Figure 11 reflects the perishability of "costs" in an economy of advancing technology and rising price levels.

Cooperative gins show a considerably higher volume than the competing gins. That is, the cooperatives are not held to break-even on an average. A break-even volume of 1,530 bales is a norm or index. The break-even volume of most gins varies from this average. From year to year one-half of the gins other than the cooperatives operate at a profit; the other half at a loss.

Differences in ginning incomes and costs between 1932-38 and 1949-50 are not the only variations. At several points in this analysis there have been considerable variations in both incomes and costs for 1949-50. As a means of showing variations, the 130 cooperative gins were grouped into four quarters on the basis of cost differences from highest to lowest. Average incomes and costs for the four groups are shown in Figure 12. In this instance the average volume of 5,621 bales was applied to each group. Average income declined as average cost declined. The differences between the highest and lowest cost quarters were $2.45 a bale income and $3.50 a bale cost.

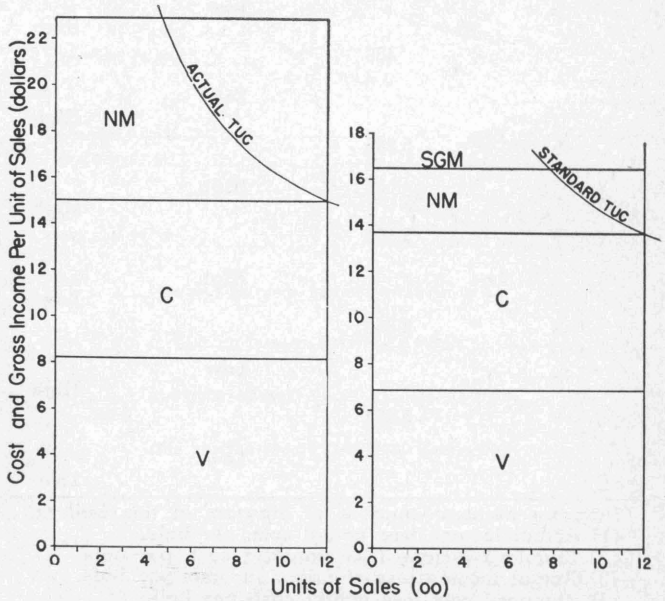


**Figure 10. Supply association with income higher than standard and cost higher than standard; left diagram, actual situation and right diagram, standard situation. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.**

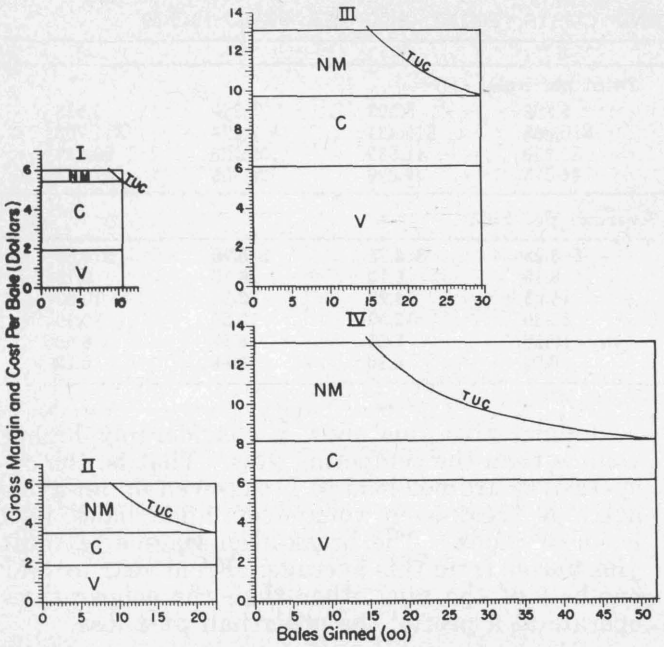


Figure 11. Average ginning incomes and costs for 1932-38 and 1949-50. Diagram I, average Texas gin, 1932-38; Diagram II, average Texas cooperative gin, 1932-38; Diagram III, average Texas gin, 1949-50 and Diagram IV, average Texas cooperative gin, 1949-50. TUC, total unit cost; C, nonvolume cost; NM, net margin; V, volume cost.

The total average net margin of the lowest cost quarter was $5,900 greater than that of the highest cost quarter.

The per bale costs of all items of cost at average volume of 5,621 bales for the four cost quarters and for all gins are shown in Table 14. Actual net margins at actual average volume for each cost quarter are recorded in Table 15. Differences between actual average net margins and standard average net margins also are accounted for in terms of differences between actual and standard income and actual and standard cost.

## COST VARIATIONS AS REVEALED IN BREAK-EVEN VOLUMES

Cost variations can be analyzed in terms of break-even volumes at actual unit gross income for actual unit costs and standard unit costs (Figure 13). Diagram I shows the gins with actual cost higher than standard. These gins were relatively inefficient as to costs. The break-even volumes to the left are at standard costs and to the right at actual costs. Diagram II shows the gins with actual costs lower than standard. These gins were relatively efficient as to costs. The break-even volumes to the right are at standard costs and to the left at actual costs.

TABLE 12. NET MARGINS AS RELATED TO ACTUAL AND STANDARD INCOMES AND ACTUAL AND STANDARD COSTS, 1949-50

| Diagram[1] number | Bales ginned | Ratio actual to standard | | Margins | | |
|---|---|---|---|---|---|---|
| | | Income | Cost | Per bale | Total | |
| | | | | | Standard and other | Actual |
| 1 | 6,149 | | | $ 5.58(1)[2] | | $34,311 |
| | | | | 5.68(2) | $34,926(5)[3] | |
| | | High | | .32(3) | 1,968(6) | |
| | | | High | — .42(4) | — 2,583(7) | 34,311 |
| 2 | 5,485 | | | 4.61(1) | | 25,286 |
| | | | | 6.04(2) | 33,129(5) | |
| | | Low | | — .12(3) | — 658(6) | |
| | | | High | —1.31(4) | — 7,185(7) | 25,286 |
| 3 | 400 | | | —6.42(1) | | —2,568 |
| | | | | —2.68(2) | — 1,072(5) | |
| | | Low | | —2.25(3) | — 900(6) | |
| | | | High | —1.49(4) | — 596(7) | —2,568 |
| 6 | 5,506 | | | 4.89(1) | | 26,924 |
| | | | | 5.50(2) | 30,283(5) | |
| | | High | | 1.55(3) | 8,534(6) | |
| | | | High | —2.16(4) | —11,893(7) | 26,924 |
| 7 | 5,509 | | | 6.67(1) | | 36,745 |
| | | | | 4.60(2) | 25,341(5) | |
| | | High | | .72(3) | 3,967(6) | |
| | | | Low | 1.35(4) | 7,437(7) | 36,745 |
| 8 | 4,858 | | | 2.17(1) | | 10,542 |
| | | | | 5.92(2) | 28,759(5) | |
| | | Low | | —3.16(3) | —15,351(6) | |
| | | | High | — .59(4) | — 2,866(7) | 10,542 |
| 9 | 5,863 | | | 4.24(1) | | 24,859 |
| | | | | 5.40(2) | 31,660(5) | |
| | | Low | | —2.67(3) | —15,654(6) | |
| | | | Low | 1.51(4) | 8,853(7) | 24,859 |

[1] Diagram number—number of diagram in this bulletin.

[2] (1) Actual income less actual cost, per bale.
(2) Standard income less standard cost, per bale.
(3) Actual income less standard income, per bale.
(4) Standard cost less actual cost, per bale.

[3] (5) Total net margin at standard income and standard cost.
(6) Net margin as related to actual and standard income; positive total, actual income greater than standard; negative total, actual income less than standard.
(7) Net margin as related to actual and standard cost: positive total, actual cost less than standard; negative total, actual cost greater than standard.

TABLE 13. AVERAGE ACTUAL AND ESTIMATED COSTS OF 25 GIN-SUPPLY ASSOCIATIONS, 1949-50[1]

| Type of cost | Total costs | | Total unit costs | |
|---|---|---|---|---|
| | Actual | Estimated | Actual | Estimated |
| Nonvolume | $12,774 | $13,945 | $2.68 | $2.93 |
| Volume | 27,369 | 30,150 | 5.76 | 6.34 |
| Total | $40,143 | $44,095 | $8.44 | $9.27 |

[1] Average volume of business: ginnings, 4,060 bales; supply, 696 units (sales $90,480).

Break-even volumes for actual ginning costs at actual incomes and standard incomes are indicated in Figure 14. In each case the total cost curve connecting the two break-even volumes was derived by adding the actual unit volume cost to the unit nonvolume costs. Break-evens tend toward lower volumes at standard income for the gins with incomes below standard in contrast to the gins with incomes above standard. This confirms the tendency of lower incomes to be associated with lower costs.

Break-even volumes for actual costs at actual and standard incomes of a group of supply associations are shown in Figure 15. The cost curve connecting each pair of break-even volumes represents actual total unit cost. As shown in Figures 14 and 15 cost behaviors of cotton gins and supply associations have much in common as to variability.

## VARIATIONS FROM STANDARD GINNING COSTS

Costs vary significantly among the various gin associations. The manner in which actual costs behave in terms of standard costs is summarized in Table 16. Twenty-eight gins, or 22 percent of the total, varied from standard costs by 5 percent or less; 60 gins, or 46 percent of the total, varied by 10 percent or less; 82 gins, or 63 percent of the total, varied by 15 percent or less; and 48 gins, or 37 percent of the total, varied from standard costs by more than 15 percent.

Why do ginning costs vary so widely? Cost differences are difficult to handle as long as they are stated in terms of varying volumes. An important step in procedures for comparing cost differences is the reduction of costs to standard, or average, volume. This adjustment was made as follows: nonvolume cost was subtracted from total actual cost; the remainder, or total volume cost, was divided by the number of bales ginned, which yielded actual volume cost per bale. This unit volume cost multiplied by 5.621 gave total volume cost at standard volume; this volume cost added to nonvolume cost gave total actual cost at standard volume. This total cost divided by standard volume yielded the cost per bale at standard volume.

The method followed for adjusting actual cost at actual volume to actual cost at standard volume may be questioned. Adjustment in residual cost for relative efficiency was made in this manner: the residual cost in each case was divided by the relative efficiency: thus the residual costs of the high cost gins were increased and of the low cost gins decreased; the adjusted residual costs were added to the total common costs to give the adjusted nonvolume costs; the adjusted nonvolume costs were subtracted from total costs and the differences were divided by numbers of bales ginned; these unit volume costs were multiplied by 5,621 and added to the adjusted nonvolume costs; these total costs were divided by standard volume and thus the unit costs were obtained for adjusted residual costs at standard volume.

TABLE 14. COST OF GINNING PER BALE AT STANDARD VOLUME OF 5,621 BALES, 1949-50

| Costs | Cost quarters | | | | Average |
|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | |
| Management | $0.58 | $0.70 | $0.60 | $0.50 | $0.59 |
| Office salaries | 0.43 | 0.43 | 0.39 | 0.36 | 0.40 |
| Labor | 3.33 | 2.74 | 2.51 | 2.15 | 2.68 |
| Repairs | 1.30 | 0.95 | 0.89 | 0.60 | 0.93 |
| Power | 0.73 | 0.65 | 0.61 | 0.49 | 0.62 |
| Insurance | 0.62 | 0.58 | 0.51 | 0.37 | 0.52 |
| Trucking | 1.11 | 0.85 | 0.61 | 0.46 | 0.76 |
| Miscellaneous | 0.23 | 0.19 | 0.11 | 0.15 | 0.17 |
| Depreciation | 0.77 | 0.70 | 0.92 | 0.68 | 0.77 |
| Office expense | 0.21 | 0.21 | 0.21 | 0.14 | 0.19 |
| Taxes | 0.12 | 0.08 | 0.10 | 0.08 | 0.09 |
| Good will | 0.10 | 0.08 | 0.08 | 0.05 | 0.08 |
| Other common | 0.08 | 0.04 | 0.12 | 0.08 | 0.08 |
| Total cost | $9.61 | $8.20 | $7.66 | $6.11 | $7.88 |

In most instances the differences in average costs derived by computing costs according to the

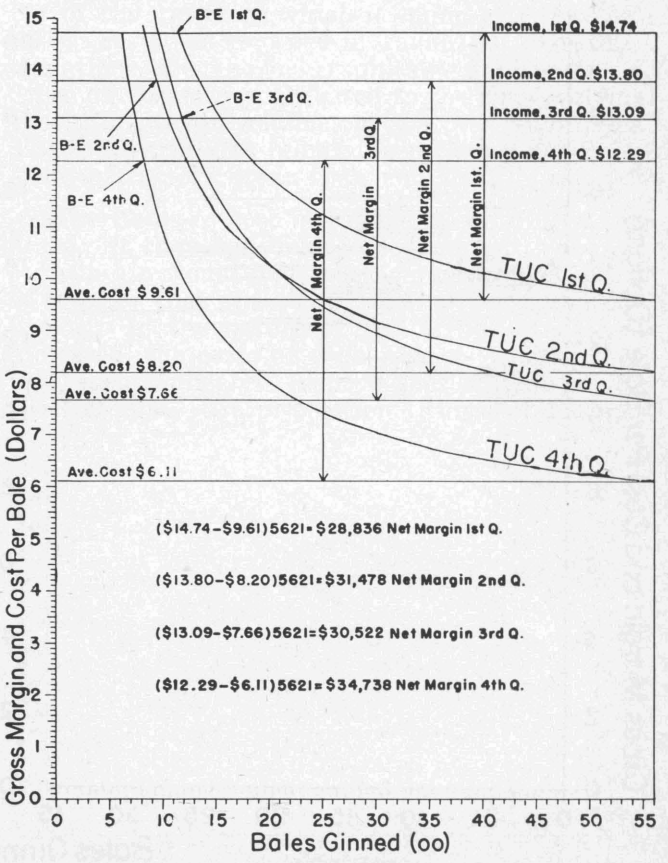


**Figure 12. Average incomes and costs of 130 cooperative gins grouped by cost quarters, 1949-50. To facilitate comparisons average volume was used.**

TABLE 15. NET MARGINS OF COST GROUPS AS RELATED TO ACTUAL AND STANDARD INCOMES AND ACTUAL AND STANDARD COSTS, 1949-50

| Cost quarter | Average bales ginned | Ratio actual to standard | | Margins | | |
|---|---|---|---|---|---|---|
| | | Income | Cost | Per bale | Total | |
| | | | | | Standard and other | Actual |
| 1st[1] | 5,635 | | | $ 5.13(1)[2] | | $28,908 |
| | | | | 5.42(2) | $30,542(5)[3] | |
| | | High | | 1.24(3) | 6,987(6) | |
| | | | High | —1.53(4) | — 8,621(7) | 28,908 |
| 2nd | 5,445 | | | 5.60(1) | | 30,492 |
| | | | | 5.53(2) | 30,111(5) | |
| | | High | | .30(3) | 1,633(6) | |
| | | | High | — .23(4) | — 1,252(7) | 30,492 |
| 3rd | 6,508 | | | 5.43(1) | | 35,338 |
| | | | | 5.56(2) | 36,184(5) | |
| | | Low | | — .41(3) | — 2,668(6) | |
| | | | Low | .28(4) | 1,822(7) | 35,338 |
| 4th | 4,923 | | | 6.18(1) | | 30,424 |
| | | | | 5.42(2) | 26,683(5) | |
| | | Low | | —1.21(3) | — 5,957(6) | |
| | | | Low | 1.97(4) | 9,698(7) | 30,424 |

[1] First quarter—highest cost in terms of standard cost; fourth quarter—lowest cost in terms of standard cost.

[2] (1) Actual income less actual cost, per bale.
(2) Standard income less standard cost, per bale.
(3) Actual income less standard income, per bale.
(4) Standard cost less actual cost, per bale.

[3] (5) Total net margin at standard income and standard cost.
(6) Net margin as related to actual and standard income: positive total, actual income greater than standard; negative total, actual income less than standard.
(7) Net margin as related to actual and standard cost: positive total, actual cost less than standard; negative total, actual cost greater than standard.

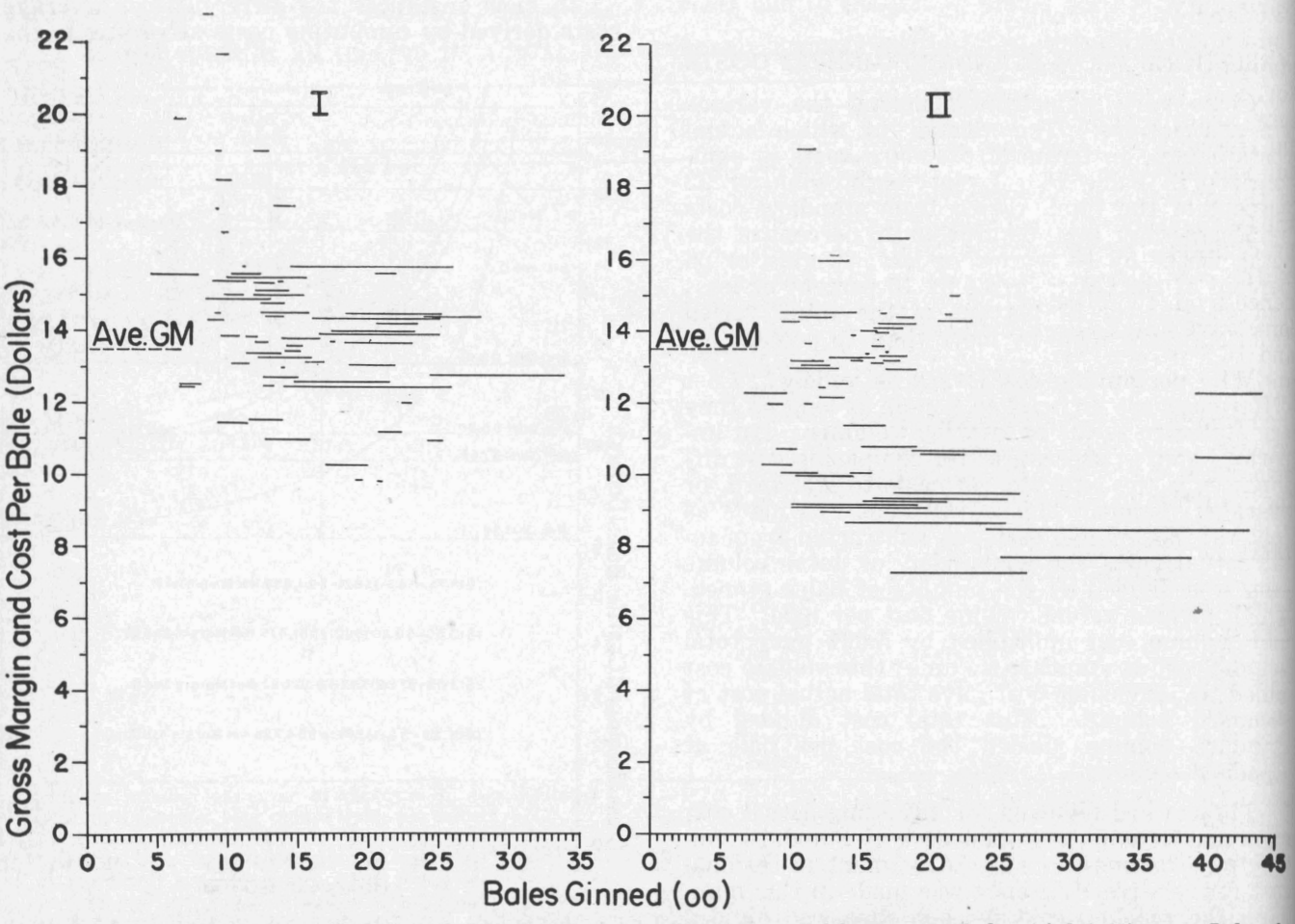


Figure 13. Break-even volumes; actual cost and standard cost at actual income per bale; (right) Diagram I, break-even volume at actual cost; (left) standard cost; gins with actual costs higher than standard; (left) Diagram II, break-even volume at actual cost; (right) standard cost; gins with actual costs lower than standard.

two methods at standard volume were too slight to have any significance. The 12 gins with relative costs of 79.9 percent or less and the 14 gins with relative costs of 125.0 percent or more were selected for special treatment. Of these 26 gins 21, or 81 percent, had differences of 12 cents or less per bale. The volume and investment of the other 5 gins are summarized in Table 17. Volumes ranged from 31 to 48 percent of the average volume of the 130 gins; investments in depreciable fixed assets ranged from 34 to 71 percent of average investments of the 130 gins. Low investment and low volume seemed to cause noticeable differences in costs computed by the two methods.

Cost differences per bale ranged from 29 cents to 65 cents for the 5 gins. Methodology and results of the two methods of computing costs for standard volume are shown in Table 18. For instance, actual costs for gin A may be restored thus: 2,180 bales (Table 17) times $9.57 (volume cost per bale) plus $4,752 (nonvolume cost); cost of standard volume with unadjusted residual costs is 5,621 bales times $9.57 plus $4,752; cost for standard volume with adjusted residual costs is 5,621 times $8.52 plus $7,042.

In the high cost gins relative costs were 61.6, 73.6 and 76.0 percent and in the low cost gins 140.4 and 154.3 percent. The relatives of costs at standard volume with residual costs adjusted for cost efficiencies and costs at standard volume unadjusted were 93.8. 96.1 and 96.8 percent for the high cost gins and 107.3 and 109.9 percent for the low cost gins. The relative significance of the differences between the costs according to the two methods of computation may be measured by dividing the percentage divergence from 100 of the cost differences by the percentage divergence from 100 of the relative costs. These divisions gave the following percentages: 12.1, 16.1 and 16.3 percent for the high cost gins and 13.4 and 24.5 percent for the low cost gins.

Permitting cost efficiencies to be reflected in volume costs alone is quite satisfactory. The disparities between costs at standard volume by the two methods of computation for the 5 gins lose significance with the realization that these low investment gins are a carryover from the 1930's.

TABLE 16. DISTRIBUTION OF GINS ACCORDING TO RELATIVE COSTS, 1949-50

| Relative costs (Percentages) | Number of gins | Percentages of total gins |
|---|---|---|
| 74.9 | 5 | 3.8 |
| 75.5- 79.9 | 7 | 5.4 |
| 80.0- 84.9 | 7 | 5.4 |
| 85.0- 89.9 | 13 | 10.0 |
| 90.0- 94.9 | 19 | 14.6 |
| 95.0- 99.9 | 14 | 10.8 |
| 100.0-104.9 | 14 | 10.8 |
| 105.0-109.9 | 13 | 10.0 |
| 110.0-114.9 | 9 | 6.9 |
| 115.0-119.9 | 7 | 5.4 |
| 120.0-124.9 | 8 | 6.2 |
| 125.0-129.9 | 5 | 3.8 |
| 130.0-134.9 | 2 | 1.5 |
| 135.0-139.9 | 2 | 1.5 |
| 140.0- | 5 | 3.8 |
| Total | 130 | 99.9 |

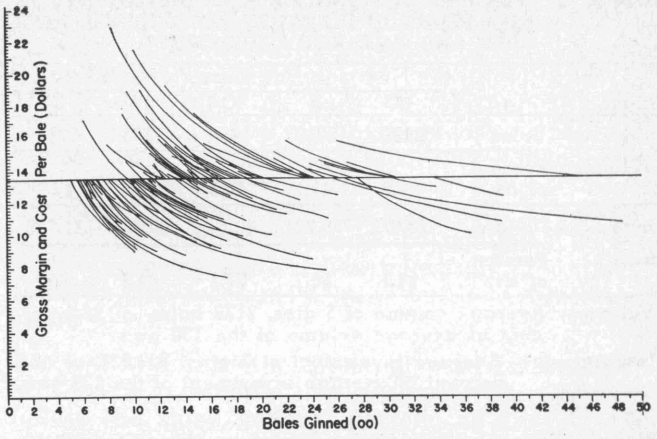


**Figure 14. Break-even volume, actual cost at actual and standard income per bale.**

## VARIATIONS IN ITEMS OF COST AT STANDARD VOLUME

Total costs as well as all items of cost were adjusted to standard, or average volume of 5,621 bales. All these totals were reduced to per bale costs and sorted from highest to lowest and listed; each cost was identified by the identity number of the gin from which it came. Highest and lowest costs are recorded in Table 19. These cost variations are shown graphically in Figure 16. Since all costs were adjusted to the same volume, the influence of volume on cost was eliminated. The cost variations remaining reflected the influences of factors other than volume.

The items of cost in Figure 16 were kept separate. If they had been joined the vertical from a given gin would have passed through the items of cost for that gin. This was not the actual situation. In the listing of the arrays of cost as indicated, the costs of each item as well as total unit costs appeared from highest to lowest for the 130 gins. Gin in position 1, highest cost, po-

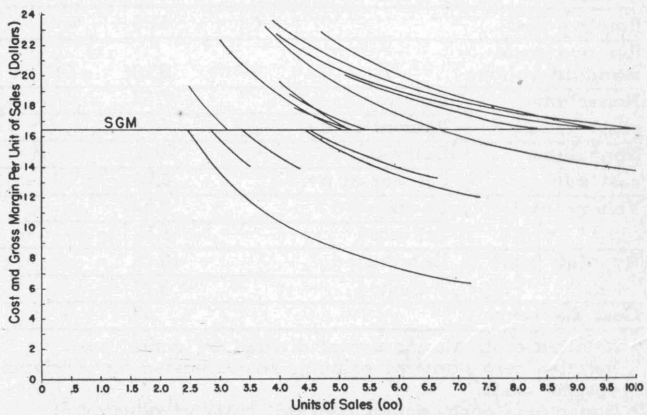


**Figure 15. Break-even volume of supply associations, actual cost at actual and standard income per unit (sales of $130).**

TABLE 17. VOLUME OF GINNING AND INVESTMENT IN GIN PLANT IN RELATION TO AVERAGE VOLUME AND AVERAGE INVESTMENT

| Items | | Gins A | B | C | D | E |
|---|---|---|---|---|---|---|
| Volume[1] | Bales | 2180 | 2313 | 1938 | 1755 | 2711 |
| | Percent of av. | 38.8 | 41.1 | 34.5 | 31.2 | 48.2 |
| Investment[2] | Dollars | 23,072 | 39,741 | 48,132 | 30,385 | 21,775 |
| | Percent of av. | 34.1 | 58.7 | 71.1 | 44.9 | 32.2 |

Volume[1] Average volume of 5 gins, 2179 bales, or 38.8 percent of average volume of the 130 gins.

Investments[2] Average investment of 5 gins, $32,621, or 48.2 percent of average investment of the 130 gins.

sitions 65 and 66, standard cost, and position 130, lowest cost of total unit costs were selected and the positions of each traced through the various items of cost as pictured in Figure 17.

Gin 1 with highest total unit cost did not register highest in a single item. Its best showing was in miscellaneous cost with position 99; its worst experience was with insurance forging ahead to position 4. Gins 65 and 66 operated at standard total unit cost; they were far from standard in any of the items. They were standard in the total because the item costs "averaged" standard. Each gin had 6 items with position below midpoint and hence in the high cost area and 3 items with positions above midpoint and hence in the low cost area. Gin 65 with position 112 in labor, an advance of 47 positions beyond that of its total unit cost position, made a remarkable showing considering the relative importance of labor cost. This performance in labor was largely cancelled by poor cost experiences in other items, particularly power and insurance. Gin 66 also made a good showing in labor, finding itself in place 80, an advance of 14 positions and made a better record than gin 65 in costs of management, insurance, trucking and miscellaneous. Gin 66, however, showed a severe setback in power cost, receding to position 2, a loss of 64 positions. Gin 130 with lowest total unit cost did not attain lowest cost in any of the items. This gin had its best cost experiences with labor, repairs, insurance, trucking and common costs. The greatest slump in position was in miscellaneous cost retreating to place 30; but more significant was the setback in power cost to place 42 since power represents a much higher percentage of total costs than miscellaneous.

## COST FACTORS OTHER THAN VOLUME

Figures 16 and 17 blueprint problems in cost analysis and in managerial control of inputs which are completely overlooked or neglected in approaches from the standpoint of volume as the only variable of significance. In the field schedules taken for 1949-50 from the cooperative gins, special attention was given to the composition of the typical gin crew. The number of men in the crew divided into the total labor cost reduced this item to man-days. The man-days multiplied by 12 gave total man-hours of labor. Total man-hours divided into total costs gave the average wage rate per hour. Hour costs and wage rates were computed for the four cost quarters (Figure 12). These quarterly average costs, extended to positions 1 and 130, gave these dollar costs: $3.49 as highest cost per bale and $1.92 as lowest cost per bale. Differences in hours of labor and in wage rates per hour accounted for the range of labor cost shown in Figure 16.

The range in hour costs was from 4.4 hours to 2.2 hours. These wide differences indicate a very real problem in labor cost. An approach to a solution would involve an intensive study of gins representing these hour-cost differences from highest to lowest. Such factors as organization of the gin crew, the plant layout, the services performed and local situations and peculiarities are significant.

TABLE 18. RELATIONS OF COSTS AT STANDARD VOLUME WITH EFFICIENCIES AND INEFFICIENCIES REFLECTED IN VOLUME COSTS AND IN RESIDUAL COSTS

| Items | | Gins A | B | C | D | E |
|---|---|---|---|---|---|---|
| Relative cost[1] | | 61.6 | 73.6 | 76.0 | 140.4 | 154.3 |
| Relative costs standard volume[2] | | 93.8 | 96.8 | 96.1 | 109.9 | 107.3 |
| Nonvolume cost[3] | Dollars | 4752 | 9162 | 7391 | 5851 | 6432 |
| | Percent of av. | 44.3 | 85.3 | 48.2 | 54.5 | 59.9 |
| Nonvolume cost adj[4] | Dollars | 7042 | 10573 | 8633 | 4719 | 4918 |
| | Percent of av. | 65.6 | 98.5 | 80.4 | 44.0 | 45.8 |
| Volume cost[5] | Unadjusted | 9.57 | 9.70 | 9.23 | 3.39 | 2.83 |
| | Adjusted | 8.52 | 9.09 | 8.59 | 4.03 | 3.39 |
| Average cost[6] | Unadjusted | 10.42 | 11.33 | 10.54 | 4.43 | 3.97 |
| | Adjusted | 9.77 | 10.97 | 10.13 | 4.87 | 4.26 |
| Cost difference | | .65 | .36 | .41 | .44 | .29 |

[1] Relative cost: standard cost divided by actual cost.
[2] Relative cost standard volume: cost adjusted for efficiencies in residual costs divided by costs with efficiencies reflected in volume costs.
[3] Nonvolume cost: actual constant costs unadjusted.
[4] Nonvolume cost adjusted: constant cost with residual component adjusted to efficiencies.
[5] Volume cost: unadjusted efficiencies reflected in volume costs; adjusted with efficiencies reflected in residual costs.
[6] Average cost: unadjusted efficiencies reflected in volume costs; adjusted with efficiencies reflected in residual costs.

TABLE 19. COST BEHAVIOR AT AVERAGE VOLUME OF 5,621 BALES, 130 COOPERATIVE GIN ASSOCIATIONS, 1949-50

| Cost items | Cost per bale | | | Ratio high cost to low cost |
|---|---|---|---|---|
| | High | Low | High cost less low cost | |
| Labor | $3.51 | $1.85 | $1.66 | 1.9 |
| Trucking | 1.52 | .10 | 1.42 | 15.2 |
| Power | .98 | .24 | .74 | 4.1 |
| Repairs | 1.25 | .61 | .64 | 2.0 |
| Management | .74 | .44 | .30 | 1.7 |
| Insurance | .64 | .40 | .24 | 1.6 |
| Miscellaneous | .29 | .07 | .22 | 4.1 |
| Office salaries | .46 | .32 | .14 | 1.4 |
| Common costs | 2.17 | .19 | 1.98 | 11.4 |

Trucking costs varied from $1.52 a bale to 10 cents a bale. This wide difference can be explained in part by the inclusion of freight and express charges in trucking costs. In the lower range of costs no trucking was involved. From the standpoint of cost analysis it would be preferable not to mingle freight and express charges with trucking costs. An adequate analysis of trucking costs calls for further details than mere bales ginned. How many bales and how many tons of cotton seed were trucked, or what percentages of the totals? How many times were these products handled in the trucking service? How far was the lint and the cotton seed transported? With such information, many of the differences in trucking costs could be accounted for.

Power costs ranged from 98 cents a bale to 24 cents. The gins were not segregated by type of power in the process of cost analysis. With a considerably larger sample than 130 cost records and with the main focus on the results rather than the methodology of cost analysis, consideration should no doubt be given to type of power. This would account for some of the differences in power costs. Information on quantities of fuel used with separate analysis by type of power, or without, would help to explain cost differences.

A minimum breakdown to afford a better understanding of the repair item is a classification under repair labor and repair parts. Some gins make this distinction. The identity of the more important repair parts would help to distinguish between repair parts and replacements. Type of power plays a part in repair costs. Repair costs of the electric power unit are of minor importance; repair costs of the steam power unit are a significant factor, especially if burrs are used as fuel.

If the influence of investment were taken out of cost of management some of the cost differences would be eliminated. If insurance on buildings, machinery and equipment were separated from workmen's compensation and social security, insurance would most likely become a common cost. Office salaries exhibited the least cost variation of all the items of cost.

Variations in common costs were the second highest of all the items. Depreciation was the most significant single cost in this group. Differences in investments and rates of depreciation were factors in common cost variations. As the low investment gins pass out, either through abandonment of the ginning business or through replacements of completely modernized machinery at current price levels, the lower common costs will end. It would be most hazardous to predict that all gin plants will ever be equipped to the same degree or have a like investment. Innovations in gin machinery may continue for many years to come.

Cost inputs of the 20 supply associations and of the 25 gin-supply associations were found to follow the same general pattern as that of the one-function gins.

## ASSUMPTIONS OF HOMOGENEOUS COST INPUTS QUESTIONED

Differences in ginning costs resulting from influences of other factors than volume as revealed in Table 19 and Figures 16 and 17 suggest doubts as to one of the fundamental assumptions in cost theory—that of homogeneous cost inputs. An implication in this asumption which theorists have either overlooked or purposely suppressed is the nature of the managerial input. Much significance is attached to the exercise of proportioning the input factors. How can the disturbances of this activity finally end in homogeneous composite input factors except through "managerial mixing?"

The collapse of the homogeneous costs input assumption undermines the assumption that volume is the only variable factor.

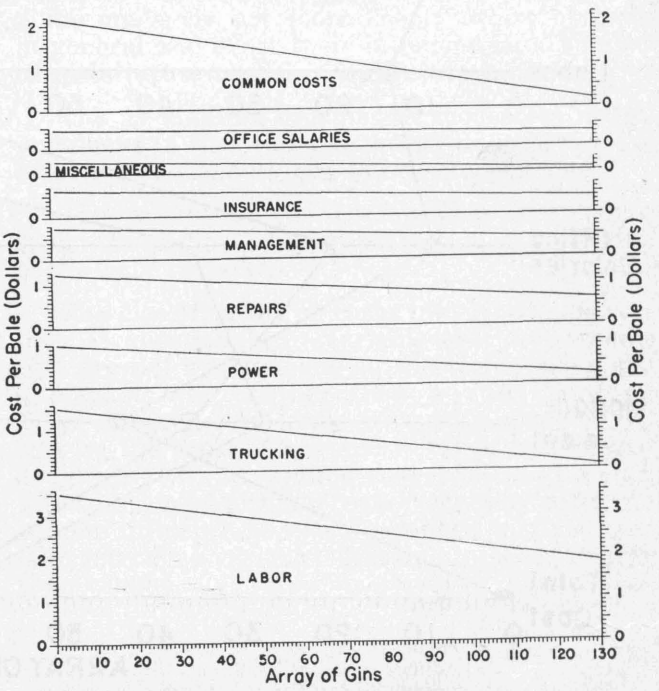


**Figure 16. Cost differences in ginning cost items resulting from factors other than volume.**

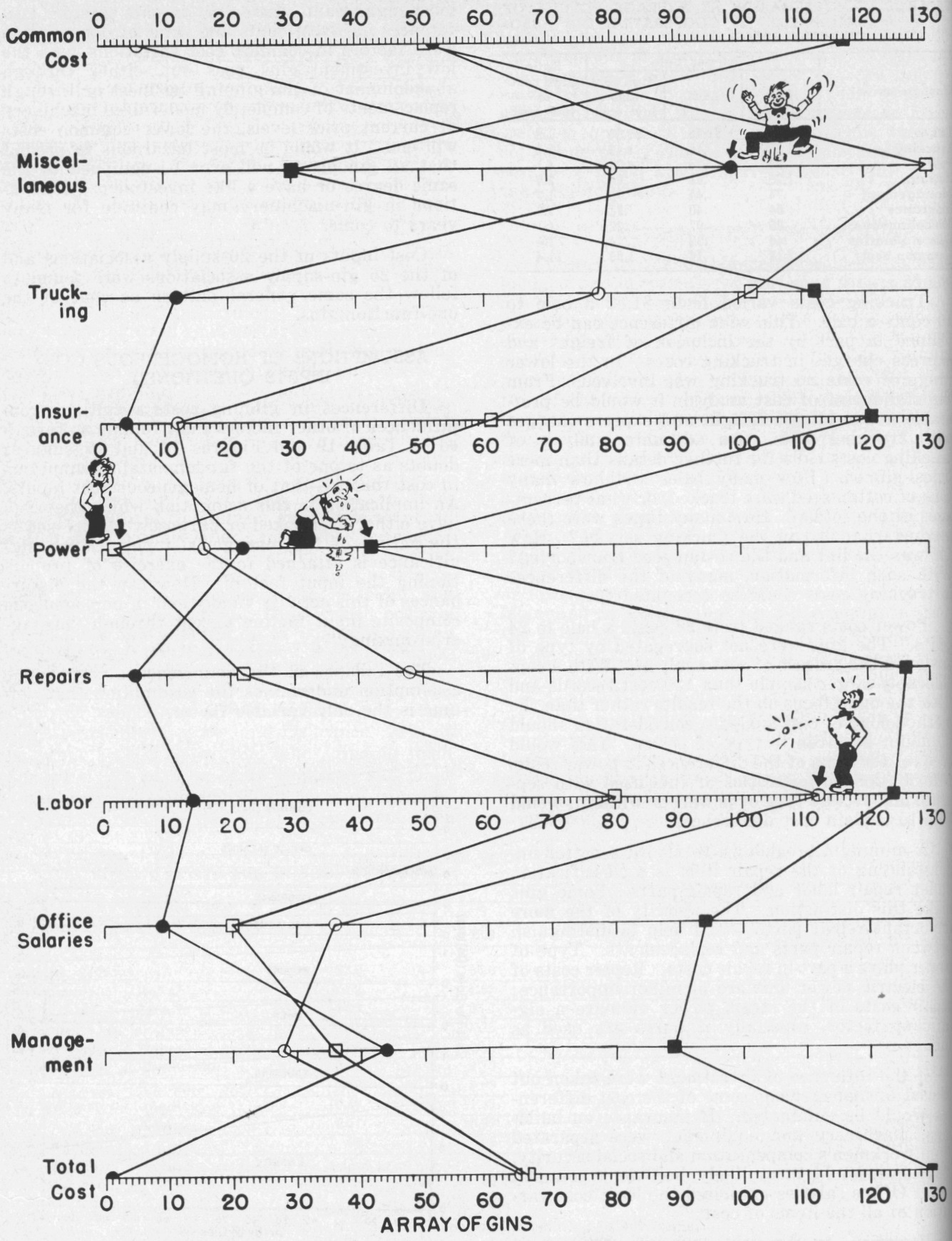


Figure 17. All average costs at average volume of 5,621 bales. Costs as positions from highest to lowest. Gins with average costs in positions 1, 65, 66 and 130 traced as to their positions in each of the item costs influenced by volume and in common costs.

## CONCLUSIONS

Break-even volume is a concept of long standing with the Texas ginning industry. Break-even volume has been a factor in fitting ginning capacity to volume of cotton production. As ginning costs have increased, ginning incomes have increased; this complementary movement of cost and income has stabilized break-even volume.

Over the years the volume of ginning of the cooperative gins has averaged slightly more than twice that of the other type of gins. The resources expended in performing ginning service have been utilized to better advantage than has been the case with the other type of gins.

Freedom of entry into the ginning business coupled with optimism as to profit possibilities in ginning and the ease of financing the business have been factors in pushing ginning capacity to break-even volume on an average.

The prewar break-even volume of 900 bales advanced to 1,530 bales in 1949-50. This shift has been occasioned by a 300 percent increase in costs and a 220 percent increase in income. Provided income remains at about the level of 1949-50, break-even volume will advance to more than 1,800 bales as the low investment gins either pass out of business or make replacements at current high prices.

Cost analysis may be implemented in terms of total or total unit costs or in terms of items of costs either total or unit. The advantages of the item approach are many. The behavior of items of cost is of consequence. Such behavior is largely hidden or averaged away in totals. Possibilities of controlling or influencing items of cost vary considerably. Cost analysis is usable to management only as effected in terms of items of cost.

For purposes of investigations of cost behavior it is advantageous to separate items of costs into those influenced by volume and those not influenced by volume. Estimating cost equations reflecting the volume influence can be derived for the former group of items; the latter group is carried over intact from actual to estimated costs; for that reason these costs are called "common" in this discussion.

The advantage of handling the items uninfluenced by volume as common costs is that the effects of wide variations in investments and depreciation rates, irregularities in appraisals for tax purposes and in tax rates and the like are reduced to a minimum.

The break-even approach offers means of comparing net margins or losses resulting from actual income and cost situations as against what they would have been if income and costs had been standard or average for the industry.

Much would be gained in economic theory in substituting the break-even concept for the visionary least cost concept with its attendant marginal curves. Break-even is real; it emphasizes the survival volume of business; a continued volume less than break-even means certain failure; a continued volume greater than break-even means assured business success. Break-even demonstrations can be made entirely with actual cost and income data. Tailored data so characteristic of least cost analysis which assumes at the beginning what it proposes to demonstrate are unnecessary in break-even analysis.

A reduction of ginning costs, totals and items, to standard or average volume eliminates volume as a variable. With volume eliminated total and items of cost exhibited wide variations. Gin labor, for instance, varied from a high of $3.51 a bale to a low of $1.85. These differences can be accounted for in full by the introduction of hours of labor per bale and wage rates per hour.

A search for answers for cost variations due to factors other than volume calls attention to a somewhat neglected phase of cost analysis. Contributions of cost analysis to increasing managerial efficiency with respect to costs flow in large part from this second aspect of costs.

Variations in costs are in part traceable to management. Some managers are particularly successful in handling labor, others in attaining high efficiency with respect to powers and others in maintaining the plant at a high state of productivity through proper attention to repairs. Some managers are more keenly aware of costs in general and exert their influence on a number of costs rather than on single costs, or a few.

The assumption of homogeneous costs inputs is dubious in that the managerial imput is by the same token also assumed to be homogeneous.

The failure of the homogeneous cost input spells the failure of the assumption that volume is the only variable.

The classification of costs into fixed and variable is questionable. Variable cost and volume cost are not synonymous as the term variable is a blanket word rather than a specific word. There are numerous kinds of variable costs. Fixed cost on the basis of selected items of cost cannot avoid elements of volume cost with most items. The addition of residual costs remaining after the volume influence has been removed to fixed cost is to introduce variable costs due to other factors than volume.

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The cartoons in Figure 17 are a contribution of Robert H. Cullen of the Texas A&M Press.

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