TEXAS BUSINESS REVIEW

Vol. XVIII, No. 12 January, 1945

A MONTHLY SUMMARY OF BUSINESS AND ECONOMIC CONDITIONS IN TEXAS

Published by the Bureau of Business Research, The University of Texas
Austin 12, Texas

ESTIMATED TEXAS RETAIL SALES 1944 BY LEADING COUNTIES · AND · CROP REPORTING DISTRICTS

LEGEND:

= ABOVE $100,000,000 = 25 TO $50,000,000

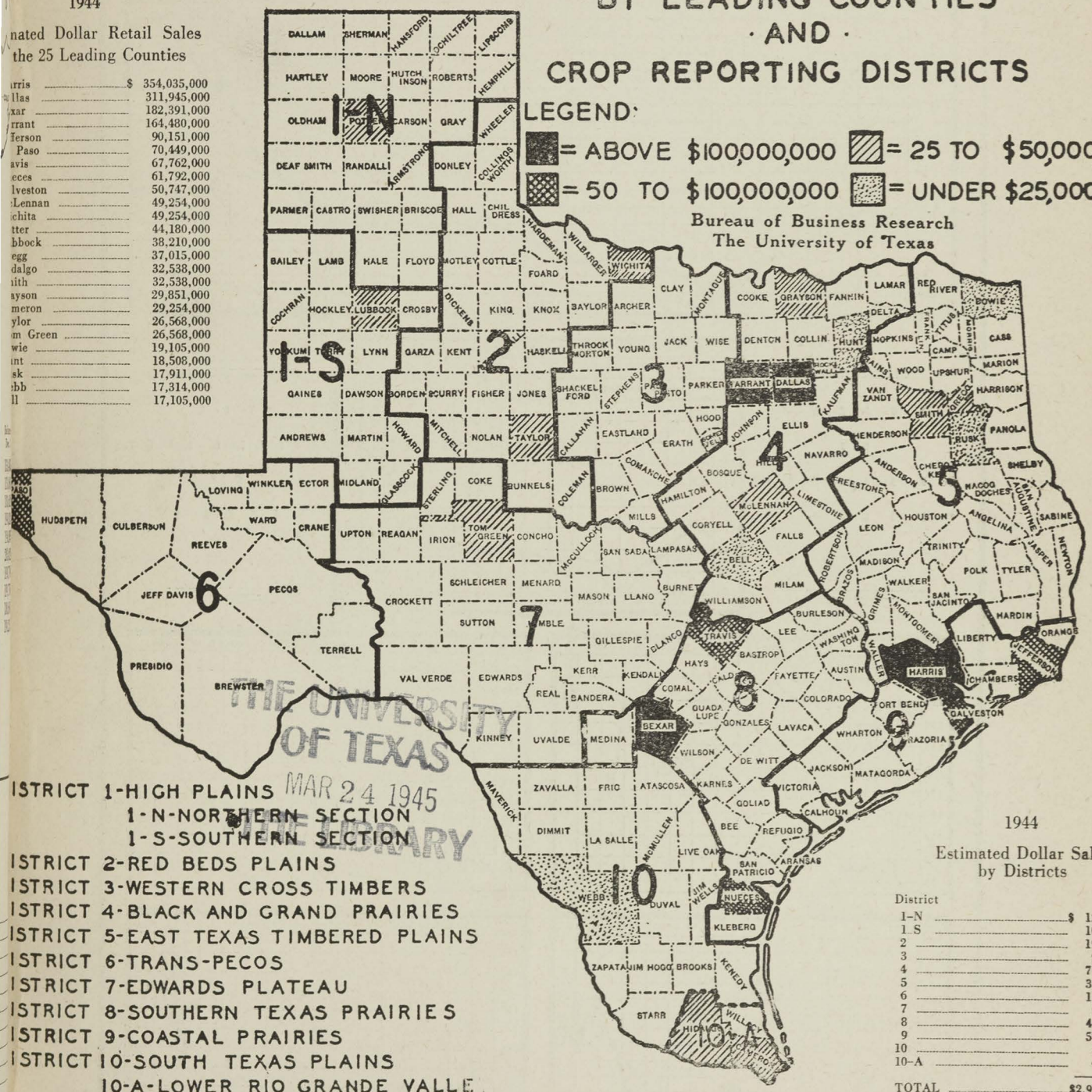
= 50 TO $100,000,000 = UNDER $25,000,000

Bureau of Business Research
The University of Texas

1944

nated Dollar Retail Sales
the 25 Leading Counties

rris	$ 354,035,000
llas	311,945,000
xar	182,391,000
rrant	164,480,000
Jerson	90,151,000
Paso	70,449,000
avis	67,762,000
eces	61,792,000
lveston	50,747,000
Lennan	49,254,000
chita	49,254,000
tter	44,180,000
bbock	38,210,000
egg	37,015,000
dalgo	32,538,000
ith	32,538,000
ayson	29,851,000
meron	29,254,000
ylor	26,568,000
m Green	26,568,000
wie	19,105,000
int	18,508,000
sk	17,911,000
bb	17,314,000
ll	17,105,000



ISTRICT 1-HIGH PLAINS
1-N-NORTHERN SECTION
1-S-SOUTHERN SECTION
ISTRICT 2-RED BEDS PLAINS
ISTRICT 3-WESTERN CROSS TIMBERS
ISTRICT 4-BLACK AND GRAND PRAIRIES
ISTRICT 5-EAST TEXAS TIMBERED PLAINS
ISTRICT 6-TRANS-PECOS
ISTRICT 7-EDWARDS PLATEAU
ISTRICT 8-SOUTHERN TEXAS PRAIRIES
ISTRICT 9-COASTAL PRAIRIES
ISTRICT 10-SOUTH TEXAS PLAINS
10-A-LOWER RIO GRANDE VALLE

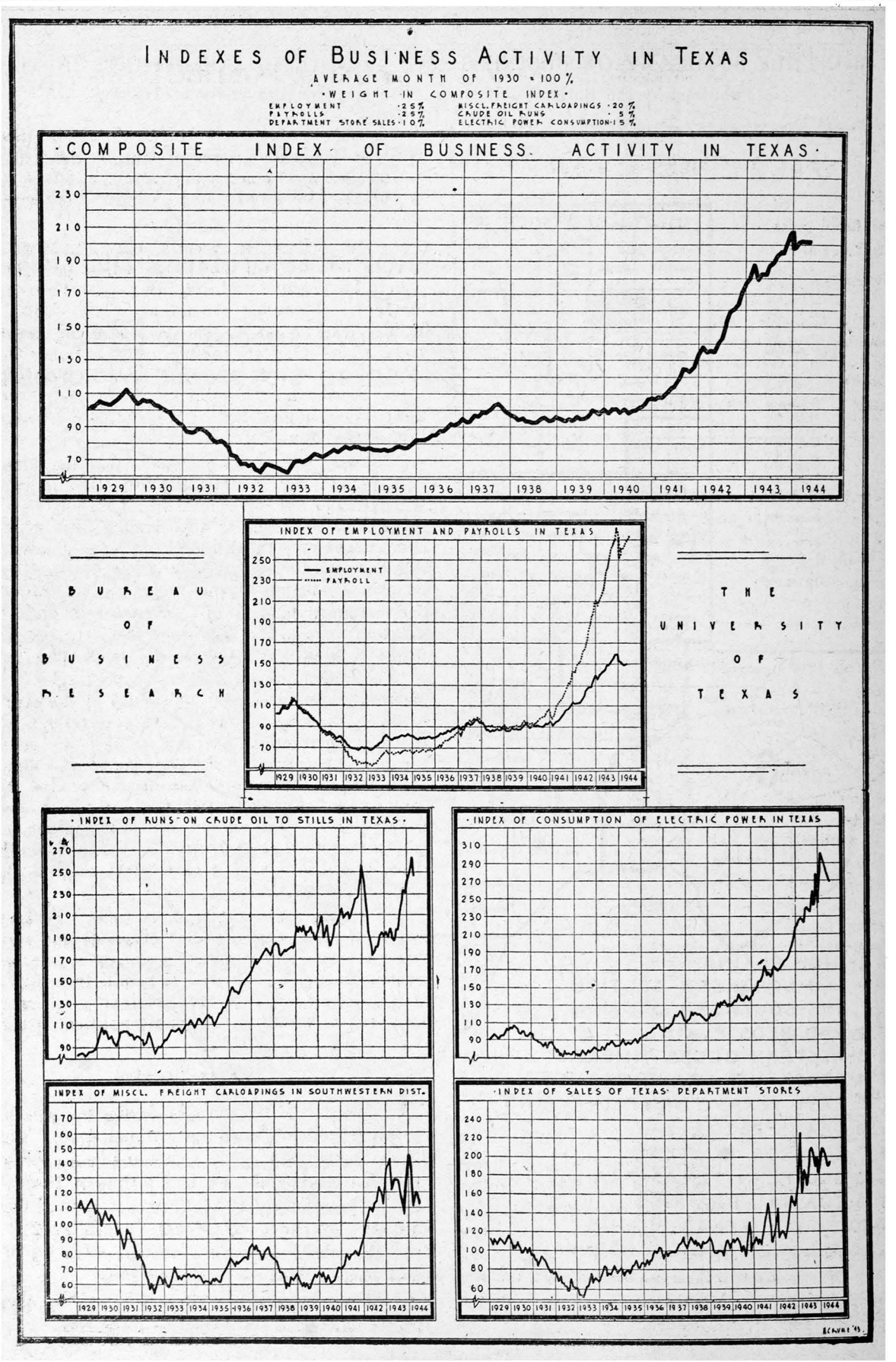
1944

Estimated Dollar Sales by Districts

District	
1-N	$ 125,078,000
1-S	109,705,000
2	193,766,000
3	94,332,000
4	770,759,000
5	331,658,000
6	119,763,000
7	98,216,000
8	447,468,000
9	580,306,000
10	58,212,000
10-A	65,673,000
TOTAL	$2,994,928,000

Entered as second class matter on May 7, 1928, at the post office at Austin, Texas, under Act of August 24, 1912

TEN CENTS PER COPY ONE DOLLAR PER YEAR


INDEXES OF BUSINESS ACTIVITY IN TEXAS
AVERAGE MONTH OF 1930 = 100%
·WEIGHT IN COMPOSITE INDEX·
EMPLOYMENT ·25%
PAYROLLS ·25%
DEPARTMENT STORE SALES ·10%
MISCL. FREIGHT CARLOADINGS ·20%
CRUDE OIL RUNS ·5%
ELECTRIC POWER CONSUMPTION ·15%
·COMPOSITE INDEX OF BUSINESS ACTIVITY IN TEXAS·
INDEX OF EMPLOYMENT AND PAYROLLS IN TEXAS
EMPLOYMENT
PAYROLL
BUREAU OF BUSINESS RESEARCH
THE UNIVERSITY OF TEXAS
·INDEX OF RUNS ON CRUDE OIL TO STILLS IN TEXAS·
·INDEX OF CONSUMPTION OF ELECTRIC POWER IN TEXAS
INDEX OF MISCL. FREIGHT CARLOADINGS IN SOUTHWESTERN DIST.
·INDEX OF SALES OF TEXAS DEPARTMENT STORES

Business Review and Prospect

TEXAS BUSINESS REVIEW

Published Monthly by the

BUREAU OF BUSINESS RESEARCH

The University of Texas, Austin 12, Texas

Staff of the Bureau of Business Research

A. B. Cox, Director

F. A. Buechel, Statistician
Income and Consumption—Editor

E. H. Johnson, Natural Resources
and Industrial Geography

Clara H. Lewis
Editorial Assistant

Norma K. Engle
Secretary

School of Business Administration Staff Co-operating

War activity promises to dominate the national economy during 1945 to a greater degree than appeared probable a few months ago. Hence earlier estimates of national income, employment, wage and price levels during 1945 may have to be revised upwards. For the months immediately ahead, less public attention is likely to be directed to problems of reconversion from war to peace economy than was true during early fall, although actually more incisive thought and effort is to be expected along this line than ever before, but it will be carried on in a manner which will be less conspicuous and which will in nowise interfere with the war effort.

The national income of $159 billion during 1944 represents an increase of nearly 8 per cent over the $147.9 billion of the preceding year, and a further slight increase during the current year is probable. Income payments to individuals in 1943 amounted to $143 billion compared with $155 in 1944 and this figure might reach $160 billion in 1945 if the war in Europe were to continue through most of the year. The expected over-all decline in the number of wage earners during 1945 will be the result largely of the return to the home, to school or retirement of marginal workers such as women, children and over-aged men and the drop in pay rolls resulting from this factor will be largely offset by higher levels in basic wage rates which may be expected to spread from industry to industry in one form or another during 1945. If the pattern of wage rates during the present war parallels that which prevailed during World War I, basic wage rates will not only rise while the war is in progress but will continue to rise for a period of years after the close of the war. Sooner or later the level of total pay rolls of industrial workers will of course drop, at least temporarily, as a result of elimination of over-time wages and because of unemployment during reconversion in the huge mass production industries which are now engaged exclusively in war work. The duration of the recession will depend upon the economic statesmanship of industry, government and labor. If the leadership in each of these groups is competent and if it is conscientiously directed in the public interest, the post-war economic recession during the reconversion period need not exceed a few months and will inevitably be followed by an extended period of intense economic activity.

As one analyst has recently stated, "Jobs do not just happen, nor are *real* jobs brought into being by federal deficit financing. Self-sustaining jobs flow from successful combinations of enterprise and capital. They involve taking risks by management which assume those risks in the hope of making profits. Hence it follows that the number of available jobs always largely depends on whether the political climate that is created by the national administration is hospitable or inhospitable toward business enterprise.

"We are being told nowadays that the plan of the administration for maintaining full employment is to do it by stimulating exports on a grand scale. . . . This is to be done by granting huge credits to foreign nations so that they may be enabled to buy our goods. We did that with public funds after the last war and it resulted in a short inflation prosperity promptly followed by the deep depression of 1921. We tried it again through private credits in the 1920's and that experiment left our investors holding large totals of foreign defaulted bonds.

"These experiments ought to have taught us that we cannot generate a durable prosperity by the easy method of giving away our goods to peoples in foreign lands and then paying for them by taxing ourselves. Neither can we do it by *spreading the work* at home. One of our great labor organizations has just adopted a resolution asking the Congress to establish a six-hour day and a five-day work week so as to spread employment. The assumption is that there is just so much work to be done, and that it should be thinly spread so that each worker may get some of it.

"Of course the assumption is false. Prosperity depends on increasing the total of goods and services so that each one of us may have a greater amount when the total is divided among us. It is still true that self-sustaining jobs flow from the combination of capital and enterprise operating in a friendly political atmosphere."

Texas Business

Economic activity in Texas during the past year has corresponded closely to the national trend. Income in Texas during 1944 was in round numbers approximately $6 billion, compared with $5.5 billion in 1943. Of this total, approximately $1.3 billion was derived from agricultural marketings, plus federal subsidies, $1.1 billion from the sale of minerals at the mines, and $0.9 billion from value added by manufacturing. The remaining $2.7 billion represent wages, fees and salaries from sources other than the foregoing categories.

Income in Texas during the past year was more than double that of the prosperity year of 1929. Moreover, the Texas share of the national income during the past year was nearly 4 per cent as compared with approximately 3 per cent in 1929. In view of the tremendous potentialities for further development of industries already in Texas and the possibilities for establishment of new industries in this State, it is safe to predict that the State's proportion of the national income will continue to increase for an indefinite period. For this reason, assuming reasonable aggressiveness in Texas business men, the expected post-war decline in the national income will not be experienced to an equal extent in this State.

It is obvious that an analysis of income in a State as large and as diversified as Texas attains added significance for business men, government agencies and the public generally if the income is computed for local subdivisions and by sources of income. Accordingly, incomes have been estimated by counties for the same four major sources as for the State as a whole, viz—agriculture, minerals, value added by manufacturing and pay rolls. It is not feasible, however, within the space available for the present article to do more than to point out a few of the more salient facts concerning income and related matters for the State as a whole and for certain larger subdivisions thereof.

Agriculture

Cash income from agriculture in Texas during 1944 was about 5 per cent greater than for the preceding year. The gain was the result almost entirely of the vastly greater production and moderately higher prices of wheat in the northern section of the Texas High Plains; and the moderate increase in production and sharp increase in price of fruits and vegetables in the citrus area of the Lower Rio Grande Valley; as well as, in the case of vegetables, of the several intensive vegetable growing areas of the State. During the early months of 1944, income from livestock and livestock products was below that of the preceding year—a result of smaller marketings and a lower level of prices. In recent months, however, both marketings and prices have been pointing moderately upward. This tendency is expected to continue into the new year.

Income from cotton and cottonseed was below that of 1943, a result of the decline in production which was not fully offset by the rise in price level of both lint and seed. Most of the decline occurred in Central and East Texas. Cash income from cotton and cottonseed in 1944 amounted to only about one fourth of the agricultural cash income of the State and since agriculture accounts for but one fifth of the State's total income, the income from cotton and cottonseed amounts to approximately one twentieth of the State's income. By way of contrast, as recently as the late twenties the income from cotton and cottonseed represented nearly one fifth of the total income of the State. Whatever the future may hold as to the actual contribution of cotton to the economy of Texas, its relative position from the standpoint of income appears destined still further to decline.

INDEXES OF AGRICULTURAL CASH INCOME IN TEXAS

(Average Month 1928–'32 equals 100)

Districts	Dec., 1944	Nov., 1944	Dec., 1943	Cumulative Cash Income (In Thousands of Dollars) Year 1944	Year 1943
1–N	203.4	231.4	139.0	130,298	108,537
1–S	363.9	330.3	150.2	118,115	107,228
2	205.7	207.3	117.4	123,149	108,958
3	310.2	284.7	264.3	58,765	51,890
4	258.9	227.0	231.4	187,438	188,361
5	338.0	191.7	313.4	64,219	86,274
6	361.7	229.0	130.7	42,911	48,566
7	184.0	217.8	146.3	72,024	71,175
8	219.6	207.4	206.4	109,362	110,126
9	401.1	514.2	373.5	88,174	90,226
10	515.6	365.2	390.5	30,100	33,219
10-A	587.9	935.6	635.4	118,870	82,657
STATE	296.7	264.0	224.3	1,143,425	1,087,217

The change of index in District 10–A, Nov., 1944 is due to revision of truck shipments of citrus fruits.

NOTE: Farm cash income as computed by the Bureau understates actual farm cash income by from six to ten per cent. This situation results from the fact that means of securing complete local marketings, especially by truck, have not yet been fully developed. In addition, means have not yet been developed for computing cash income from all agricultural specialties of local importance in scattered areas throughout the State. This situation, however, does not impair the accuracy of the *indexes* to any appreciable extent.

With farm prices pointing definitely upward and prospects for crops and livestock favorable for this season of year, it is expected that farm cash income will be fully maintained at present levels or above, barring developments which cannot be foreseen.

The significance of agriculture to the economy of the State is by no means fully measured by figures on cash income. To this monetary factor must be added the contributions made by the farm homestead to the family in the form of food and shelter; and, even more significantly, the raw materials which agriculture furnishes to a wide variety of Texas industries for processing, thus creating urban industrial pay rolls and numerous trade and service activities. Moreover, agriculture premeates every section of the State and its influence is not limited to a few areas of high concentration.

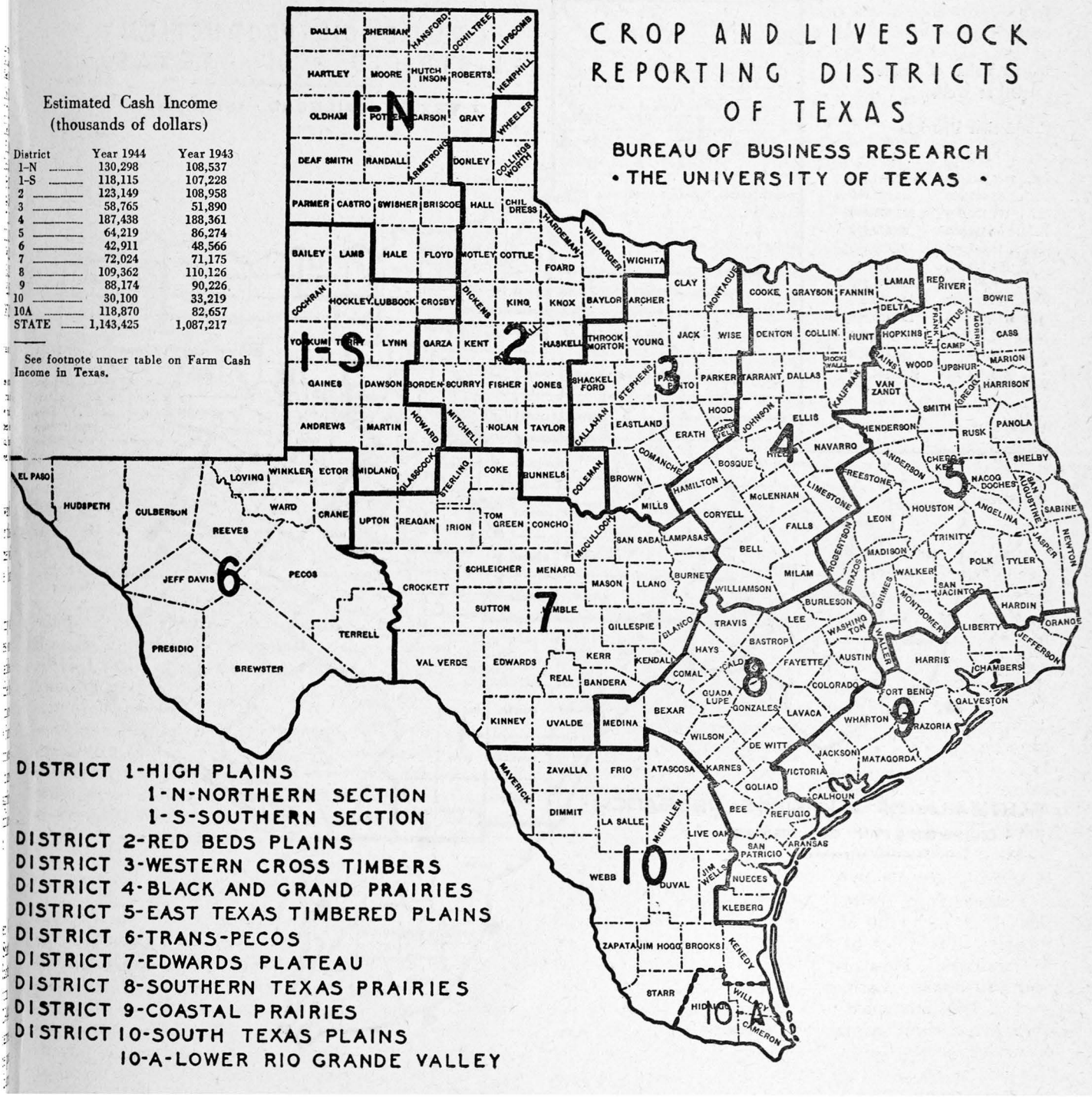
Mineral Production

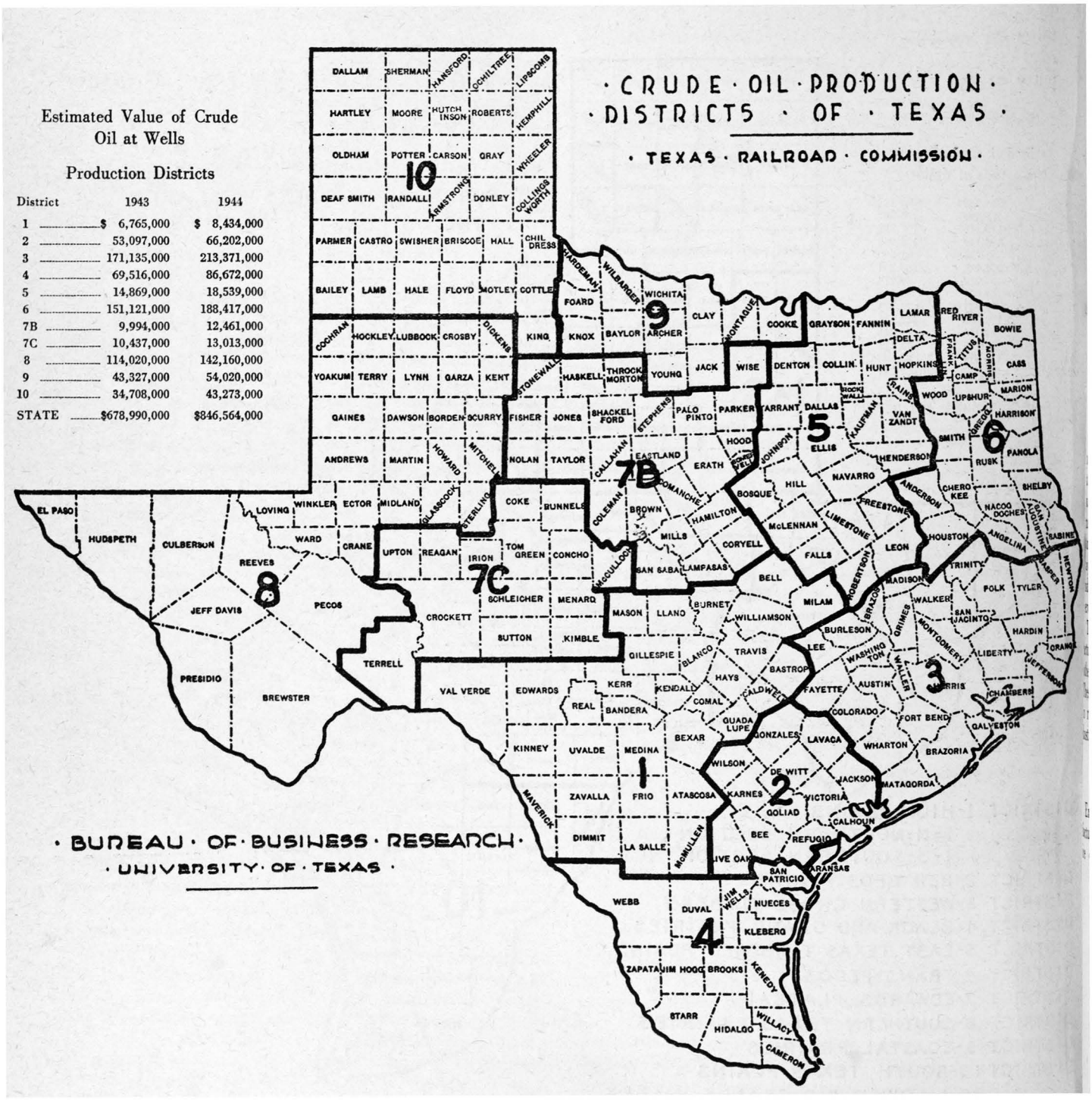
Oil and gas normally represent a little over 80 per cent of the value of minerals produced in the State. At present, because of the abnormally high production of oil, the proportion of the total increase from these sources is probably nearer 85 per cent. For 1944 production of oil is estimated at 740 million barrels or approximately 25 per cent more than during the preceding year. At an average of nearly $1.15 per barrel at the wells this volume would amount to $847 million. The value of natural gas at the wells during 1944 was such as to bring the combined value of oil and gas at the wells to approximately $925 million. All indications point to the maintenance of the current high level of

Estimated Cash Income
(thousands of dollars)

District	Year 1944	Year 1943
1-N	130,298	108,537
1-S	118,115	107,228
2	123,149	108,958
3	58,765	51,890
4	187,438	188,361
5	64,219	86,274
6	42,911	48,566
7	72,024	71,175
8	109,362	110,126
9	88,174	90,226
10	30,100	33,219
10A	118,870	82,657
STATE	1,143,425	1,087,217

See footnote under table on Farm Cash Income in Texas.




Estimated Value of Crude Oil at Wells
Production Districts
District 1943 1944
1 $ 6,765,000 $ 8,434,000
2 53,097,000 66,202,000
3 171,135,000 213,371,000
4 69,516,000 86,672,000
5 14,869,000 18,539,000
6 151,121,000 188,417,000
7B 9,994,000 12,461,000
7C 10,437,000 13,013,000
8 114,020,000 142,160,000
9 43,327,000 54,020,000
10 34,708,000 43,273,000
STATE $678,990,000 $846,564,000
· CRUDE · OIL · PRODUCTION ·
· DISTRICTS · OF · TEXAS ·
· TEXAS · RAILROAD · COMMISSION ·
· BUREAU · OF · BUSINESS · RESEARCH ·
· UNIVERSITY · OF · TEXAS ·

production during 1945 and any changes in prices for either oil or gas are likely to be upward rather than the reverse. Thus during the present year the value of Texas minerals promises to reach an all-time peak. The following table gives the estimated value of oil by railroad commission districts for 1943 and 1944 as computed by this Bureau.

ESTIMATED VALUE OF OIL—1943 AND 1944 CRUDE OIL PRODUCTION DISTRICTS

(Texas Railroad Commission)

District	1943	1944
1	$ 6,765,000	$ 8,434,000
2	53,097,000	66,202,000
3	171,135,000	213,371,000
4	69,516,000	86,672,000
5	14,869,000	18,539,000
6	151,121,000	188,417,000
7B	9,994,000	12,461,000
7C	10,437,000	13,013,000
8	114,020,000	142,160,000
9	43,327,000	54,020,000
10	34,708,000	43,273,000
STATE	$678,990,000	$846,564,000

Because of the commercial importance at points of production of oil, gas, and sulphur in which Texas stands pre-eminent, sight is often lost by the general public of the contribution which these raw materials make as the basis for industry in the State. A substantial part of the value-added-by-manufacturing and of pay rolls is attributable to these products and these industries in turn give rise to ever widening spheres of service and trade activities with their attendant pay rolls.

To an even less extent is the public conscious of the actual and potential importance of the wide variety of other non-metallic minerals in the State's economy. These minerals are not so well known because their value in raw form is relatively small, but as bases for industries, they have outstanding possibilities.

Industrial and Commercial Pay Rolls

Exclusive of pay rolls included in the income in manufacturing, mining and agriculture, the pay rolls for service occupations—professional, clerical and domestic, together with wages and salaries received in commercial activities such as retail and wholesale trade and the like, amounted in 1944 to approximately $2.7 billion, or 45 per cent of the total income of the State. These pay rolls are a direct result of the industries based upon the development of the State's natural resources. Thus every expansion of existing industries and additions thereto of new ones not only adds directly to jobs and pay rolls in the industries immediately concerned but brings in its train new opportunities in the form of service occupations and commercial activity. It is this cumulative effect in job creation which makes the expansion of industry so important at this time.

Retail Trade

In spite of the fact that many lines of merchandise were unobtainable during the past year—especially hard merchandise such as household utensils, automobiles, building materials and the like, as well as many classes of soft merchandise such as piece goods, work clothes, children's garments, etc.—retail dollar sales in Texas during 1944 amounted to approximately $3 billion or one half of the State's income. Normally retail sales have amounted to more than two thirds of the spendable income of the State and the tendency will be to approach this proportion again as more goods are produced for civilian use and the total income tends at least temporarily to decline following the termination of the war. The outlook for retail trade thus appears bright for at least several years after the close of the war.

In summary: the high level of income which prevailed during 1944 promises to continue during the current year in each of the four main categories from which income is derived in this State, viz.—agriculture, mineral production, value added by manufacturing and commercial, professional, domestic and industrial employment. Retail sales, therefore, which are closely related to income, also promise to remain on a high level and will represent a larger proportion of the State's income during and following the reconversion period from war to peace economy.

F. A. Buechel.

Fundamental Bases of Cotton Problems

Fundamental problems of cotton have their roots deeply imbedded in three major sets of conditions and forces. These are, first, geographic and unequal distribution of natural resources on the globe; second, changes being brought about in the economic significance of resources by science, technology, and social progress, and third, national and international competitive relations.

Geography

The fact that the world is a globe revolving around the sun and rotating on an inclined axis divides the world into broad climatic zones. These zones, modified by location with reference to large bodies of water, land masses, and physiographic features in conjunction with growth requirements of different plants and animals, divide the world into a variety of distinct natural regions for the efficient production of agricultural products. There are thus distinct regions which furnish the optimum conditions for each of the major crops, whether of bananas, cotton, hard spring wheat, or potatoes.

The area adapted to efficient cotton production is limited and concentrated. The cotton belt of the United States contains over 50 per cent of the best cotton lands of the world, and the United States has need for little more than 50 per cent of the area's capacity to produce cotton. This means that the cotton belt must trade with the rest of the world if it is to use its capacity to produce the crop for which it has the greatest advantage.

Science and Technology

Research in science, technology, and social development is constantly bringing about changes in the relative values of resources and their products. This is done by causing changes in demand for products, desired qualities, and volume of raw materials required. Costs of production of raw materials, of processing, and of manufacturing and distribution of products are being altered constantly, and through these the fortunes of whole natural regions are being vitally affected by altering the competitive strength of their major products.

In more recent years science and technology have been much more aggressive in developing synthetic products. Synthetic fibers, which only a few years ago were novelties, are now staple products, taking markets from cotton on a quality and price basis, where cotton was once thought to be impregnable. The rapid increase in production of synthetic fibers during the war, the great strides being made in improvement of qualities, and the capacity and apparent ability to lower prices, declare in no uncertain terms that cotton must find ways to meet prices and qualities of synthetics, as well as competition from foreign cotton production.

Foreign Relations

A wide variety of reasons has been offered for the growing intensity of nationalism among the nations of the world which reached its climax in 1939; such as national security, means of increasing employment, and the stabilization of domestic economy. This movement has gone a long way toward stifling the free flow of raw materials required by their geographic distribution, if all parts of the world are to be properly supplied. This in turn has tended to block the most effective development of world, national, and regional resources.

The conditions and forces just described have created three major sets of problems for cotton in the United States. One set is growing out of the necessity of lowering costs and improving qualities of cotton and cotton goods to meet increasing competition of foreign growths, but more especially competition of synthetic fibers, whose qualities are being constantly improved and costs of production reduced.

Another set of problems adhere in the necessity of gaining access to foreign markets because the cotton production capacity of the United States is so large relative to domestic demand that it requires access to world markets in order to find outlets for the necessary production to enable each portion of the cotton industry to function at maximum efficiency, especially in production, processing, and distribution.

The third set of problems related to cotton is growing out of the necessity of finding new jobs for those destined to be eliminated from cotton production because of increased mechanization and other means of lowering costs of production, to hold markets against synthetics and the lower standards of foreign producers.

Solution of these problems will be the subject of the next article.

A. B. Cox.

COTTON BALANCE SHEET FOR THE UNITED STATES AS OF JANUARY 1, 1945

(In Thousands of Running Bales Except as Noted)

Year	Carryover Aug. 1	Imports to Jan. 1*	Gov't. Est.* As of Dec. 1	Total	Consumption to Jan. 1	Exports to Jan. 1*	Total	Balance to Jan. 1
1935–1936	7,138	42	10,734	17,914	2,424	3,461	5,885	12,029
1936–1937	5,397	57	12,407	17,861	2,897	3,177	6,074	11,787
1937–1938	4,498	40	18,746	23,284	2,644	3,185	5,829	17,455
1938–1939	11,533	65	12,008	23,605	2,799	1,902	4,701	18,905
1939–1940	13,033	57	11,792	24,882	3,310	3,134	6,444	18,438
1940–1941	10,596	48	12,686	23,330	3,579	601	4,180	19,150
1941–1942	12,367	†	10,976	23,343	4,441	†	4,441	18,877
1942–1943	10,590	†	12,982	23,572	4,713	†	4,713	18,869
1943–1944	10,687	†	11,478	22,165	4,324	†	4,324	17,841
1944–1945	10,727	65‡	12,359	23,151	4,027	650‡	4,677	18,484

The cotton year begins August 1.
*Figures are in 500-pound bales.
†Not available.
‡Figures to December 1st instead of January 1st.

Recent Industrial Advance in Texas

The Dynamic Factor in Texas' Economic Development

That there is urgent need for an over-all picture of Texas economy, few who are vitally interested in the economic future of Texas will question. The object of this brief article, the central theme of which is concerned with the *Regional Economy* of Texas, is to set forth some of the essential items in the bigger picture of Texas as regards industry and particularly the vast range of industrial potentialities the State so magnificently affords from the standpoint of the rich and varied natural resources with which Texas is so well endowed.

Some idea perhaps of the scale of recent developments in Texas is conveyed by the figures of the War Production Board on war supply contracts (air craft, ships, ordnance, as the main ones) and facility projects (industrial and military) which have been made to Texas from June, 1940 through November, 1944. The grand total amounted to 7 billion, 623 million dollars, of which industrial projects not including air craft, ships and ordnance through October, 1944, amounted to 1 billion, 100 million dollars. Of supply contracts through November, 1944, aircraft accounted for 2 billion 295 million dollars; ships for 1 billion, 435 million dollars; ordnance for nearly 403 million dollars; and all other, for 1 billion 574 million dollars.

No matter what predilections may be involved as to the future of Texas' economic development, or how insistent they may be, one single item stands far out in a large and prominent manner in any study that seeks to evaluate trends in Texas economic development. This feature is industrialization. Industrialization is the core of the evolving regional economy that currently is giving deserved distinction to Texas and the Gulf Southwest.

It behooves everyone truly interested in Texas and its potentialities in the future to have a broad-gauged yet substantial inclusive perspective of what Texas is, of what it comprises, and of the larger significance of economic development in the State.

Of foremost importance is its natural resources, together with the agricultural and manufacturing industries built on the utilization of these natural resources, as well as the associated service industries thereby supported.

The history of precisely how and why these important economic activities have evolved in the State, as well as a recognition of the essential part they now play in the State's economic life, afford a background for envisioning the broader fields of endeavor in Texas. These economic developments, however, are climaxed in the current colossal industrial developments in Texas —particularly of such vital military necessities as 100-octane gasoline, synthetic rubber together with other chemical industries including toluene manufacture, the mass-production of chemical intermediates as well as metallic magnesium and the like.

All of these are now actual accomplishments; furthermore they are of such scope and their respective activities have attained so high a level that to consider them in only their broader aspects is sufficient to well-nigh stagger the imagination.

Yet here they are—representing a significant proportion of one of the greatest industrial developments in all time. Without these achievements carried out on so vast a scale the United States would today be in a sadder state than it is. Texas' natural resources have been freely available and producing industries in Texas are furnishing essential materials in vast quantities which in no uncertain way have helped to turn the tide in what without the natural resources of the United States, without the industries of the United States and the "know-how" all combined to supply vital materials would certainly have been a global conflagration of greater intensity than it is and which inevitably would have destroyed not only civilization itself but also all hopes for rebuilding a free world for perhaps hundreds of years to come. To such a future the United States itself would have otherwise succumbed in time.

For instance, Dr. Gustav Egloff could write in October, 1944: "American inventions in aviation gasoline processes gave the R.A.F. 100-octane fuel, and tactical superiority over the Luftwaffe in 1940. This made possible the winning of the Battle of Britain and turned the course of history. Without our research and development in motor fuel manufacture, . . . the United Nations might well have lost this war."

One needs hardly to ask now where we in the United States would be without the achievements in synthetic rubber manufacture. Or how much less effective our bombing operations would have been without toluene! Not that Texas has been the only source for supplying these vital necessities, but take Texas out of the picture and then consider the gap—and all the implications involved.

It is obvious to everyone that industrialization applies with special emphasis in the vital war effort which has still a long way to go; the point of emphasis here is that industrialization applies with even greater emphasis to Texas as regards the adjustments that necessarily will be foremost among the State's economic problems in the post-war period.

The most needed item in getting a picture of what Texas has done and is doing industrially is, of course, more and wider knowledge of a precise sort—precise knowledge of the growth of industry in the State, in the first place as based upon the utilization of the large and diversified natural resources concerned, and, in the second place, as related to the factors of economic development itself, such as the significance of an advancing technology applied to production, transportation, and utilization of commodities, together with the economic significance of markets outside the State as well as domestic markets inside Texas and the Southwest.

In addition, the growth and diversification in Texas industry are, of course, part and parcel of a larger movement—of a movement that is world wide, yet one that applies with particular emphasis to the United States, and its several major regions. This movement may be appropriately designated as *geographic dispersion of industry;* one phase of its results is especially illustrated,

and abundantly so, in what is happening in the rapid growth of numerous new industries in the Gulf Southwest as well as on the Pacific Coast in the Far West.

All this leads naturally to the next item, which is concerned with the wide range of potentialities for further industrial development and expansion in Texas. These potentialities are primarily based upon the more elaborate utilization of Texas natural resources in the light of revolutionary advances in science and technology, on the one hand, and which without doubt will be applied on a still larger scale in the postwar years; and, on the other hand, upon the basis of growing demands for new products or greatly modified old ones, all occasioned by an expanding economy which the United States particularly is certain to witness during the coming decades.

Texas' endowment of natural resources, both as to volume and diversity, in association with the geographic orientation of the State, is such that it can readily supply raw materials in adequate amount and variety to support a vast expansion in certain lines of manufacturing industries in the post-war period if Texas leadership is sufficiently interested in having this expansion take place in Texas.

Any discussion of the Regional Economy of Texas, or of any of its main groups, such, for instance, as industrialization, has of necessity to be based on hard facts which give substantiality to the situation concerned. This is so whether emphasis on the one hand is placed upon past development, and the achievements to date of a large and diversified production which has been taking place during the past few years, and still is being expanded and modified at a rapid tempo, or whether, on the other hand, an attempt is made to present a preview of things to come industrially.

So new to Texas, and to the United States for that matter, are many of the industrial aspects that apparently will be of a determining nature in the further expansion of Texas industry in the immediate future and so complex are the various sets of conditioning factors that it is by no means an easy or simple task to grasp even the larger essentials; as to the wider scope of economic problems concerned in, and the implications of, the broad sweep of adjustments which necessarily will take place during the next decade or so in established industries together with expansions of an industrial nature and the establishment of entirely new industries—that is something still more difficult to portray.

In another sense, however, the wide sweep of the essential natural resources, whether considered individually or in combination, as regards their occurrence in the State, together with their distinctiveness so well displayed because of their wide distribution as well as the conditions under which they exist, makes it possible for those who are so inclined, to comprehend the fundamentals involved in the broad front of the changing economic scene in Texas. From these diversified natural resources are obtained a wide array of essential raw materials and intermediates from which are fashioned and fabricated the thousands of products now being supplied in large quantities by Texas industry. In like manner, with the progress of science and technology making possible further utilization, or a higher type of elaboration, of these raw materials and intermediates, the rich natural resources of the State will come to support not only larger industries in certain of the lines already in operation but also will furnish the bases for wholly new industries, some of which unquestionably will be built on a rather tremendously large scale. One of Texas' problems is concerned with whether these new industries, based on the utilization of Texas natural resources and raw materials derived from these resources will be located in Texas or whether they will be built outside the State, to be fed with the raw materials Texas so bountifully supplies. There is no question but that these new industries will be built—in fact, for many, the plans have already passed beyond the blue print stage, and in still others, construction work has already been well begun.

Broader Perspective of Texas Economic Development

Perhaps for the sake of perspective it would be well to call to mind the larger categories in the field of Texas economic development as regards production, with emphasis on these lines of development that apparently will be outstanding in the next decade or so.

First, it would, indeed, be a mistake not to emphasize Texas soil resources and their widespread significance to adjustments which undoubtedly are coming in agriculture, the livestock grazing industry, in forest utilization, as well as in a more scientific utilization of agricultural raw materials by industry. One of Texas' outstanding groups of natural resources, it must not be forgotten, consists of the extensive and rapidly growing forests of East Texas. The development of modern utilization of wood products is only well begun in the State. And certainly it is a fact worthy of mention that Texas has the bulk of the rich soil resources of the Southern Prairies so well exemplified in the Black Prairies; and in the High Plains, the Red Beds Plains, and in South Texas the State has by far the great bulk of the Southern Black Earth or Chernosem soils of the United States. The vast areas of native grasses admirably adapted to grazing purposes insure for Texas a huge range livestock industry for an indefinite time in the future.

Second, Texas' rich and diversified natural resources, which have assumed such vast importance particularly since World War I, are of such immense magnitude that, it is safe to say, their potentialities, individually as well as collectively, are as yet appreciated only in part, even by those who have given these subjects a considerable amount of attention. That their significance is being more fully perceived, especially in other sections of the United States, has become rather self-evident. The essential point, however, and it is one that can hardly be overemphasized, concerns the post-war period when new techniques will necessarily be applied to their more effective utilization on a large scale, when wholly new and sizable industries based on the mass-produced products will come into being. Then the magnitude of the fundamental significance of these natural resources of Texas to the State's economy will dwarf the ordinary concepts of their significance such as prevails at the present time.

Third, two of the newer developing industries which hold such great potentialities for the Texas of tomorrow should be given more than passing mention even in a brief paper. These include (1) the Chemical Industry, which in itself is in reality a vast complex of industries, and (2) Fabricating Industries, particularly those producing consumers' goods. The latter are especially important in that they comprise industries that employ proportionately large numbers of workers.

That Texas will continue to produce, at least for some time, conventional bulk products in large volume from its oil resources is not to be doubted; but new techniques and new mass-production processes have transformed most of the petroleum refineries of the State and elsewhere, for that matter, into veritable chemical plants, devoted primarily to chemical conversion of oil hydrocarbons to synthetic organic chemicals rather than to merely their physical separation which obtained rather generally until only recently in the refining industry. In the same way, the emphasis upon natural gas in the future—and in the near future at that—will be placed, not upon the conventional uses, important though such uses certainly are, but upon the chemical conversion aspects of the hydrocarbons which can be so bountifully and at the same time so readily supplied from the rich chemical storehouse made possible by the State's natural gas resources.

Fourth, in addition not only to a scientific knowledge of natural resources, but also of the revolutionary technology applied to the utilization of these resources, it is also necessary to have an appreciation of the dynamic aspects of modern industry if we are to have anything more than mere assemblages of facts and figures stacked without regard to any underlying scientific principles. The growth factor of modern industry, since its inception in England somewhat less than 200 years ago, pivots about the fact of geographic shifts by which large industries are concentrated in certain natural regions—in regions possessing desirable combinations of certain natural resources and which at the same time are also commercially accessible to raw materials of wide variety, whether from nearby or distant points. These shifts illustrate, of course, the principle of geographic dispersion of industry. These developments were also part and parcel of an expanding world economy—an all-enveloping movement which to date has by no means reached its limits of extension. As time went on, and as new industries came into being, these centers of large industry, particularly so for the heavy industries, became intricately integrated in their operations, one group producing, for instance, what became raw materials for manufacture by other groups, and at the same time by-products, or even waste products, of certain industries became the bases for wholly new and large industries, many of which have grown to be undertakings of considerable proportions. Always, these large industries produced for a market that extended far beyond the confines of local trade territories—in fact, theirs were world-wide markets as a rule. Universally, in the wake of the expanding larger industrial establishments, there grew up hundreds of smaller industries supplying a great variety of consumers' goods for the local markets engendered by the growing dominant large industries of the region.

Recent Outstanding Industrial Developments in Texas

What Texas has done industrially serves to give some indication of the lines in which further developments may well take place. Petroleum refining has been for years the outstanding manufacturing industry in the State. It has been primarily upon the greatly modified and expanded refining industry of recent years that wholly new industries in Texas such as synthetic rubber, toluene, 100-octane aviation gasoline are based, all of which are largely synthetic organic chemicals. The colossal programs for 100-octane gasoline and synthetic rubber constitute two of the greatest industrial undertakings of all time. The construction of production facilities in the United States alone for the production of 100-octane gasoline in the war program has cost some 760 million dollars, and of this huge amount, around 82 per cent was furnished by the oil companies. Data on how much of this was spent in Texas have not as yet been released to the public but it has been estimated by those in a position to judge that Texas refineries have been contributing 40 to 50 per cent of such critical military products as 100-octane and other aviation fuels, all-purpose gasolines, military distillates, and special navy fuel oil.

It may also be noted that the total costs of the facilities built in the 100-octane program for the entire United Nations have been placed at approximately 920 million dollars.

Recently plans have been made for the expenditure of more than 352 million dollars on new domestic and foreign refining facilities, according to a statement made in October, 1944, by Ralph K. Davies, deputy petroleum administrator. Somewhat more than half of this amount is to be spent on domestic refinery construction, and the rest, in foreign construction. Of the domestic construction, more than half of the projected expenditures will be for catalytic cracking facilities. It may be noted that nearly 4 million dollars are to be spent for research and development purposes.

Facilities for the production of toluene from petroleum constitute a third chemical venture initiated in World War II. The Army Ordnance Department's toluene program includes 15 plants, all of which have also contributed toluene as an ingredient for use as a blending agent in the manufacture of 100-octane aviation fuel.

An outline of war-time petroleum refinery developments in Texas occurs in the *Texas Business Review* for April, 1944. It is appropriate, however, at this place to summarize the larger aspects of this vast industry.

No longer do physical separations of crude oil components by distillation and crystallization predominate in oil refining, as they did during the period of World War I.

Petroleum refining in World War II employs specific chemical processes to supply products of precise physical and chemical characteristics. These products are individual hydrocarbon compounds such as isooctane,,

isopentane, triptane, isobutylene, isobutane, isoprene, ethylene, acetylene, toluene, and cumene.

From these various compounds supplied from petroleum are made such chemical derivatives as phenols, cresols, alcohols, aldehydes, ketones, organic acids, butadiene, styrene, and others, all vitally important as raw materials for 100-octane (and 100-octane plus) gasoline, an almost bewildering array of resins and plastics, explosives, synthetic rubbers, and so on.

The vast new field of chemicals from petroleum and natural gas, a field as vitally significant as it is fascinating, has recently been aptly summarized by Gustav Egloff as follows:

"The industries based on the newer chemistry, involving aliphatic hydrocarbons as base materials, have infinitely greater possibilities than the industries based on coal tar chemistry, even though it is estimated that coal tar has served as a source of about 500,000 derivatives. Coal tar hydrocarbons are mainly aromatic in character which limits the number of derivatives which can be produced from them. In comparison, natural gas and petroleum are veritable treasure troves of paraffin, olefin, acetylene, cyclo-paraffin, cyclo-olefin, and aromatic hydrocarbons that open vast vistas in chemical research which have been only faintly explored. In view of the great number of hydrocarbons available as starting materials, it is not unlikely that over a million new organic compounds will be produced from petroleum and natural gas.

"The larger number of aliphatic hydrocarbons potentially available compared to the aromatic hydrocarbons of coal tar is due to the number of isomeric modifications in the paraffin, olefin, and acetylene groups. In the paraffin series there are over 4,000 isomers having fifteen carbon atoms in the molecules, and when the carbon atom content is 30, over four billion hydrocarbons are possible. In the mono-olefin series, because of the additional factor of different locations of the double bond, the fifteen carbon atoms group comprises 36,000 isomeric forms, and the twenty carbon atoms group, over four million. When these are considered as starting materials for new compounds, it is difficult to overestimate the potentialities, and the field which opens up is a challenge to the organic chemist."

It is appropriate at this point to refer to Dr. E. P. Schoch's work in obtaining acetylene from natural gas. Chemists interested in the wide potentialities of acetylene, which is considered to be too high in cost to favor its fuller development industrially, have long been concerned with the development of more efficient methods for large production of this chemical. Dr. Gustav Egloff recently stated in a public address that Dr. Schoch apparently has the answer to low-cost acetylene.

Synthetic Rubber Program

On the basis of data released in the summer of 1944, the Government's synthetic rubber program was scheduled to cost nearly 700 million dollars. Texas' share in this huge industrial program is in excess of one-third of the total. Up to November 5, 1944, one copolymer plant alone in Texas, that of B. F. Goodrich's Rubber Rancho Grande at Port Neches, which began operations in August, 1943, has produced 100,000,000 pounds of synthetic rubber—approximately a twelfth of the volume of natural rubber consumed annually in the United States in the years just before the war. The synthetic rubber plants, including the production of intermediates and the copolymer plants in which the synthetic rubber is made, as well as most of the aviation gasoline capacity have come into production during the year. In reality, the hydrocarbon compounds for the intermediates as well as the final products are chiefly refinery gases supplied in large volume by the new processes in cracking, especially catalytic cracking.

The Government synthetic rubber plants when originally built were to have a total rated capacity for the production of 735,000 long tons of GR-S (Government Rubber-Styrene). Improvements that already have gone into operation by January 1, 1945, have made possible an actual production of 130 per cent of their original "design capacity."

It is estimated that the new Goodyear process, (discussed later in this paper) when fully utilized will bring the actual capacity up to 180 per cent of the design capacity, thus bringing the total production potential up to 1,338,000 long tons.

More than 85 per cent of the Government program is concerned with producing GR-S.

Summary of All United States Government Owned Synthetic Rubber Plants, August 31, 1944

Rated capacity per year: 827,000 long tons.

Total production through June, 1944: 555,400 long tons of synthetic rubber.

Estimated investment cost: $699,798,549.

Total production of Texas copolymer plants through June, 1944: 114,360 long tons.

The Rubber Reserve Company announced in January, 1945, that the actual capacity of the Government plants for producing synthetic rubber is 1,000,000 long tons annually—which is 200,000 tons in excess of the goal set when the program was initially undertaken.

The 1944 output of synthetic rubber in the United States was 763,000 tons, of which 737,000 tons were supplied by Government plants, and 26,000 tons by private industry.

In addition to the production of synthetic rubber, the announcement states that the plants have produced more than 25,000,000 gallons of ethylbenzene and approximately 4,000,000 gallons of cumene, which is isopropyl benzene. Cumene is used as blending agent in the manufacture of 100-octane aviation fuel.

GR-S

GR-S (Government rubber-styrene), regarded as the best of the general purpose synthetic rubbers, forms the backbone of the government program, and is the basis for tires manufactured from synthetic. The Texas phase of copolymer GR-S production is summarized in the following table.

TEXAS PLANTS IN SYNTHETIC RUBBER PROGRAM

Operator	Location	Estimated Investment Cost	Rated Annual Capacity	Month of first Production
Copolymer Plants				
B. F. Goodrich Co.	Borger	$ 8,980,272	45,000 long tons	August, 1943
B. F. Goodrich Co.	Nort Neches	16,584,896	60,000 long tons	August, 1943
Firestone Tire and Rubber Co.	Nort Neches	16,584,896	60,000 long tons	November, 1943
General Tire and Rubber Co.	Baytown	7,986,848	30,000 long tons	July, 1943
Goodyear Synthetic Rubber Corp.	Houston	*13,373,698*	*60,000* long tons	October, 1943
TOTAL, TEXAS		$ 63,510,610	225,000 long tons	
TOTAL, UNITED STATES		$161,902,644	705,000 long tons	
Texas per cent of total		*38%*	*36%*	
Butyl				
Humble Oil and Refining Co.	Baytown	$ 26,000,000	30,000 long tons	September, 1944
United States		53,000,000	68,000 long tons	
Texas per cent of total		*49%*	*44%*	
Butadiene Plants				
from Butylene:				
Humble Oil and Refining Co.	Baytown	$ 19,400,000	30,000 short tons	August, 1943
Neches Butane Products Co.	Nort Neches	58,686,196	100,000 short tons	August, 1943
Sinclair Rubber, Inc.	Houston	31,500,000	50,000 short tons	April, 1943
From butane:				
Phillips Petroleum Co.	Borger	35,000,000	45,000 short tons	September, 1943
From naphtha and gas oil: (refinery products)				
Humble Oil and Ref. Co.	Ingleside	4,100,000	7,000 short tons	October, 1943
Taylor Refining Co.	Corpus Christi	1,800,000	5,500 short tons	April, 1944
From natural gas:				
Celanese Corp of America	Bishop		10, short tons	Not in operation
TOTAL, TEXAS		$150,486,196	247,500 short tons	
TOTAL, UNITED STATES		346,633,296	657,600 short tons	
Texas per cent of total		43%	37.6%	
Styrene Plants				
Dow Chemical Co.	Velasco	$ 18,150,000	50,000 short tons	September, 1943
Monsanto Chemical Co.	Texas City	19,700,000	51,000 short tons	March, 1943
TOTAL, TEXAS		$ 37,850,000	101,000 short tons	
TOTAL, UNITED STATES		$ 82,750,000	192,700 short tons	
Texas per cent of total		45.6%	52%	

Styrene is dehydrogenated ethylbenzene, made from ethylene and benzene.
Ethylene is a refinery gas but it also can be derived from natural gas. Benzene although obtainable from petroleum is probably supplied by the coal tar industry.

The program includes 16 copolymer plants, the designed annual capacity of each of which ranges from 30,000 to 90,000 long tons; one of these is located at Sarnia, Canada.

Five of these copolymer plants are in Texas. Louisiana has two; Ohio (Akron) two; California two; and Connecticut and Kentucky, one each.

The two principal ingredients of GR-S are butadiene and styrene, which upon copolymerization yield latex which is treated and milled not unlike natural rubber.

Butadiene is grouped into 4 main classes, according to the feed stock used.

1) The alcohol process is used in 3 plants, two of which (at Institute, West Virginia and Louisville, Kentucky) are operated by Carbide and Carbon Chemical Corporation; the other, at Kobuta, Pennsylvania, is operated by the Koppers United Company.
2) The butylene dehydrogenation process, (the Jersey process), in which normal butylene is dehydrogenated, is used in 5 plants, 3 of which are in Texas, and one each at Lake Charles and Baton Rouge. Another large plant using this process is located at Sarnia, Canada, and is operated by Imperial Oil, Ltd.
3) The butane dehydrogenation process is used in 3 plants. One of these, at Borger, is operated by Phillips Petroleum Company; the other two, one at El Segundo, California (Standard Oil of California), the other at Toledo, Ohio (Sun Oil Company) use the Houdry dehydrogenation process.
4) The naphtha cracking process using naphtha and gas oil as feed stock, is used in 4 plants.

The capacity of these plants individually and in the aggregate is small. Two of the plants are located in Texas, at Ingleside and Corpus Christi; another is located at El Dorado, Arkansas, and the fourth, at Baton Rouge.

Styrene is made in 7 plants. One of these is in Canada, at Sarnia, and is operated by the Dow Chemical Company of Canada, Ltd.

Of the large styrene plants, Texas has two, one at Velasco, the other at Texas City.

The styrene program is built largely around the Dow Chemical Company process which has been in successful operation for several years. The Carbide and Carbon Chemical Corporation uses a process of its own; Monsanto Chemical Company and Koppers United Company employ modified Dow systems.

Butyl and Other Synthetic Rubbers

Only two plants in the United States for making butyl rubber are included in the rubber program, one at Baton Rouge, operated by the Standard Oil Company of

Louisiana, the other at Baytown, operated by the Humble Oil and Refining Company.

The Baton Rouge plant began operations in March, 1943; the Baytown plant, in September, 1944. A small butyl plant, to be operated by Imperial Oil, Ltd., is being built by Sarnia, Canada.

Butyl rubber is made by catalytically combining isobutylene, a refinery gas, with a small amount of isoprene.

Neoprene, a duPont product, which is derived from acetylene and chlorine, is the second main synthetic chosen for the government program. Neoprene production is being carried out by E. I. duPont de Nemours and Company, operating two plants, one at Deepwater, New Jersey, the other and by far the larger one, at Louisville, Kentucky. The Louisville plant began operating in October, 1942. The grand total of Neoprene designed capacity was placed at 63,000 long tons by the War Production Board on August 31, 1944.

Thiokol production is not included in the Government program. The Dow Chemical Company has a $2,500,000 Thiokol (polysulphide) plant at Freeport.

One common mistake, according to John A. Tallant, technical service data manager of Hycar Chemical Company, is the belief too often held that synthetic rubber is merely a makeshift substitute for the natural product. Far from being a substitute for natural rubber, Dr. Tallant emphasizes, synthetic rubber in its present state of development is held not only the equal of tree-grown rubber in important qualities, but excels it in so many other respects that the two can hardly be compared.

This is particularly the case for a wide variety of special purpose rubbers which had become very important in industrial applications even before World War II. Even more striking is the fact that these special purpose rubbers became of commercial importance during the Great Depression years.

Speeding Up of Milling Time

In September, 1944, General Tire and Rubber Company announced a new process wherein carbon black is incorporated into rubber in liquid form as the finished rubber or latex comes from the copolymer plant, and before it is coagulated and dried.

By this process not only is the carbon black perfectly distributed uniformly throughout the rubber but it also reduces the milling time of rubber which is an expensive, and time-consuming process in using synthetic rubber.

Previously, the rubber had to be ground in giant mills during which process the carbon black was mechanically mixed into the rubber. The new process enables the carbon black to be blended naturally into the rubber, reducing milling time by 35 per cent and saving some 20 per cent in power consumption.

The new method is already in commercial use at the General Tire and Rubber Company's 30,000-ton copolymer plant at Baytown, Texas—a government-owned plant which is operated by General Tire and Rubber Company.

Continuous Polymerization on Commercial Scale

Goodyear Tire and Rubber Company developed in 1944 a new technique which will speed up production by 40 per cent, it is claimed. This new technique is a continuous polymerization process which replaces the batch process which hitherto has been a delaying factor in capacity output in synthetic rubber copolymerization plants. Installation of equipment for making use of this process would require an additional investment of only about 1 per cent of the original capital cost.

"Continuous polymerization," Dr. Dinsmore of Goodyear summarizes, "allows a more efficient and simple plant operation. The rate of production is increased and, what is more, can be accomplished with an actual decrease in manpower requirements. More efficient, automatic control of the process can be obtained, resulting in a more uniform rubber."

New Developments in Synthetic Rubbers

Mathieson Alkali Works in 1944 developed a new synthetic rubber that withstands elevated temperatures, and which is said to be especially suitable for heavy-duty tires for military vehicles, trucks, and busses.

This new rubber is a copolymer of dichlorostyrene and butadiene, dichlorostyrene constituting 30 to 40 per cent of the feed stock. This gives the new rubber a 12 to 16 per cent content of chlorine.

This rubber is said to excel GR-S in such qualities as tensile strength, elongation, tear resistance, flex cracking, and resistance to heat, moisture, oil, kerosene, and gas permeability. It is reported as being superior to natural rubber in hot tensile strength, resistance to heat aging, oil resistance, and water absorption.

Goodyear Tire & Rubber Company developed in 1944 what is claimed to be a superior tire rubber. It is a butadiene copolymer, made of butadiene and a, as yet, unnamed new chemical, the latter being substituted for styrene. This synthetic though claimed to excell GR-S in resilence and crack growth resistance, has a low tensile strength at high temperatures.

Also in 1944 the B. F. Goodrich Company announced an improved synthetic rubber also of the butadiene type. An abundant natural material is used for its production; the synthetic approaches natural rubber in processing characteristics. It has increased abrasion resistance, possesses greater tackiness and reduced tread cracking in comparison with earlier developed tire synthetics. Complete information will not be available until after the war. No major changes in the existing plants of the Government rubber program are required for its production.

Uskol is a new synthetic rubber made by the United States Rubber Company. Uskol is said to have high resistance to high octane gasoline as well as excellent aging qualities. It can be produced with existing equipment. It is reported that Uskol handles easily in manufacture and that it blends well with other synthetics.

Silicone rubber, developed in 1944 by General Electric Company, and now only in pilot-plant production, differs materially in its chemical nature from the other synthetic rubbers. Units of dimethyl silicon are polymerized to form long chain polymers. It is reported that silicone rubber will resist heat above 300° F. This is in sharp contrast with natural rubber and many synthetics which show rapid deterioration at a temperature of 212° F.

This synthetic costs about 10 times that of other synthetics, but it can be used for highly special purposes. Continued research may overcome the low tensile strength and low tear resistance of this synthetic.

Thiokol Corporation announced in September, 1944, a new type of polysulphide rubber, Thiokol LP–Z. This synthetic possesses high resistance to solvents and low temperature flexibility. Thiokol ST is another recently developed polysulphide rubber. Thiokol production is not included in the Government synthetic rubber program. Thiokol Corporation has embarked definitely on a policy of diversification for manufacturing specialized products for special industrial applications; the specialized lines of production of Thiokol Corporation are confined to the polysulphide field in industrial chemistry. The company is laying out a program with a view toward the prospects in the post-war period for enlarged sales volume through new outlets.

Tires from Synthetic Rubber

Status, January 1, 1945, adapted from *National Petroleum News*, Technical Section, January 3, 1945:

1. Compounding and manufacturing tires from synthetic rubber is around 80 to 90 per cent as efficient as with natural rubber. With increased know-how and improving methods, the gap between synthetic and natural rubber is constantly being reduced.

2. Passenger car tires made from GR-S under today's driving conditions give service comparable to that from "first line pre-war tires."

3. Truck and bus tires, under the heavier loads and higher speeds to which they are subjected, present the most difficult problem for synthetics.

4. The further widespread use of synthetic rubber seems assured—but to what extent it will displace natural rubber will depend upon economic factors and the progress of synthetic rubber technology.

5. Overcoming difficulties of heavy-duty tires made from synthetic rubber is still a major problem. The heavy-duty tires run hot, hotter than those made from natural rubber. The heat cannot be rapidly dissipated through the thick walls; this weakens the tire, rendering it more susceptible to abrasion and tearing.

If natural rubber is mixed with synthetic, the heat generated is reduced and the tire has more flexibility and elasticity, which lessens the risks of tire failure.

Substitution of rayon or other synthetic fiber cords for the cotton usually used is another factor in solving the heat problem. Rayon becomes stronger when it dries out; cotton fibers react in the opposite manner. Cotton fibers in tires possess a small amount of moisture and when the tire heats up, the moisture is driven off with the consequent weakening of the cotton fiber. Since rayon fiber in tires also contains moisture, and as this moisture is driven off as the tire heats up, thus the rayon becomes actually stronger. This is the primary advantage of rayon over cotton for tire fiber cords.

Nylon fiber cords would probably be better still, as nylon possesses greater strength than rayon. Nylon therefore wouldn't stretch or bag—but before it can be used in tire fiber cords, certain technical problems must be solved, such, for instance, as the slickness of nylon, and this is important as the synthetic is less sticky than natural rubber.

Summary of the Magnesium Situation

The capacity of United States facilities for magnesium production now stands at approximately 600,000,000 pounds annually, 92 per cent of which is owned by the Defense Plant Corporation, and in two of the plants Great Britain has an equity. Actual production, however, never reached the level of full capacity operations.

Actual production, due to ordered shut-downs, now stands at a sixth of the above figure, at around 100,000,000 pounds. But the current rate of production is 16 times what it was prior to the war, the pre-war output being around 6,000,000 pounds.

The current production of 100,000,000 pounds yearly is said to be going largely into structural uses, parts for airplanes, wheels for artillery pieces, as well as a wide variety of portable communication equipment, all of which are greatly lightened by the wider use of magnesium.

The magnesium capacity owned and privately operated by the Dow Chemical Company is about 50,000,000 pounds per annum. Dow may seek to lease or acquire the Government's magnesium plant at Velasco, Texas—a plant which was closed down by January 1, 1945.

Texas capacity for producing magnesium amounts to 132,000,000 pounds annually.

The Velasco plant near Freeport operated by Dow for the government was producing 72,000,000 pounds a year; International Minerals and Chemical Corporation was producing at its Austin plant at the rate of 24,000,000 pounds a year. The Dow plant at Freeport, owned jointly by Dow and the Government has a capacity of 36,000,000 pounds annually.

The Defense Plant Corporation's magnesium plant at Las Vegas, Nevada, which was operated by Anaconda Copper Mining Company is the only other magnesium plant in the United States whose capacity of 72,000,000 pounds a year matches that of the Velasco plant, but when in operation, the Las Vegas plant had the highest cost of production in the country, while the Velasco plant had the lowest.

In the fall of 1944 when the magnesium stock pile rose to more than 100,000,000 pounds, still greater cutbacks were ordered.

Between March, 1944 and the close of the year the following Government-owned plants were closed down: Dow Magnesium Company, at Marysville and Ludington, Michigan; Amco Magnesium Company, Wingdale, New York; Mathieson Alkali Works, Inc., Lake Charles, Louisiana (which had never operated successfully); Permanente Metals Corporation, Manteca, California; Basic Magnesium, Inc., Las Vegas, Nevada; Ford Motor Company, Dearborn, Michigan; and International Minerals and Chemical Corporation, Austin, Texas.

The latest shut-downs, scheduled for January 1, 1945, are the Government-owned plant operated by the Dow Magnesium Company at Velasco, Texas, and the plant operated by the Electro Metallurgical Company at Spokane, Washington, and partial curtailment was ordered for the plant operated by Diamond Magnesium

Company at Painesville, Ohio, which has a rated capacity of 36,000,000 pounds annually.

Magnesium production in the United States began in World War I; in 1918 output amounted to 142 tons. Production was pioneered by Dow and a subsidiary of the Aluminum Company of America, but by 1927 the latter company dropped out of the picture.

Dow continued its efforts and by 1939 had achieved an output of 7,000,000 pounds or 3,350 tons; in the same year Germany produced 18,000 tons.

In 1937 Dow embarked on a program for expansion of magnesium production. As a consequence, the company made plans to produce 24,000,000 pounds a year, half of which would be produced at Midland, Michigan, and this meant doubling the production at Midland. It was later decided to produce the other 12,000,000 pounds at Freeport, Texas.

The Freeport location was decided upon after Dow Chemical had arrived at the decision that it is cheaper to pump sea water and treat it than to mine magnesium-bearing rock, or to depend upon brine from wells, *provided* a sea-water site could be found which had an abundant supply of limestone and salt and for which cheap power could be made available.

During World War II, United States production of magnesium was stepped up rapidly to supply magnesium as a structural metal alloy in airplanes and bombs, as well as for pyrotechnic and incendiary uses. In 1940 Dow arranged to produce some 18,000,000 pounds annually of magnesium at Midland, of which 2,500,000 pounds were financed by the British Government.

Soon after the Freeport plant, with a rated capacity of 12,000,000 pounds annually, was put in operation, facilities financed by the British government for producing 6,000,000 pounds annually were added.

"In February 1941 the United States Government for the first time provided capital for the expansion of magnesium, and authorized the construction of facilities by Dow Chemical for the production of an additional 18,000,000 pounds of magnesium per annum at the Freeport, Texas, plant. This increased the rated annual capacity of Dow Chemical to 54,000,000 pounds."

In June 1941, the Defense Plant Corporation authorized the construction of facilities for producing 72,000,000 pounds of magnesium annually at Velasco, Texas; the plant was built and operated by Dow Magnesium Company, a subsidiary corporation of Dow Chemical. Output rose to 184,000 tons in 1943 (65,000 of which were used for incendiary bombs) and the 1944 output was probably about the same as for 1943. Of the 1943 output Dow operated plants, together with plants using the Dow process, supplied 60 per cent of the total. The Government's magnesium program is estimated to have cost around $400 million. Of this sum, $150 million went to Dow operated plants and the two plants (Diamond Magnesium Company and International Minerals and Chemical Corporation) using the Dow know-how.

As a consequence of the war program which resulted in greatly stepping up magnesium production in the United States, a few conclusions which are particularly important to Texas, are outstanding:

1. The know-how for efficient production of magnesium metal has become established.

2. The oceans constitute a virtually inexhaustible reserve of magnesium compounds—magnesium chloride and magnesium sulphate. Experience has demonstrated the feasibility for extraction of magnesium metal from these waters. It has been stated that each cubic mile of sea-water (which is more than 1,049 billion gallons in volume) contains more than 4,500,000 tons of magnesium.

Besides successfully extracting magnesium from the Gulf waters, Dow also extracts bromine in considerable quantities from these waters.

3. The practical solution of many problems concerning magnesium fabrication has been achieved.

4. Texas has acquired a great new industry, initiated by Dow before the United States entered the war, and which was greatly expanded as a part of the war production program.

5. The peace-time markets for magnesium are in an unsettled state, and in part depend upon further efficiencies being achieved in magnesium fabrication operations.

The post-war automobile industry is regarded as the nucleus for expanded uses of the light metals, and particularly will this be so immediately in trucks and busses as a result of increasing pressure to conserve automotive fuel.

Other industries holding promise for opportunities in the further use of magnesium include airplanes, furniture production, electrical appliances, household appliances, photographic equipment, and the like.

In conclusion, it is appropriate to call attention to the factors Dow considered as important in establishing its initial Texas plant at Freeport. These are:

1) Adaptability of the site for obtaining a huge intake of uncontaminated Gulf waters, and at the same time the adaptability of the site for disposal of the waste waters at a distance of several miles from the point of intake.

2) Availability of natural gas to insure cheap power.

3) The occurrence of large supplies of calcium carbonate in the form of oyster shells at the bottom of Galveston Bay.

4) The presence of a near-by salt dome from which adequate supplies of brine could be piped.

5) In addition, large supplies of sulphur and petroleum were near at hand for the supply of materials for other types of chemical production in which Dow is interested.

6) Transportation is adequate.

Perhaps, too, an outline of the processes used by Dow at Freeport for extraction magnesium is in order—of the process whereby a barrel of sea water yields a third of a pound of magnesium.

1) The intake pumps are capable of delivering 300 million gallons of water a day—a fact which is indicative of the immensity of the undertaking. This water is taken at a depth of some 30 feet in Freeport harbor in order to avoid possible dilution from rainwater. Not all this water is used in the magnesium plant, for after screening, a part of it is diverted to the bromine plant.

2) Gulf water for the magnesium plant is sent to a huge tank where it comes in contact with a milk of lime. The latter is obtained from oyster shells which have been dredged from Galveston Bay, subsequently treated in a huge lime kiln and then slaked. In this tank the magnesium chloride and magnesium sulphate react with the lime, yielding magnesium hydrate which settles to the bottom of the tank as a heavy sort of milk of magnesia.

3) The milky magnesia, after being conveyed to properly prepared tanks where it is treated with hydrochloric acid, yields magnesium chloride.

4) Upon being treated and dried, the magnesium chloride becomes the feed (raw material) for the Dow electrolytic cells which extract the pure metallic magnesium.

It may be noted further that the plant was ready to begin operations by the middle of January, 1941, and the first ladle of metallic magnesium ever obtained from sea water was poured on January 21, 1941. An unlooked for difficulty, however, soon appeared, which lowered the efficiency of the electrolytic cells to a third of what was expected of them. Finding the cause of this difficulty brought feverish days at Freeport as the research staff worked day and night in their search, for the fate of the new enterprise depended upon its solution. The cause was found to be the presence of a rare element, boron, in very small quantities in sea water—and which does not occur in the brines Dow had formerly used. The next thing was to get rid of the troublesome boron—which proved easy. By adding a little extra lime in the hydrating process, the boron remained in solution and was carried off with the waste water.

In conclusion, it should be recalled that Dow is operating an 8 million dollar magnesium alloys plant at Freeport, and that aside from magnesium and bromine developments, Dow has developed large scale chemical production in its Freeport plants, based on the utilization of hydrocarbon gases.

Dow owns some 1300 acres of land at Freeport and nearby and has invested millions of its own money in the Freeport enterprises.

Industrial Significance of Hydrocarbon Gases

The elaborate and complex utilization of refinery gases in the building of gigantic industries during World War II emphasizes as nothing else can the growing significance of hydrocarbon gases to industry, particularly to the newer phases of the chemical industry.

In many cases, however, the components of natural gas can also be used advantageously for making many of the intermediates concerned and this phase of natural gas utilization is one that will certainly be vastly expanded in the immediate future. In fact, beginnings have already been made, particularly in Texas, Oklahoma and Louisiana.

As to one phase of potentialities in the Texas chemical industry based on natural gas hydrocarbons, a bit of research history may be illustrative. Years ago, Dr. George O. Curme, of the former Prest-O-Lite Company, was seeking a more economical method for producing acetylene than the calcium carbide process afforded. Curme found that acetylene could be produced by cracking gas oil—but there was a drawback in that ethylene, an unwanted by-product, was also formed. In order for the process to be operated economically, an industrial use for ethylene had to be found. The result of research work along this line gave ethylene glycol (Prestone). Carbide and Carbon Chemicals Corporation for several years now has been making ethyl alcohol from ethylene derived from natural gas. Today ethylene is in demand for a variety of uses, as in the field of resins and plastics, explosives, solvents, lacquers, and others. The most recent of these uses is for making polythene, a new hydrocarbon resin developed in 1941 and made by the polymerization of ethylene. All available polythene is now going into military uses, but the versatility of its uses will make it an important plastic when it becomes available for civilian use. Incidentally, it may be noted that the Carbide and Carbon Chemicals Corporation of today stems from the earlier researches on acetylene, in the days of the Prest-O-Lite Company.

The significant fact for Texas is that not only acetylene and ethylene but a host of other highly important hydrocarbon products can be made economically and effectively from natural gas. In addition, it may be noted that in years to come a significant proportion of our gasoline output is very likely to be made from methane, the hydrocarbon making up ordinarily 80 to 90 per cent or more of natural gas.

The point of emphasis is that oil and gas hydrocarbons are available not only for manufacturing the bulk conventional products of the refining industry but that also, in addition, they are amply adequate for the support of vast new industries, such for instance, as synthetic rubber, and the rapidly growing fields as synthetic resins and plastics, synthetic fibers of a wide variety, as well as numerous other intermediates, solvents and other processing chemicals, including alcohols, aldehydes, acetone, acetic acid, and so on.

Within the past year Monsanto Chemical Company has constructed a million dollar unit at its Texas City plant for making formaldehyde, a basic intermediate of several kinds of plastics. A derivative of formaldehyde and ammonia has become, through recent developments in that field, one of the most important chemicals for use in certain explosives.

Early in 1944 duPont purchased an 862-acre tract lying just north of La Porte, and in January, 1945, a contract for construction of the first unit of what is expected eventually to become a 50 million dollar plant on this tract was awarded to the Rust Engineering Company of Pittsburgh, Pennsylvania. Projected undertakings here comprise the manufacture of a diversified line of chemicals.

Celanese Corporation of America is constructing a five million dollar plant at Bishop for making methanol (wood alcohol), acetone, acetic acid, and formaldehyde. These products will be made from natural gas. In December 1944, it was reported that this project would be doubled. Celanese also has under construction at Bishop a $2,750,000 plant for making butadiene, chief component of GR-S rubber, also to be made from natural gas, using the Aldol process. In this process acetaldehyde is the primary chemical intermediate. These

projects, it may be noted, are being privately financed. All of these undertakings reflect the growing interest of Celanese Corporation in the field of synthetics—especially the plastics.

Shell Oil Company has begun construction of a million dollar unit at its Deer Park refinery on the Houston Ship Channel for the manufacture of allyl chloride and allyl alcohol; allyl chloride will be made by chlorinating propylene gas, which in turn will be converted to allyl alcohol. Allyl alcohol is the major component of the new resin, C. R. 39, sometimes called "plastic glass," which is in very great demand for certain military uses.

Shell Oil Company has also recently been granted permission to build an 11 million dollar catalytic cracking unit at its Deer Park refinery.

In connection with all these developments, the field of catalysts has risen to high place in chemical processing and conversion, especially in the fields of 100-octane aviation gasoline, synthetic rubber, synthetic resins and plastics, and so on. Texas has three plants manufacturing catalysts, one at Corpus Christi, another at Houston, and the third and largest at Fort Worth. The aggregate costs of these plants is in the neighborhood of five million dollars.

The manufacture of tires from synthetic rubber has imposed new demands upon the carbon black industry. During 1944 the War Production Board approved the construction of new carbon black plants to cost $19,500,000. These plants will be located in Texas and other states of the Southwest.

Increased demands for liquefied petroleum gases at natural gasoline and recycle plants have brought new projects into the production picture. Carbide and Carbon, Dow, and Monsanto have been increasing their consumption of lighter petroleum gases during the past several years. Other chemical companies are coming into this picture and of the oil companies themselves Shell and Standard of New Jersey particularly have been engaged in basic research concerning these compounds and their uses.

As one illustration of a new commercial development is the recently-approved $842,200 project of Dow Chemical Company for the construction of a 79-mile long, 4-inch pipeline from the Humble Oil and Refining plant in the Katy field to Dow's chemical plant at Freeport. The Humble plant is reported to produce isobutane and yields as by-products liquefied petroleum gases needed by Dow in its chemical manufacturing operations.

Most recently established large enterprise in Texas in the line of fabricating industries is the tire plant of General Tire and Rubber Company at Waco, which has been built at a cost of several million dollars. This plant will make tires from synthetic rubber manufactured at the company's copolymer plant at Baytown, Texas. It has just been announced (January 13, 1945) that a $6,000,000 tire manufacturing plant, to be constructed and operated by the Kelly Springfield Tire Company, will be located at Pasadena in the Houston district.

The plant will be located near the site of Goodyear Tire and Rubber Company's synthetic rubber plant on the Ship Channel. Plans call for a daily output at peak production of 1000 heavy truck tires, and for the employ of at least 1000 persons. Whether or not the plant remains in operation after the war is contingent upon the fortunes of synthetic rubber.

Also, Southern Acid and Sulphur Company, Inc., is constructing a $3,500,000 super-phosphate fertilizer and chemical plant on the Houston ship channel.

Pattern of Things to Come

In summing up this brief survey, the line of industrial expansion which promises most in Texas from the standpoint of increased and diversified volume production of basic materials during the coming years is that of synthetic organic chemicals based upon the more elaborate utilization of the hydrocarbons available as raw materials, directly or through chemical conversion, in vast amounts from the petroleum and natural gas resources of the State. This particular field is that of the aliphatic hydrocarbons, a field that American chemists and industrialists have developed in an almost spectacular manner since World War I and which has been so vitally important in World War II.

In conclusion, it would, indeed, be amiss not to call attention to two other problems with which Texas will be more and more concerned in the coming years. One of these is *Conservation of Natural Resources,* a vast field in itself and one which will demand the best technical and economic knowledge it will be possible to bring to bear on the problem. The big items in conservation in Texas are concerned with soils, forests, and the native grasses, as one important group, and with petroleum and natural gas, as another vital group, together with the whole field of water supplies, both for municipal and industrial purposes. With the expansion of industries and the attendant concentration of population in industrial areas as well as in metropolitan centers —an expansion which may reasonably be expected in Texas—the problem of insuring adequate and dependable water supplies will become an increasingly urgent one in the State.

The other problem is centered about *Texas Industry and International Trade.* The pattern of American international trade which predominantly held sway until the period of World War I was considerably modified by the rapid tempo of changes that took place between World War I and World War II. In the years to come, the United States exports will apparently be dominated by a wide range of industrial specialties shipped in large volume to markets that are global in extent. One of the groups of these industrial specialties is practically certain to be complex chemicals. As to potentialities for large-scale mass production by huge industries operating in the rapidly growing field of synthetic organic chemicals from petroleum and natural gas hydrocarbons, Texas occupies an enviable position. Unquestionably organizations now engaged in, or planning to enter the field of manufacturing chemicals in Texas, are already giving considerable attention to the possibilities of certain lines of these products in international trade during the post-war period.

Elmer H. Johnson.

EMPLOYMENT AND PAY ROLLS IN TEXAS

December, 1944

	Estimated Number of Workers Employed* Nov., 1944(1)	Dec., 1944(2)	Percentage Change from Nov., 1944	from Dec., 1943	Estimated Amount of Weekly Pay Roll Nov., 1944(1)	Dec., 1944(2)	Percentage Change from Nov., 1944	from Dec., 1943
MANUFACTURING								
All Manufacturing Industries	171,051†	172,922†	+ 1.1	+ 2.4	$6,109,149	$6,163,430	+ 0.9	+ 11.1
Food Products								
Baking	10,562	10,582	+ 0.2	+ 19.1	408,217	422,084	+ 3.4	+ 53.0
Carbonated Beverages	3,521	3,437	− 2.4	− 5.8	103,581	102,765	− 0.8	− 2.8
Confectionery	1,726	1,911	+ 10.7	+ 12.1	24,393	27,514	+ 12.8	+ 20.9
Flour Milling	2,233	2,407	+ 7.8	+ 5.0	74,632	83,823	+ 12.3	+ 28.5
Ice Cream	1,406	1,346	− 4.2	+ 8.3	41,181	39,902	− 3.1	+ 22.9
Meat Packing	6,209	6,235	+ 0.4	− 5.8	217,630	207,221	− 4.8	− 8.7
Textiles								
Cotton Textile Mills	4,970	5,188	+ 4.4	− 8.4	119,814	123,863	+ 3.4	− 2.0
Men's Work Clothing	4,017	3,990	− 0.7	− 5.9	73,299	69,781	− 4.8	− 8.6
Forest Products								
Furniture	1,305	1,300	− 0.3	− 29.6	37,326	37,849	+ 1.4	− 19.5
Planing Mills	1,724	1,747	+ 1.4	− 12.3	55,736	53,528	− 4.0	− 5.4
Saw Mills	14,666	14,765	+ 0.7	− 6.6	272,148	265,726	− 2.4	− 9.8
Paper Boxes	912	958	+ 5.0	− 1.3	21,823	23,549	+ 7.9	− 4.3
Printing and Publishing								
Commercial Printing	2,299	2,456	+ 6.8	− 3.3	83,925	96,734	+ 15.3	+ 3.9
Newspaper Publishing	3,761	3,835	+ 2.0	− 6.1	117,077	120,711	+ 3.1	+ 5.0
Chemical Products								
Cotton Oil Mills	3,319	3,257	− 1.9	− 21.7	61,345	61,412	+ 0.1	− 13.3
Petroleum Refining	25,147	25,381	+ 0.9	+ 9.1	1,467,173	1,471,371	+ 0.3	+ 11.2
Stone and Clay Products								
Brick and Tile	1,656	1,723	+ 4.0	− 0.4	28,959	30,282	+ 4.6	+ 4.1
Cement	718	724	+ 0.8	− 31.6	28,700	29,700	+ 3.5	− 24.5
Iron and Steel Products								
Structural and Ornamental Iron	2,313	2,421	+ 4.7	− 12.4	81,639	87,773	+ 7.5	+ 1.1
NONMANUFACTURING								
Crude Petroleum Production	27,925	27,896	− 0.1	+ 7.1	1,600,970	1,594,541	− 0.4	+ 16.1
Quarrying	(3)	(3)	+ 2.5	− 0.9	(3)	(3)	+ 1.9	+ 7.5
Public Utilities	(3)	(3)	+ 0.1	+ 1.0	(3)	(3)	− 1.1	+ 3.1
Retail Trade	225,509	264,235	+ 17.2	− 3.5	5,540,272	6,432,763	+ 16.1	+ 3.3
Wholesale Trade	62,066	62,507	+ 0.7	− 1.3	2,498,417	2,520,905	+ 0.9	+ 6.8
Dyeing and Cleaning	2,831	2,913	+ 2.9	+ 6.1	69,888	71,209	+ 1.9	+ 17.8
Hotels	19,520	19,872	+ 1.8	+ 3.2	362,249	376,714	+ 4.0	+ 17.1
Power Laundries	13,612	13,546	− 0.5	− 3.8	245,471	253,044	+ 3.1	+ 2.6

CHANGES IN EMPLOYMENT AND PAY ROLLS IN SELECTED CITIES(4)

	Employment Percentage Change Nov., 1944 to Dec., 1944	Dec., 1943 to Dec., 1944	Pay Rolls Percentage Change Nov., 1944 to Dec., 1944	Dec., 1943 to Dec., 1944		Employment Percentage Change Nov., 1944 to Dec., 1944	Dec., 1943 to Dec., 1944	Pay Rolls Percentage Change Nov., 1944 to Dec., 1944	Dec., 1943 to Dec., 1944
Abilene	+ 3.8	− 1.8	+ 5.8	+ 17.7	Galveston	+ 4.6	− 22.8	− 1.9	− 12.0
Amarillo	+ 2.1	− 1.4	+ 2.9	− 2.7	Houston	+ 1.6	− 12.0	+ 6.2	+ 16.5
Austin	+ 8.4	+ 2.6	+ 5.4	+ 2.9	Port Arthur	+ 1.5	+ 11.8	− 0.7	+ 13.2
Beaumont	+ 1.5	+ 3.4	− 1.4	− 3.7	San Antonio	+ 3.3	− 4.9	+ 2.1	+ 0.3
Dallas	+ 5.9	− 3.9	+ 6.1	+ 8.4	Sherman	+ 3.7	+ 41.0	+ 3.9	+ 68.0
El Paso	+ 1.9	+ 5.3	+ 2.6	+ 18.7	Waco	+ 7.3	− 3.7	+ 0.6	+ 3.0
Fort Worth	+ 0.2	− 22.3	+ 5.4	− 9.0	Wichita Falls	+ 0.6	− 1.8	+ 6.9	+ 3.6
Corpus Christi	+ 2.0	(3)	+ 0.8	(3)	STATE	+ 3.1	− 6.4	+ 6.0	− 1.4

ESTIMATED NUMBER OF EMPLOYEES IN NONAGRICULTURAL BUSINESS AND GOVERNMENT ESTABLISHMENTS(6)

	1942(1)	1943(3)	1944		1942(1)	1943	1944
January	1,170,000	1,385,000	1,429,000(2)	July	1,317,000	1,450,000(1)	1,448,000(2)
February	1,199,000	1,397,000	1,433,000(2)	August	1,352,000	1,441,000(2)	1,446,000(2)
March	1,226,000	1,415,000	1,433,000(2)	September	1,373,000	1,448,000(2)	1,432,000(1)
April	1,222,000	1,433,000	1,435,000(2)	October	1,384,000	1,455,000(2)	1,420,000(2)
May	1,251,000	1,458,000	1,435,000(2)	November	1,389,000	1,461,000(2)	
June	1,291,000	1,478,000	1,448,000(2)	December	1,413,700	1,470,000(2)	

*Does not include proprietors, firm members, officers of corporations, or other principal executives. Factory employment excludes also office, sales, technical and professional personnel.
†Does not include strictly war industries.
(1)Revised.
(2)Subject to revision.
(3)Not available.
(4)Based on unweighted figures.
(5)Less than 1/10 of one percent.
Not including self-employed persons, casual workers, or domestic servants, and exclusive of military and maritime personnel. These figures are furnished by the Bureau of Labor Statistics, U.S. Department of Labor.
Prepared from reports from representative Texas establishments to the Bureau of Business Research co-operating with the Bureau of Labor Statistics.
Due to the national emergency, publication of data for certain industries is being withheld until further notice.

POSTAL RECEIPTS

	Dec., 1944	Dec., 1943	Nov., 1944	Year 1944	Year 1943
Abilene	$ 63,701	$ 61,784	$ 48,293	$ 582,825	$ 504,664
Amarillo	83,629	76,429	59,942	715,316	631,345
Austin	139,018	116,003	111,646	1,239,694	1,062,149
Beaumont	67,545	63,031	52,931	605,216	514,780
Big Spring	18,881	16,388	11,518	144,784	120,287
Brownsville	17,876	15,351	11,736	148,792	125,659
Brownwood	42,919	43,210	27,270	319,800	307,929
Childress	10,322	10,010	7,813	76,382	62,532
Cleburne	9,448	7,790	6,005	75,411	60,627
Coleman	6,509	5,808	4,754	66,843	48,430
Corpus Christi	110,817	94,459	69,823	860,556	696,876
Dallas	744,252	634,476	622,341	6,803,433	5,746,272
Del Rio	11,870	9,199	6,329	85,936	70,252
Denison	16,263	16,201	11,003	129,873	114,264
Denton	16,103	14,155	11,685	144,859	119,108
Edinburg	6,418	5,750	4,683	55,959	45,719
El Paso	141,586	148,367	95,035	1,212,688	1,113,635
Fort Worth	336,847	292,117	287,619	3,115,682	2,555,899
Galveston	75,635	67,395	50,330	643,189	565,652
Gladewater	5,693	5,370	4,631	54,498	45,570
Graham	5,182	4,426	3,488	43,916	24,134
Harlingen	24,623	19,853	14,206	181,148	138,139
Houston	586,050	490,890	414,558	4,853,120	4,004,004
Jacksonville	7,584	6,252	4,718	68,557	110,435
Kenedy	2,785	7,988	1,857	29,715	32,590
Kerrville	7,209	6,146	4,168	53,887	45,232
Lubbock	50,126	45,208	40,127	443,264	373,249
Lufkin	10,273	8,958	7,255	95,876	78,246
McAllen	12,620	9,534	8,245	96,955	74,945
Marshall	16,163	14,636	10,758	140,369	113,784
Palestine	11,437	10,605	7,577	102,442	87,131
Pampa	18,572	15,930	10,710	130,305	117,593
Paris	33,928	30,096	23,481	283,459	234,817
Port Arthur	44,454	42,554	26,846	358,990	300,994
San Angelo	37,716	32,101	22,938	287,298	236,732
San Antonio	372,172	360,008	260,668	3,234,769	2,907,310
Sherman	21,088	17,547	13,015	162,104	136,186
Snyder	3,515	3,077	2,638	34,135	25,539
Sweetwater	13,322	10,918	7,336	106,033	89,875
Temple	27,498	24,095	16,106	201,279	154,334
Texarkana	42,697	39,202	28,261	371,623	291,475
Tyler	45,456	44,941	31,200	382,003	337,866
Waco	79,025	72,007	53,243	678,328	574,028
Wichita Falls	67,685	64,938	44,666	536,973	488,487
TOTAL	$ 3,466,513	$ 3,085,203	$ 2,563,452	$29,948,283	$25,488,774

NOTE: Compiled from reports from Texas chambers of commerce to the Bureau of Business Research.

DECEMBER CREDIT RATIOS IN TEXAS DEPARTMENT AND APPAREL STORES

(Expressed in Per Cent)

	Number of Stores Reporting	Ratio of Credit Sales to Net Sales		Ratio of Collections to Outstandings		Ratio of Credit Salaries to Credit Sales	
		1944	1943	1944	1943	1944	1943
All Stores	56	42.3	41.6	64.6	64.2	0.8	1.0
Stores Grouped by Cities:							
Austin	6	36.3	36.8	73.6	75.5	0.7	0.8
Bryan	3	39.5	33.6	55.9	50.1	0.6	1.1
Dallas	7	52.5	51.7	61.1	60.2	0.6	0.8
El Paso	3	37.8	38.4	65.4	69.6	0.8	0.9
Fort Worth	6	42.9	38.2	68.2	65.9	0.9	1.1
Houston	8	39.3	39.4	64.6	60.9	1.2	1.2
San Antonio	4	37.0	37.9	59.6	67.4	0.9	1.1
Waco	4	38.5	39.7	70.8	62.3	0.9	1.2
All Others	15	35.8	36.6	68.0	74.1	0.7	0.8
Stores Grouped According to Type of Store:							
Department Store (Annual Volume Over $500,000)	17	40.9	39.9	66.2	65.4	1.0	1.1
Department Stores (Annual Volume under $500,000)	10	35.9	36.5	71.1	71.3	0.9	1.0
Dry-Goods-Apparel Stores	2	37.9	37.8	65.9	65.7	1.2	1.2
Women's Specialty Shops	16	49.4	49.0	60.1	59.0	0.4	0.6
Men's Clothing Stores	11	38.8	39.5	75.4	70.2	0.9	0.9
Stores Grouped According to Volume of Net Sales During 1943:							
Over $2,500,000	17	40.8	38.8	63.5	62.9	0.9	1.1
$2,500,000 down to $1,000,000	10	31.2	38.2	76.3	73.2	0.8	1.2
$1,000,000 down to $500,000	11	34.7	35.5	68.1	71.9	0.9	1.2
Less than $500,000	18	29.9	31.4	70.5	65.2	1.7	2.0

NOTE: The ratios shown for each year, in the order in which they appear from left to right are obtained by the following computations: (1) Credit Sales divided by Net Sales. (2) Collections during the month divided by the total accounts unpaid on the first of the month. (3) Salaries of the credit department divided by credit sales. The data are reported to the Bureau of Business Research by Texas retail stores.

BUILDING PERMITS

	Dec., 1944	Dec., 1943	Nov., 1944	Year 1944	Year 1943
Abilene	$ 20,440	$ 7,912	$ 4,015	$ 347,795	$ 238,449
Amarillo	47,342	11,730	147,200	1,263,425	556,409
Austin	53,181	93,014	61,844	712,857	439,957
Beaumont	33,925	15,616	48,048	824,712	2,085,370
Big Spring	12,750	3,293	31,190	358,600	106,164
Brownsville	4,235	2,552	19,540	126,415	68,088
Brownwood	26,400	1,680	2,400	211,142	24,243
Cleburne	5,002		3,825*		
Corpus Christi	167,169	45,385	152,370	2,103,155	3,079,742
Dallas	339,639	576,164	386,032	7,176,621	5,534,869
Denton	1,450	1,510	1,300	26,240	28,845
Edinburg	1,880	1,645	2,065	61,659	39,329
El Paso	34,795	42,458	48,167	1,368,389	465,121
Fort Worth	156,935	204,295	276,192	3,417,602	6,508,870
Gladewater	200	35	5,100	29,695	7,000
Harlingen	0	0	6,450	422,510	10,148
Houston	501,510	995,380	459,310	9,173,253	8,458,060
Jacksonville	3,912	2,080	100	66,187	14,955
Kenedy	1,000	75	0	9,450	5,740
Kerrville	9,200	506	8,125	38,867	58,409
Lubbock	131,116	37,825	78,741	1,163,977	270,731
McAllen	13,350	21,820	17,850	221,500	99,573
Marshall	6,557	7,959	12,529	152,146	343,294
Midland	47,970	8,225	58,150	544,895	45,769
New Braunfels	1,883	790	7,465	52,137	14,702
Palestine	2,805	950	1,305	18,177	36,774
Pampa	400	0	3,900	32,526	436,195
Paris	17,885	78,355	3,725	194,441	265,105
Port Arthur	39,535	11,885	20,360	328,942	210,768
Seguin	2,330	1,800	1,088		36,772*
Sherman	16,795	9,408	10,365	145,301	132,088
Snyder	0	1,550	0	0	42,400
Sweetwater	4,575	1,415	110,610	249,380	40,530
Texarkana	15,195	22,625	41,150	171,556	276,483
Tyler	19,487	12,822	21,900	258,420	128,657
Waco	32,707	56,240	48,200	1,306,659	785,788
Wichita Falls	9,175	82,300	24,404	265,606	280,524
TOTAL	$ 1,792,926	$ 2,383,924	$ 2,162,340	$32,935,023	$31,425,632

*Not included in total.

NOTE: Compiled from reports from Texas chambers of commerce to the Bureau of Business Research.

TEXAS CHARTERS

	Dec., 1944	Dec., 1943	Nov., 1944	Year 1944	Year 1943
Domestic Corporations:					
Capitalization*	$1,072	$1,289	$909	$11,211	$9,196
Number	67	50	59	672	444
Classification of new corporations:					
Banking-Finance	2	3	0	16	22
Manufacturing	8	6	6	69	61
Merchandising	27	13	26	190	88
Oil	7	1	6	45	33
Public Service	4	2	0	17	5
Real Estate Building	10	13	7	111	125
Transportation	3	3	4	28	18
All Others	6	9	10	196	96
Number capitalized at less than $5,000	34	29	24	208	180
Number capitalized at $100,000 or more	3	2	1	25	15
Foreign Corporations (Number)	16	20	2	169	107

*In thousands.

NOTE: Compiled from records of the Secretary of State.

COMMODITY PRICES

	Dec., 1944	Dec., 1943	Nov., 1944
Wholesale Prices:			
U.S. Bureau of Labor Statistics (1926=100)	104.7	103.2	104.4
Farm Prices:			
U.S. Bureau of Labor Statistics (1926=100)	125.5	121.8	124.4
Retail Prices:			
Food (U.S. Bureau of Labor Statistics (1935–1930=100)	*	137.1	136.5
Cost of Living Index (1935–1939 =100)	*	124.4	126.5
Department Stores (Fairchild's Publications January, 1931=100)	113.4	113.1	113.4

*Not to be released until January 31.

PERCENTAGE CHANGES IN CONSUMPTION OF ELECTRIC POWER

	Dec., 1944 from Dec., 1943	Dec., 1944 from Nov., 1944	Year, 1944 from Year, 1943
Commercial	+ 9.5	+ 1.0	+16.0
Industrial	+17.2	− 1.0	+21.1
Residential	+12.7	+ 7.6	− 3.3
All Others	−38.8	+ 4.0	−12.7
TOTAL	+ 7.0	+ 1.1	+10.0

Prepared from reports of 10 electric power companies to the Bureau of Business Research.

DAIRY PRODUCTS MANUFACTURED IN PLANTS IN TEXAS

Product and Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
CREAMERY BUTTER (1000 lb.)													
1944*	2,043	2,126	2,765	3,535	4,008	3,527	3,569	2,792	2,535	2,138	1,549	1,717	32,304
1943*	2,636	2,743	3,076	3,652	4,544	4,120	4,363	3,584	2,621	2,582	2,210	2,044	38,175
1930–39 average	2,074	2,109	2,392	3,138	3,556	3,166	4,113	2,867	2,513	2,608	2,301	2,211	33,048
ICE CREAM (1000 gal.)‡													
1944*	1,115	1,211	1,520	1,687	2,491	2,944	3,200	2,997	2,193	1,897	1,680	1,075	24,010
1943*	1,125	1,187	1,396	1,770	2,302	2,478	2,778	2,898	2,125	1,744	1,398	996	22,197
1930–39 average	215	262	434	570	752	893	904	845	686	460	259	205	6,485
AMERICAN CHEESE (1000 lb.)													
1944*	902	956	1,229	1,884	2,273	2,159	2,076	1,621	1,372	1,148	869	208	17,197
1943*	914	948	1,063	1,594	2,010	1,866	1,782	1,319	984	786	625	694	14,585
1930–39 average	554	590	737	1,050	1,215	1,129	1,119	1,025	866	852	718	641	10,496
MILK EQUIVALENT OF DAIRY PRODUCTS† (1000 lb.)													
1944*	67,873	71,519	92,663	119,889	144,977	137,502	140,357	115,184	97,137	82,777	63,531	57,443	1,190,852
1943*	80,106	83,301	94,470	118,447	149,577	139,948	147,397	126,028	92,753	84,922	70,334	62,657	1,249,940
1930–39 average	54,675	57,139	67,456	89,641	104,323	97,562	97,075	89,185	76,165	73,444	60,119	55,872	922,656

*Estimates of production made by the Bureau of Business Research.

†Milk Equivalent of Dairy products was calculated from production data by the Bureau of Business Research.

‡Includes ice cream, sherbets, ices, etc.

NOTE: 10-year average production on creamery butter, ice cream and American cheese based on data from the Agricultural Marketing Service, U.S.D.A.

DECEMBER SHIPMENTS OF LIVE STOCK CONVERTED TO A RAIL-CAR BASIS*

	Cattle		Calves		Swine		Sheep		Total	
	1944	1943	1944	1943	1944	1943	1944	1943	1944	1943
Total Interstate Plus Fort Worth	4,764	3,697	1,125	993	405	1,186	522	510	6,816	6,386
Total Intrastate Omitting Fort Worth	1,059	436	198	57	31	101	115	62	1,403	656
TOTAL SHIPMENTS	5,823	4,133	1,323	1,050	436	1,287	637	572	8,219	7,042

TEXAS CAR-LOT* SHIPMENTS OF LIVE STOCK FOR YEAR-TO-DATE

	Cattle		Calves		Swine		Sheep		Total	
	1944	1943	1944	1943	1944	1943	1944	1943	1944	1943
Total Interstate Plus Fort Worth	64,013	63,194	14,134	11,745	13,688	16,420	13,952	13,337	105,787	104,696
Total Intrastate Omitting Fort Worth	9,242	8,299	1,831	1,927	850	832	2,609	1,389	14,532	12,447
TOTAL SHIPMENTS	73,255	71,493	15,965	13,672	14,538	17,252	16,561	14,726	120,319	117,143

*Rail-car Basis: Cattle, 30 head per car; calves, 60; swine, 80; and sheep, 250.

Fort Worth shipments are combined with interstate forwardings in order that the bulk of market disappearance for the month may be shown.

NOTE: These data are furnished the United States Bureau of Agricultural Economics by railway officials through more than 1,500 station agents, representing every livestock shipping point in the State. The data are compiled by the Bureau of Business Research.

DECEMBER, 1944, CARLOAD MOVEMENT OF POULTRY AND EGGS

Shipments from Texas Stations

	Cars of Poultry						Cars of Eggs					
	Chickens		Turkeys		Shell		Frozen		Dried		Shell Equivalent†	
*Destination	1944	1943	1944	1943	1944	1943	1944	1943	1944	1943	1944	1943
TOTAL	13	16	142	141	28	14	42	84	117	101	1,048	990
Intrastate	3	0	7	16	16	11	9	41	14	1	146	101
Interstate	10	16	135	125	12	3	33	43	103	100	902	889
Receipts at Texas Stations												
TOTAL	3	4	3	5	78	63	79	35	11	11	324	221
Intrastate	1	1	3	4	14	8	15	19	11	0	132	46
Interstate	2	3	0	1	64	55	64	16	0	11	192	175

*The destination above is the first destination as shown by the original waybill. Changes in destination brought about by diversion factors are not shown.

†Dried eggs and frozen eggs are converted to a shell egg equivalent on the following basis: 1 rail carload of dried eggs=8 carloads of shell eggs, and 1 carload of frozen eggs=2 carloads of shell eggs.

NOTE: These data furnished to the Division of Agricultural Statistics, B.A. E., by railroad officials through agents at all stations which originate and receive carload shipments of poultry and eggs. The data are compiled by the Bureau of Business Research.

PETROLEUM

Daily Average Production (In Barrels)

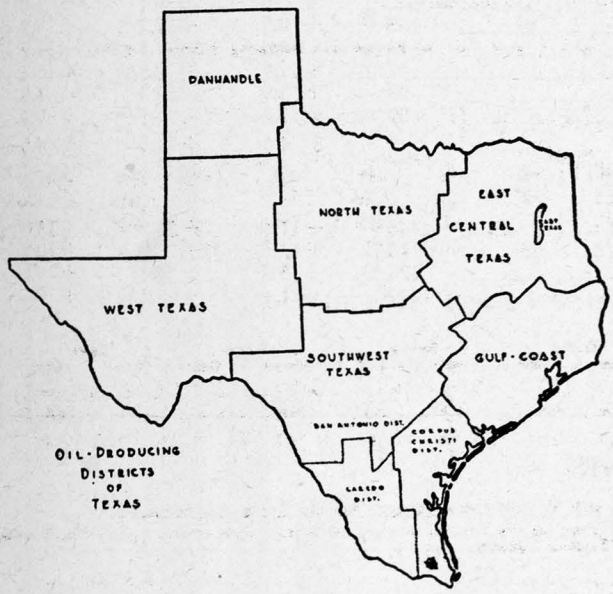
	Dec., 1944	Dec., 1943	Nov., 1944
Coastal Texas*	553,050	520,650	551,700
East Central Texas	142,250	125,650	145,150
East Texas	370,250	365,600	368,250
North Texas	143,250	143,350	150,950
Panhandle	90,100	93,450	94,650
Southwest Texas	345,850	291,400	345,750
West Texas	472,000	355,050	476,000
STATE	2,116,750	1,895,150	2,132,450
UNITED STATES	4,710,500	4,371,850	4,730,500

*Includes Conroe.

NOTE: From American Petroleum Institute. See accompanying map showing the oil producing districts of Texas.

Gasoline sales as indicated by taxes collected by the State Comptroller were: November, 1944, 103,241,404 gallons; November, 1943, 103,031,954 gallons; October, 1944, 109,452,159 gallons.

November sales of gasoline to the United States Government as recorded by motor fuel distributors in Texas were 266,526,450 gallons.



CEMENT

(In Thousands of Barrels)

	Nov., 1944	Nov., 1943	Oct., 1944
Texas Plants			
Production	523	730	520
Shipments	478	603	579
Stocks	893	1,010	848
United States			
Production	8,304	9,218	9,194
Shipments	7,380	8,405	10,263
Stocks	16,973	20,386	16,075
Capacity Operated	42.0%	45.0%	45.0%

NOTE: From U.S. Department of Interior, Bureau of Mines.

DECEMBER RETAIL SALES OF INDEPENDENT STORES IN TEXAS

(By Districts)

	Number of Establishments Reporting	Percentage Changes: Dec., 1944 from Dec., 1943	Dec., 1944 from Nov., 1944	Year 1944 from Year 1943
TOTAL TEXAS	893	+15.8	+30.0	+11.6
TEXAS STORES GROUPED BY PRODUCING AREAS				
District 1–N	60	+14.2	+ 8.9	+13.4
Amarillo	24	+11.3	+26.9	
Plainview	9	+14.4	+18.2	
All Others	27	+17.6	− 6.7	
District 1–S	24	+11.0	+16.2	+11.2
Lubbock	14	+10.4	+16.5	
All Others	10	+12.5	+15.5	
District 2	66	+ 9.2	+25.7	+ 0.3
District 3	27	+23.1	+20.9	+14.2
District 4	215	+18.0	+33.6	+14.1
Dallas	34	+18.2	+33.9	
Fort Worth	30	+20.1	+34.9	
Waco	25	+16.4	+35.9	
All Others	126	+12.9	+27.3	
District 5	108	+14.7	+24.0	+10.4
District 6	33	+14.9	+26.9	+15.9
District 7	44	+13.4	+41.7	+15.9
District 8	161	+17.2	+30.5	+17.2
Austin	12	+22.0	+46.3	
Corpus Christi	21	+11.9	+ 6.5	
San Antonio	42	+17.9	+33.9	
All Others	86	+12.1	+20.5	
District 9	89	+11.5	+ 30.2	+ 8.8
Houston	40	+13.7	+30.4	
All Others	49	+ 5.1	+29.4	
District 10	24	+21.4	+36.5	+15.0
District 10A	42	+11.9	+25.1	+11.0

NOTE: Prepared from reports of independent retail stores to the Bureau of Business Research, coöperating with the U.S. Bureau of the Census.

LUMBER

(In Board Feet)

	Dec., 1944	Dec., 1943	Nov., 1944
Southern Pine Mills:			
Average Weekly Production per unit	184,643	227,374	186,196
Average Weekly Shipments per unit	179,927	222,565	193,555
Average Unfilled Orders per unit, end of month	1,513,360	1,409,337	1,214,233

NOTE: From Southern Pine Association.

TEXAS COMMERCIAL FAILURES

	Dec., 1944	Dec., 1943	Nov., 1944	Year 1944	Year 1943
Number	0	0	0	1	9
Liabilities*	0	0	0	$8	$243
Assets*	0	0	0	6	198
Average Liabilities per failure*	0	0	0	8	27

*In thousands.

NOTE: From Dun and Bradstreet, Inc.

DECEMBER RETAIL SALES OF INDEPENDENT STORES IN TEXAS

	Number of Establishments Reporting	Percentage Changes in Dollar Sales: Dec., 1944 from Dec., 1943	Dec., 1944 from Nov., 1944	Year 1944 from Year 1943
TOTAL TEXAS	893	+15.8	+30.0	+11.6
STORES GROUPED BY LINE OF GOODS CARRIED:				
APPAREL	893	+20.1	+42.2	+13.8
Family Clothing Stores	23	+14.0	+60.7	+ 8.0
Men's and Boys' Clothing Stores	34	+18.2	+55.9	+ 7.6
Shoe Stores	16	+43.3	+26.1	+11.7
Women's Specialty Shops	32	+20.7	+38.4	+19.0
AUTOMOTIVE*	72	+ 3.2	+ 6.9	+ 6.1
Motor Vehicle Dealers	62	+ 0.2	+ 2.0	+ 6.0
COUNTRY GENERAL	87	+16.6	+16.5	+10.1
DEPARTMENT STORES	56	+17.5	+34.6	+14.1
DRUG STORES	99	+ 7.9	+34.9	+10.9
DRY GOODS AND GENERAL MERCHANDISE	29	+21.7	+60.5	+ 9.6
FILLING STATIONS	23	− 6.3	+ 1.3	+ 4.5
FLORISTS	22	+18.0	+80.0	+26.1
FOOD*	120	+17.0	+ 9.6	+12.4
Grocery Stores	31	+13.4	+11.8	+ 7.1
Grocery and Meat Stores	81	+17.3	+ 9.2	+13.5
FURNITURE AND HOUSEHOLD*	61	+18.5	+14.2	+ 4.2
Furniture Stores	55	+20.0	+14.3	+ 5.6
JEWELRY	23	+ 2.8	+130.7	− 1.2
LUMBER, BUILDING, AND HARDWARE*	155	+ 8.5	+11.2	+ 4.9
Farm Implement Dealers	13	+ 0.6	− 4.4	+21.9
Hardware Stores	47	+17.7	+ 8.5	+16.4
Lumber and Building Material Dealers	93	+ 5.5	−19.2	− 1.0
RESTAURANTS	29	− 7.2	− 7.7	+ 9.3
ALL OTHER STORES	7	+ 4.6	+21.5	+ 4.5
TEXAS STORES GROUPED ACCORDING TO POPULATION OF CITY:				
All Stores in Cities of—				
Over 100,000 Population	146	+17.4	+33.2	+13.8
50,000–100,000 Population	113	+12.7	+29.9	+10.5
2,500–50,000 Population	425	+13.0	+27.4	+ 9.0
Less than 2,500 Population	209	+11.4	+ 6.2	+ 9.5

*Group total includes kinds of business other than the classification listed.

Prepared from reports of independent retail stores to the Bureau of BusinessResearch, coöperating with the U.S. Bureau of the Census.

CONTENTS

Business Review and Prospect, F. A. Buechel 3
Fundamental Basis of Cotton Problems, A. B. Cox 8
Recent Industrial Advance in Texas, Elmer H. Johnson 9

LIST OF CHARTS

Estimated Texas Retail Sales, 1944 1
Indexes of Business Activities in Texas 2

LIST OF TABLES

Building Permits 21
Carload Movement of Poultry and Eggs 22
Cement 23
Charters 21
Commercial Failures 23
Commodity Prices 21
Cotton Balance Sheet 8
Credit Ratios in Texas Retail Stores 20
Dairy Products Manufactured in Plants in Texas 22
Employment and Pay Rolls in Texas 19
Lumber 23
Percentage Changes in Consumption of Electric Power 21
Petroleum 23
Postal Receipts 20
Retail Sales of Independent Stores in Texas 23, 24
Shipments of Live Stock 22