AN INDUSTRIAL PRODUCTION INDEX FOR THE HOUSTON ECONOMIC AREA

A Thesis

Presented to

the Faculty of the Department of Economic

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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by

Antonio Furino

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ABSTRACT

A monthly index of industrial production is a significant economic indicator. A comparison of trends in physical output by the regional industries with trends in other regions or in the country as a whole is useful to the planner, the businessman, and the manager in their measuring and anticipating cyclical fluctuations in manufacturing output or, more generally, in their acquiring a deeper understanding of the economic environment. Also, an industrial production index affords a host of potentialities in the field of regional economic research.

The purpose of this study is to develop an index of Industrial Production for the Houston metropolitan community and its service area. The selected region is called the Houston Economic Area and consists of the counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Mongomery and Waller.

After a review of the existing indexes on industrial production, the criteria used in defining the region under study are presented. Then, a list of the fundamental assumptions made concerning the sources of information and the methods of constructing, revising and adjusting the index are followed by a delineation of the procedure for its computation.

Limitations of the index are mainly related to the statistical crudeness imposed by scarcity of necessary data. However, inasmuch as 79 per cent of the index's content reflects actual physical output, it is believed that the index retains valuable properties as a tool of analysis.

For those industries lacking meaningful data -- as a unit of measurement -- man-hours are used to reflect value added in production. These series should be adjusted to allow for estimated trends in productivity (output per man-hours). At the time of the computation of the index, the information available on Houston industries was not sufficient to warrant the formulation of reliable productivity factors and the indexes were left unadjusted. However, the procedure that will be employed in making productivity adjustment when the necessary data will be collected is outlined.

The Index of Industrial Production of the Houston Economic Area is presently released monthly to all the participating firms. A release to the general public will follow the planned revisions and refinements of the index -- namely, the use of new weights based on the 1963 Census of Manufactures, the introduction of productivity factors, and the computation of new seasonals.

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Without the financial support of the Texas National Bank of Commerce of Houston, Texas, and the help of its prestige within the local business community, this study could not have been possible. To the Directors of the Bank and to the head of its Economic Department, Dr. David E. Snell, who closely followed the progress of this study and furnished support and guidance whenever necessary, the author's warmest thanks.

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CHAPTER I

INTRODUCTION

Introductory Remarks

The usefulness of regional information is multifold. Because the regional economic experience is not the same as the national, it becomes necessary to isolate relationships and closely examine the variations of the two in order to furnish explanations of the differences. Until very recently little was known about what makes for local economic growth in the United States. The concentration of economic thinking and policy recommendations on national economic problems had left almost unnoticed those matters which affect economic growth at the local, state, and regional levels.

In the last few years, the growing need of stimulating substantial economic development and the contribution and dedication of minds like Professor Walter Isard, have filled many theoretical gaps in our knowledge of the regional economies. However, in spite of the intensified discussion on the subject, there remains a serious lack of data on many of its important aspects. And even the theoretically well-prepared regional economist is handicapped and often frustrated in his endeavor by the absence of a number of measures which are basic in probing regional economic experience.

The problem of developing economic indicators at state and regional levels exists and demands solution.

An economic indicator is any data series which can be used to show changes in the rate and volume of economic activity. If the indicators have reasonably clear and stable cyclical characteristics, they will be helpful in learning about the business cycle of the region and in predicting future trends.[1]

A monthly index of industrial production for a region falls into the group of significant economic indicators. Comparing trends of physical output by the regional industries with trends in other regions or with those in the country as a whole, is useful to the planner, the businessman, the manager in measuring and anticipating cyclical fluctuations in manufacturing output or, more generally, in acquiring a deeper understanding of the economic environment.

This study was initiated in the Summer of 1963 for the National Bank of Commerce of Houston whose name, after a merger with the Texas National Bank of Houston, has been changed to Texas National Bank of Commerce. Director of the project from its inception has been Dr. David A. Snell, Economic Advisor of the Bank. Owing to the cooperation of the participating firms, the efficiency of the economic department of the Bank and the use of the Bank's data processing facilities, a preliminary index was released in October, 1963, and has been published monthly since. To now, the index has been subject to only minor revisions, but more comprehensive ones are planned.

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[1]Comments by Harry F. Stark at the Interstate Conference on Labor Statistics, Rutgers University, June, 1964.

Purpose and Scope

It is the purpose of this study to develop an index of Industrial Production for the Houston metropolitan community and its service area. The region will be called the Houston Economic Area and will consist of the counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller.

This study will not fully explore and evaluate the information content of a regional industrial index, nor discuss exhaustively its value in Regional Economic Analysis. Its main purpose is more empirical.

Relevant existing indexes on industrial production, the methodology followed in their construction and their limitations are discussed in chapter two. The criteria used in defining the region under study are presented in chapter three. In chapter four are listed the fundamental assumptions made concerning the sources of information and the methods of constructing, revising and adjusting the index. Chapters five and six deal with the procedure for the computation of the Index of Industrial Production for the Houston Economic Area. Finally, in chapter seven, the limitations of the index are indicated and some uses of the index and areas demanding further research suggested.

While the research efforts will be necessarily focused on the Houston industrial economic environment, it is hoped that the study will serve as a useful suggestion to the business community in developing those tools of regional analysis which are necessary to strengthen and further develop regional economic science.

Definition of Terms

In the introductory remarks a brief definition of an economic indicator has been presented. It is time, now, to turn to the conceptual definition of a region. There is a variety of purposes for which one might want to use the demarcation of a region,[2] and therefore, this favorite subject of discussion among geographers appears still unsettled. "Self-sufficiency" was the concept used in some early discussions of the meaning of the word region;[3] then, "homogeneity," which regards a region as an area in which nearly all parts, because of similarity of rescurces or population characteristics, carry on the same type of activity, has been considered a more operational concept to demarcate a region.[4] The two concepts in economically developed areas tend to conflict as homogeneity of activity means specialization of production, and implies dependence on exchange of products with other areas.

In connection with regional economic growth, the most appropriate concept of a region seems to be a geographic area within which there exists an especially high degree of interdependence among individual incomes.[5] Close to this concept is the approach that emphasizes

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[2]A region has also been defined simply, "An area delimited for a purpose."

[3]National Resource Committee, Regional Factors in National Planning (Washington, 1935).

[4]John Mayer, "Regional Economics: A Survey," The American Economic Review, LIII (March, 1963), p. 22.

[5]Joseph L. Fisher and Edgar M. Hoover, "Research in Regional Economic Growth," Problems in the Study of Economic Growth, National Bureau of Economic Research (New York, 1949), p. 178.

"nodality" or "polarization" often around some urban center. Finally, the approach called "programming" or "policy oriented," emphasizes the administrative coherence or identity between the area being studied and available political institutions for effectuating policy decisions.[6] In practice, regional definitions may represent a compromise between these approaches. Among the many considerations facing the researcher, we will mention two of the most significant. Firstly, a region's boundaries must follow those of the major areas used in tabulating general-purpose statistics, if such tabulations are to be used effectively in analysis and planning for the region. Secondly, a region considered with any reference to possible action by state or local government authorities must logically follow the boundaries of such jurisdicational units.

In tracing the boundaries of the region which has been called the Houston Economic Area, it is believed that the chosen area reasonably satisfies the definition of a region as a socio-economic time-space where a set of economic relations and activities of the regional community are, during certain periods, at least partially closed within the region territory, and as the arbitrarily created territorial units of the political, social, and economic organization of human society. By "economic relations and activities" is meant such basic economic relations as those between production and consumption, personal income and expenditures and places of work and dwelling.

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[6]Mayer, loc. cit.

A more detailed explanation of the criteria justifying the inclusion of the seven counties contiguous to Harris County in the Houston Economic Area will be presented in chapter three.

Methodology

Basically, an index number is a weighted average of a set of relatives taken either over space or over time. At the time of the compilation of the index, the chosen base was the six-month period of January-June, 1963. The choice of such a base was forced by the desire of using physical output as a measure of industrial activity, instead of the usual man-hour data, and by the impossibility of obtaining historical data prior to January, 1963, from the cooperating firms. The base has since been changed to a 1963-1964 average and, when enough time has elapsed, it will be made to agree with base years suggested by the Bureau of the Budget.

When, for some industries like electrical machinery, a useful standard of measurement for output was non-existent, man-hour data were used. The problem of adjusting the month-to-month changes in man-hours for productivity trends in order to provide a good reflection of production trends, will be discussed in detail in a later chapter.

The use of physical output data at the cost of foregoing the possibility of historical comparison and seasonal adjustments has been indicated by two main considerations. Firstly, the foremost problem in creating and computing a regional index of industrial production using productive man-hour[7] data lies in the fact that in some industries,

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[7]Productive man-hours are defined as man-hours including all direct labor and supervisory man-hours. Excluded are administrative and maintenance man-hours.

employment is not a true reflector of the physical output of the industry and the adjustment of man-hour data to allow for trend in productivity represent only the trend and not the short-term variations. Furthermore, there is a considerable interval between times when revisions in the productivity estimates are possible; in the interim, only approximations of the current productivity trends can be made.[8] Finally, statistics of production workers employment in the Houston Economic Area are incomplete and often not available in the form of continuous time series.

The lack of sufficient historical data did not allow, at first, the computation of seasonal factors. They have been computed at the end of the year 1964, and a revision is planned by the end of 1965.

The 1958 Census of Manufactures was used to determine the relative importance of each manufacturing industry to total industrial activity.

The Standard Industrial Classification Manual (with supplement) published by the Bureau of the Budget in its 1957 revision was used to provide industry and product descriptions and a valid classification system.

The contribution of utilities and mining sectors to the industrial activity of the area was significant enough to warrant inclusion in the aggregate index. Mining and utilities are included in the industrial production index published by the Board of Governors of the Federal Reserve System at the national level; but only mining is

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[8] Methodology of the Texas Industrial Production Index, A mimeographed paper prepared by the Federal Reserve Board Bank of Dallas (May, 1962).

included in the one index of Industrial Production available for the State of Texas. The construction industry was not included in the aggregate index because reliable data were not available.

The basic simplicity of the approach did not rule out several technical problems. Statistics for physical output and for productive man-hours were not available for the chosen region. Thus, a system for the collection and manipulation of the data had to be devised.

For the mining and utilities sectors, estimates had to be made from the available statistics and whatever first-hand information could be obtained on a continuous basis.

Because the Texas National Bank of Commerce undertook the study with the purpose of performing a service for the local business community, practical problems of timing, division of labor, coordination of efforts and distribution of the information had to be solved. Presently, the index is released less than thirty days after the end of the month reported.

CHAPTER II

EXISTING INDEXES OF INDUSTRIAL PRODUCTION

The National Indexes

An index of Physical Volume of Manufacturing at a national level is prepared by the Bureau of the Census jointly with the Board of Governors of the Federal Reserve System. At the time of this study, two publications of the index were available. One published in 1952[1] contains detailed production indexes for 1947 relative to the 1939 base period. The indexes computed for major industry groups and individual industries as well as for all manufacturing are largely based on data published in Volume II, Statistics by Industry of the 1947 Census of Manufactures. The indexes are based upon similar methodology and represent a continuation of those made by Solomon Fabricant[2] for the years 1899-1939.

The other publication was released in 1958[3] and contains measures of changes in manufacturing output from 1947 to 1954 with historical comparison back to 1899. Also, in this case the basic data used were obtained from the industrial statistics of the Census of Manufactures. Approximately 6,000 individual product items were separately classified for the 1947-54 calculations as compared with approximately 1,700 available for the 1939-47 calculations.

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[1]Census of Manufactures: 1947, Indexes of Production, U. S. Government Printing Office, Washington, 1952.

[2]Solomon Fabricant, The Output of Manufacturing Industries, 1899-1937, National Bureau of Economic Research, New York, 1940..

[3]Census of Manufactures: 1954, Indexes of Production, U. S. Government Printing Office, Washington, 1958, Vol. IV.

The purpose of the two previsouly mentioned agencies is to construct aggregate measures of output changes that are free from the influence of price changes. "Physical Volume" is defined as the change in value of net output, or value added, at constant prices. Net output of an industry in a given period is obtained by subtracting from the value of its product (gross output) the contributions to this value made by other industries in the form of raw materials, fuels and other inputs supplied by them and consumed in manufacture.[4] This difference is also called "Value Added."

Using constant prices taken from a chosen base, the index is calculated for the 1939-47 period using the formula:

$$\text{Index}_{\text{net}}: \frac{\Sigma q_{47} p_c - \Sigma Q_{47} p_c}{\Sigma q_{39} p_c - \Sigma Q_{39} p_c},$$

where q represents the quantities of each of the materials produced; pc--the constant prices of q; Q--the quantities of each of the materials consumed; and Pc--the constant prices of Q. To obtain constant prices, the Marshall-Edgeworth or cross-weighted formula was used as it was in Fabricant's work. A similar procedure (with some refinements in the periods used to deflate prices) was followed for the 1947-54 comparison.[5]

The major value of these indexes lies in the fact that they provide bench marks for current production indexes. Census of Manufactures data are usually more comprehensive than those available monthly or annually from other sources. Therefore, current monthly

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[4]U. S. Census of Manufactures: 1947, op. cit., p. 2.

[5]U. S. Census of Manufactures: 1954, op. cit., pp. 14-15.

indexes can be improved by adjusting their levels to bench mark indexes based on census data. However, census indexes are available only at infrequent intervals of time and the data usually lag publication from four to eight years.[6] Furthermore, they represent a narrower area of economic activity than those covering "industrial production" which in some indexes includes not only manufacturing but also mining, utilities and construction output. Finally, the Census' index is computed only for given years.

One of the most widely used indicators of business activity on the national level is the Federal Reserve monthly index of the physical volume of industrial production. It was first compiled during the early 1920's in cooperation with the Harvard Committee on Economic Research and a number of other organizations. Since then, the index has been subject to four major revisions.

In the 1940 revision, man-hour series adjusted for broad changes in productivity were introduced to provide direct representation of production in the machinery industries and some other industries for which neither output nor materials input statistics were available. The reference base period was shifted from 1923-25 to 1935-39.

The second major revision was made in 1953. Comprehensive annual indexes were introduced to facilitate and improve adjustments of monthly series to bench mark levels, for both product and man-hour series. New industries and product series were added, series were grouped according to the new standard industrial classification, and the reference base was again shifted to the average for 1947-49.

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[6]The 1958 indexes of production will be published during the year 1966.

In 1959 the index was broadened to include utility output of electricity and gas. The enlarged index is based on 207 monthly series, quite an increase in coverage from the 60 monthly series on which the FRB index was originally constructed.

An improvement of considerable analytic value was the division of the 207 monthly series into three major market groups: consumer goods, equipment and ordnance, and materials, together with appropriate subgroups. Since the production series represent total industry output, they include output for export as well as for domestic use. However, they do not include imported materials although processing of imported materials is included. Subtotals of the three summary market sectors are provided for such groups as consumer automotive products, commercial equipment, and construction materials, partly to facilitate analytical comparisons with sales and expenditures data. An important use of such comparisons is a timely indication of changes in the physical volume of business inventories occurring when sharp divergencies develop between movements in expenditure and production data, or between output of final products and output of materials.

As in earlier revisions, the weight base was brought forward to take account of changes in price relationships.[7] Also, all indexes were shifted to a base of 1957 as 100.[8] In 1962, the Federal Reserve index of industrial production was shifted to a new comparison base (1957-59=100) in line with the recommendations of the Bureau of the

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[7]Federal Reserve Board, Industrial Production 1959 Revision, Washington, 1960, pp. 1-75.

[8]For a discussion of some of the technical considerations involved in revising the index, see Victor Perlo's, "The Revised Index of Industrial Production," American Economic Review, June, 1962, pp. 496-522.

Budget. At the same time, a general revision in seasonal factors and interim adjustments in the levels of eight series have been introduced in the index. The revisions substantially modify the cyclical patterns of some of the component indexes.[9]

Originally, the FRB index was constructed from physical output data. Man-hour series, corrected for estimated productivity changes, were added later to increase coverage. In 1953 deflated value series were introduced as an annual adjustment mechanism. The importance of deflated value series were increased in the 1959 revision. The percentage decrease of the quantity series as part of the global index displeased some users of the FRB index. Their argument was based on the contention that the validity of an index of products as a tool of analysis depends upon its construction from physical quantities and not values. In other words, the information content should be of how much was produced in physical terms and not value terms. The use of a deflator can approximate the same result but it is subject to a second order of error.[10]

Value added data for the year 1957 were the basis for the weights in both the 1959 and the 1962 revisions. With the change in the comparison base, 1957 value added data were adjusted to 1957-59. For each series the 1957-59 value added figure in the 1957 prices was obtained

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[9]Federal Reserve Board, Industrial Production, 1957-59 Base, Washington, 1960, pp. 1-7.

[10]Victor Perlo, "The Revised Index of Industrial Production," American Economic Review, June, 1962, pp. 502-508. See also the reply by Clayton Gehman on the same issue, pp. 513-522, and "Industrial Production in Current Analysis," by the same author, American Statistical Association, 1960 Proceedings of the Business and Economic Statistics Section.

by dividing 1957 value added by the ratio of production in 1957 to production in 1957-59.

The algebraic formulation of the procedure for calculating the production index for the period January, 1953 on a 1957 base is shown below:

(1) Multiply the relative on a 1957 base for an individual series for the given month by its 1957 weight. Symbolically, this may be represented as follows:

$$\frac{q_x}{q_{57}} \times 100 \cdot \frac{q_{57}p_{57}}{\Sigma q_{57}p_{57}}$$

The first ratio is called the relative and the second the weight, which is value added for the series divided by total value added in industrial production in the year 1957, with value added expressed as 1957 quantity times 1957 value added per unit of quantity. Multiplying the relative by its weight gives the weighted value for each series.

(2) Total the weighted relatives to obtain an aggregate for the given month, or symbolically:

$$\Sigma \left(\frac{q_x}{q_{57}} \times 100 \cdot \frac{q_{57}p_{57}}{\Sigma q_{57}p_{57}} \right)$$

(3) Divide the total of the weighted relatives for the given month by the aggregate in 1957, to obtain subtotal and total indexes.

For a subgroup of the total index the symbolic expression is as follows:

$$\frac{\sum\left(\frac{q_x}{q_{57}} \times 100 \cdot \frac{q_{57}p_{57}}{q_{57}p_{57}}\right)}{\frac{\sum^* q_{57}p_{57}}{\sum q_{57}p_{57}}}$$

where $\sum^*$ represents a summation of series in the subgroup as distinct from the summation without the asterisk which includes all series in the total index. This reduces to

$$\frac{\sum^* q_x p_{57}}{\sum^* q_{57}p_{57}} \times 100$$

which is the ratio of group value added in the given month to the comparable value added in 1957, in value added per unit prices of 1957.

For the total index the symbolic expression is:

$$\frac{\sum\left(\frac{q_x}{q_{57}} \times 100 \cdot \frac{q_{57}p_{57}}{q_{57}p_{57}}\right)}{\frac{\sum q_{57}p_{57}}{\sum q_{57}p_{57}}}$$

This reduces to

$$\frac{\sum q_x p_{57}}{\sum q_{57}p_{57}} \times 100$$

which is the ratio of total value added in the given month to the comparable value added in 1957, both in value added per unit prices of 1957. This is the symbolic expression of the index of total industrial production for any month of the period beginning with January, 1953.[11]

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[11] Federal Reserve Board, Industrial Production 1959 Revision, Washington, 1960, pp. 40-41.

For the pre-January, 1953 period a more complex procedure is required for each aggregate and the total index.[12] The FRB index is also adjusted for seasonal variation. The technique used is a ratio-to-moving-average method described in "Adjustment for Seasonal Variation" published in the Federal Reserve Bulletin for June, 1941, pages 518-528. Since the 1959 revision, the seasonal adjustment work has been facilitated by use of a computer and charting machine, and by the availability of the Census Method II program for seasonal adjustment by electronic computers.

The Index of the Federal Reserve Bank of Dallas[13]

The Texas Industrial Production Index published monthly by the Federal Reserve Bank of Dallas is based on 21 monthly series. After the 1962 Revision, the 21 categories, or industry groups, conform to their respective two-digit standard industrial classifications as published in the 1957 Standard Industrial Classification of the Bureau of the Budget. The 21 categories are combined into three subindexes which reflect the production of durable goods manufactures, non-durable goods manufactures, and minerals--including fuels.

Two main sources of information are used to obtain the basic data. First, approximately 51 per cent of the weight of the index is dependent upon man-hour data supplied by the Texas Employment Commission. Secondly, approximately 49 per cent of the weight of the Index is based upon production data received from the Bureau of Mines and the Texas Railroad Commission.

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[12] Federal Reserve Board, Ibid., p. 41.

[13] Federal Reserve Bank of Dallas, "Methodology of the Texas Industrial Production Index," 1962 Revision, (Mimeographed).

In the 1962 Revision, the Index is weighted on the basis of the Value Added by Manufactures as reported in the 1958 Census of Manufactures and Census of Mineral Industries for Texas. The base used is the 1957-59 period as 100. The weighted relative method, as described for FRB index, is employed.

For the categories based on man-hour data, adjustments are made to allow for estimated trends in productivity (output-per-man-hour). The productivity factors employed are computed mainly from deflated value of shipments data obtained from the Census of Manufactures, Texas, for 1947, 1954, and 1958.

While the index as a whole represents a reasonably good indication of the output of Texas factories and mines, its foremost shortcoming lies in its high dependence on man-hour data and on the difficulty of computing meaningful productivity factors.

The Index for Massachusetts and New England of the Federal Reserve Bank of Boston[14]

The Index for the Federal Reserve Bank of Boston was developed by Professor Harry Ernst of Tufts University in 1955. The index has been published monthly since 1957 and data are available from 1950.

The Index was based on three main types of information: man-hours worked by production workers, their output-per-man-hour, and the consumption of kilowatt hours of electricity by industry in the various New England states.

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[14]Federal Reserve Bank of Boston, "Manufacturing Indexes--New England and Massachusetts: New Tools of Analysis," New England Business Review, Boston, January, 1957, pp. 8-10. Also Federal Reserve Bank of Boston, "Regional Manufacturing Indexes--Progress Report," Technical Memorandum, (Mimeographed), November, 1957.

The problem of computing productivity had been solved by linking output per man-hour changes to changes in use of kilowatts of electricity per man-hour. It was assumed that each man-hour yields greater output on the average as more electrical power is used in the productive process.

An estimating equation based on this assumption was used to derive output per man-hour. Then this man-hour output was multiplied by the number of man-hours in the industry to arrive at total monthly production. Output data used in preparing the estimating equations were of two sorts. In six industries accounting for 42 per cent of New England's manufacturing output in 1953, deflated value of product data was employed. In the remaining industries, undeflated value-added-by-manufacturing data were used.

The industry indexes compiled using value added data were deflated for price changes before estimating trends in total manufacturing output. Weights derived from the relative position of each industry in its 1950-52 contribution to value created by manufacturing were applied to provide a simple index for the region.

The advantage of this technique was to rely on only two types of comprehensive data. This could make possible a uniform and simultaneous collection of data from each state; and, if all the suppliers of monthly data held to the planned schedule, all the needed information could reach the computation centers in time to have monthly manufacturing output estimates published within thirty days of the close of the month.[15] However, having based the estimating equations on the relationship of kilowatt hours and production worker man-hours to actual output in the

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[15] Ibid., pp. 8-10.

base period, new estimating equations are needed periodically to account for changes in technology. To obtain them requires the expensive and time-consuming process of collecting and analyzing more output data. For this reason, a new index has been devised by the Federal Reserve Bank of Boston based on a new concept originated by Dr. Paul Anderson of the Bank's research staff.[16]

In the new index, output derived from man-hours production workers is estimated by setting up a proportion between New England and the nation with output on one side and man-hour input on the other. Thus, it takes advantage of the great amount of national output data presented monthly in the Federal Reserve Board indexes. The assumption is that, for each major industry, output in New England in any month is in the same ratio to output in the United States for that month as man-hours in the region are to man-hours in the nation, each adjusted for output per man-hours.

The following is the algebraic formulation of the procedure used:

1. The proportion between the region and the nation is

$$\frac{A'_t}{A_t} = \frac{K'_s \; L'_t}{K_s \; L_t}$$

2. The estimated New England output is

$$A'_t = \frac{K'_s \; L'_t}{K_s \; L_t} \cdot A_t$$

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[16]Federal Reserve Bank of Boston, "Measuring New England's Manufacutring Production," New England Business Review, Boston, October, 1963, pp. 6-7.

Where A_t is the Federal Reserve Board Production index for the nation for month "t," A'_t is the estimate of New England production for month "t," K_s is the ratio of value-added by manufacture to production worker man-hours for the nation for year "s," K'_s is the ratio of value-added by manufacture to production workers man-hours for New England for year "s," L_t is the production workers man-hours for the nation for month "t," L'_t is the production workers man-hours for New England for month "t."

The formula is used to estimate output for each of the 21 2-digit industries[17] with the result expressed as a relative of the 1957-59 average.[18]

Other Indexes

The need for regional production estimates has motivated other attempts to construct a regional index of production. The Bureau of Economic Research of Rutgers University has published a monthly index of manufacturing production for the State of New Jersey.[19] The index uses monthly series from 1947 to 1958. The index has not been brought up to date since 1958.

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[17]See Bureau of the Budget, Standard Industrial Classification Manual, Washington, 1957.

[18]Federal Reserve Bank of Boston, Technical Supplement to "Measuring New England's Manufacturing Production," New England Business Review, October, 1963, (mimeographed).

[19]Gerhard, Bry, Charlotte, Boshau, and Richard Kilgore, A Monthly Index of Manufacturing Production in New Jersey, Bureau of Economic Research of Rutgers University, New Brunswick, 1963.

The basic method used consists of the application of national output ratios[20] to man-hours of New Jersey production workers. This computation is done separately for each of twenty major industries. The estimating equation for any single month is as follows:

$$\text{New Jersey Production} = \text{N. J. Man-hours} \times \frac{\text{U. S. Production}}{\text{U. S. Man-hours}}$$

The results are weighted using 1947 and 1949 value-added data and combined into nine industry groups, into a durable and non-durable goods class, and finally into a consolidated production index for all manufacturing. The chosen bench mark is 1947-49=100.

The evident advantage of simplicity in this approach as compared with the more sophisticated one of the Federal Reserve Bank of Boston may or may not be over shadowed by results so crude as to lose all their usefulness. The New Jersey Index was tested by the authors using for comparison ratios of value of product or of value added to labor input. This was necessary because regional output ratios were not available in physical terms. The tests seemed to prove, that for the State of New Jersey, production estimates which apply national output ratios to regional labor input lead to fairly realistic results. The same approach when applied to other regions may not prove as reliable.[21]

One more index of manufacturing output is presently available in published form. The region is that of the State of New York and it is

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[20]National Output Ratios: ratios of manufacturing output to man-hours of production workers.

[21]Ibid., pp. 5-17.

computed and published by the New York State Department of Commerce in Albany. The basic approach consists of correcting Federal Reserve Board Indexes of national production in various manufacturing industries for difference in employment changes between New York State and that of the United States. Manufacturing output is estimated as labor input adjusted for productivity changes. The labor input measure is total employment. The productivity adjustment is based on the changing relationship between production and employment on the national level as measured by the Federal Reserve Bank Index and the corresponding Bureau of Labor Statistics employment data.

CHAPTER III

THE HOUSTON ECONOMIC AREA

It has been noted that the investigator dealing with the problem of defining a region will choose the component areas of the region in terms of specified physical, socio-economic or other criteria. However, serious constraints to his choice may be imposed by the form in which statistical data are available for the purpose involved.

Standard Metropolitan Statistical Areas

The Committee on Standard Metropolitan Statistical Areas bases its definition of a SMSA on two considerations: First, the presence of a city or cities of specified population to constitute the central city and to identify the county in which it is located as the central county; secondly, the existence of economic and social relationships with contiguous counties which are metropolitan in character, so that the periphery of the specific metropolitan area may be determined. A Standard Metropolitan Statistical Area must include at least one city or two contiguous cities with 50,000 or more inhabitants. The metropolitan character relates primarily to the attributes of non-agricultural workers.[1] Finally, the criteria of integration used relates to the economic and social communication between the outlying

[1]At least 75 per cent of the labor force of the county must be in the non-agricultural labor force.

counties and the central county.[2]

The criteria used by the Committee reflect the historical experience of most of the American cities where the manufacturing plants and the related distributing and service firms are clustered within the county or around the metropolitan area's central city. However, since World War II, the development of petrochemical complexes has changed the growth pattern of many industrial areas in the United States.

Review of the Current Criteria for Defining Standard Metropolitan Statistical Areas.

One of the important features of a petrochemical complex is the existence of a network of pipelines which moves feedstocks from plant to plant within the complex. Because of the use of this means of transportation, it is not necessary for the plants of the complex to be clustered within a narrow area but they can be built at considerable distances apart, yet, the movement of raw materials by means of pipeline network ties the area together in a closely interrelated economic pattern. Since the petrochemical plants and their allied distributing and service firms are spread throughout the complex, workers can readily find jobs near their homes, or homes near their jobs so that the inter-county movement of workers is minimized. Because of the decentralization of job producing activities throughout the area encompassing the "new" industrial complexes, it becomes difficult to "fit" some regions,

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[2]A county is regarded as integrated with the county containing the central cities of the area if either of the following criteria is met: (a) if 15 per cent of the workers living in the county work in the county containing central cities of the area, or (b) if 25 per cent of those working in the county live in the county or counties containing central cities of the area.

although economically integrated, to the definitional criteria used by the Committee on Standard Metropolitan Statistical Areas. The decentralization distinguishing the new petrochemical complexes creates the need for new definitional criteria so that the statistical data collected for the SMSA would accurately reflect the broader economic area.

The Houston Petrochemical Complex

The Houston complex[3] is most representative of the new development that is occurring in the industrial growth pattern of the United States. Originating on the banks of the Houston Ship Channel, industrial activity in Houston has spread out into the counties contiguous to Harris County. Raw materials, intermediates and products can be transferred from plant to plant at low cost by means of an extensive pipeline network. The petrochemical industry uses feedstocks supplied by the refineries and utilizes other raw materials found in the area. Since materials can be interchanged by pipelines, the plants in this petrochemical complex did not locate in close proximity but scattered in an eight county area (Harris, Brazoria, Chambers, Fort Bend, Galveston, Liberty, Montgomery, and Waller) which is home for 1.07 million barrels per stream day of refining capacity. The economic prosperity in all these counties is influenced to a considerable extent by the annual and seasonal movement of materials through the pipeline network. Also, a number of major oil companies have their drilling, production, marketing,

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[3]A more complete discussion on this subject is contained in a Brief and Exhibits on behalf of the Houston Chamber of Commerce presented before the Federal Committee on Standard Metropolitan Statistical Areas in the matter of the Houston Metropolitan Statistical Area.

refining and engineering headquarters in this area.

The number of workers living in a county adjoining Harris County who find it necessary to travel to Harris County jobsites is in inverse ratio to the progress of industrialization in the county. For instance, the number of workers coming from the counties of Galveston and Brazoria to work in Harris County is comparatively small since these two counties are highly industrialized sections of the petrochemical complex.

The strong economic ties based on the unique industrial relationships are reflected by other indicators. A traffic survey revealed that an average of 39,196 people living in the seven counties contiguous to Harris County drive daily into Harris County to work, shop and transact business. Houston, the dominant city in the area, serves as headquarters for retailing, wholesaling, communications, transportation, finance, management, education, amusements, convention and services activity.

The correspondent connections of Houston banks with banks located in the area constitute the majority of those banks correspondent connections.

The circulation of newspapers beyond the borders of a community is a commonly used measure of that community's influence on the neighboring area. ABC (Audit Bureau of Circulation) reports show that more than half of the households in each county contiguous to Harris County, except Chambers and Galveston counties, receive at least one Houston newspaper. In the Chambers and Galveston counties the percentage decreased to 44 per cent. The number of telephone calls and that of leased telephone circuits between Harris County and points

in the contiguous counties also shows a significant community of interest.

For the reasons discussed, it is believed that defining the Houston Economic Area as comprehending Harris County and the adjoining seven counties of Brazoria, Chambers, Fort Bend, Galveston, Liberty, Montgomery and Waller satisfies the definition of socio-economic time-space as well as that of administrative relationships. That the boundaries selected have statistical significance is partially proved by a recent decision of the Federal Committee on Standard Metropolitan Areas to include Brazoria, Fort Bend, Liberty and Montgomery counties in the data for the Houston SMSA in the 1963 Census of Manufactures.

CHAPTER IV

FUNDAMENTAL ASSUMPTIONS

Before initiating the compilation of the index, several fundamental assumptions are made concerning the sources of information and the methods of constructing, revising and adjusting the index.

The first assumption is that the Census of Manufactures is an accurate and basic source of statistics on value added, value of shipments and other measures of manufacturing activity. As it will be seen, the Index of Industrial Production for the Houston economic area depends on census data for the weights necessary to compute aggregate indexes of groups and subgroups.

Second: The Standard Industrial Classification Manual in its latest 1957 edition with supplement is a valid classification system and the industry and product description used therein are comprehensive and representative.

Third: Physical output is the best measure of industrial activity. However, in some industries, like electrical machinery, a useful standard of measurement for output is nonexistent or in some cases physical output data are not collected by the firms. Whenever direct production data re not available, man-hour data are a reliable indicator of month-to-month changes in industrial output. It is recognized, however, that for a few highly mechanized industries, the month-to-month changes in man-hours need to be adjusted for productivity trends in order to provide a good reflection of production trend beyond a few months time,

since new plants and improve technology cause significant increases in output per man-hour.

Fourth: A January-June 1963 base for the Houston production index was temporarily accepted due to the impossibility of obtaining from cooperating firms historical data before January, 1963. However, since then, the base has been changed to a 1963-64 average and when sufficient data are collected, the base year will be made to agree with base period set by the Bureau of the Budget.

Fifth: The distributions of value added by manufacturing obtained from data taken from the 1958 Census of Manufactures and the 1958 Census of Mineral Industries are the best available data on which weights to determine the relative importance of each manufacturing industry to total industrial activity can be calculated. The 1958 Census of Manufactures was the closest source of bench mark data available as weights. When the 1963 Censuses of Manufactures and Mineral Industries are published, bench marks from the later publications will be used.

Sixth: The contribution of utilities and mining sectors to the industrial activity of the area are significant enough to warrant their inclusion in the aggregate index; and the relative estimates of value added by utility and mining activity are adequate.

Seventh: The construction industry was not included in the index because reliable data for this industry were not available. The exclusion, it is believed, will not significantly impair the validity of the index.

CHAPTER V

GATHERING THE RELEVANT DATA

The Sample

The representativeness of a regional index depends on the cooperation of an adequate panel of firms.

All the firms with more than 10 employees located in the Houston Economic Area and listed in the Directory of Manufactures published yearly by the University of Texas, were invited to cooperate. After the first and second letters in which the project undertaken by the bank was explained to the chief executive of the company, extensive telephone conversations and personal meetings were required to discuss with the firms' key executives the usefulness of the index and the secrecy with which the data would be handled. In the case of large companies, the local executives sometimes had to clear the matter with a home office located out of town.

Other delays were caused by the necessity of setting up in each firm a routine by which the necessary data could be recorded and sent to the bank.

Out of the approximately 2,000 firms operating in the Houston Economic Area, 210 originally agreed to cooperate. These firms have been estimated to produce more than 90 per cent of the total industrial output for the region. Currently, the number of cooperating firms is 397 participants.

More than three months elapsed in the attempt to secure an adequate panel and probably it would not have been possible to obtain satisfactory results without the prestige of the Texas National Bank of Commerce, the foresight of the Area's businessmen, and the persuasive ability of the economic advisor of the Bank, Mr. David A. Snell.

The Disclosure Clause

In the letter sent to the prospective participants, the following paragraph refers to the secrecy with which the data were to be handled at the Bank:

> All data that are furnished will be held in secrecy. No more than three people in the Bank will see the data, all of whom are associated with the economics department. Further, all data will be combined into an aggregate so that in all cases, individual production data would be hidden in one figure that is massed from about six hundred individual facts. Industry indexes will be compiled only where at least ten firms report for that industry. Much of the data we request are already submitted to other agencies, especially government. However, these agencies do not publish them on a strict county, regional basis. In their present form, they are not suitable for the things we wish to do. The index itself will be mailed directly to participants, and will be released several days later as public information.

The Questionnaire

All the firms operating in the region were classified by SIC (Standard Industrial Classification) two-digit numbers and a questionnaire was prepared covering all the products made by the firms in each two-digit SIC number. Then, each product listed was identified with a four-digit number which also calssified the individual product by product market as durable and non-durable goods, output of consumer goods and output of equipment, etc. The individual firms were identified with another two-digit number which was stamped on the questionnaire before it was mailed.

There were twenty-one SIC numbers used as follow:

SIC 13, Products Recovered from Natural Gas; SIC 20, Food and Kindred Products; SIC 22, Textile and Mill Products; SIC 23, Apparel and Other Finished Products Made From Fabrices and Similar Materials; SIC 24, Lumber and Wood Products; SIC 25, Furniture and Fixtures; SIC 26, Paper and Allied Products; SIC 27, Printing and Publishing; SIC 28, Chemical and Allied Products; SIC 29, Petroleum Refining; SIC 30, Rubber and Plastic Products; SIC 31, Leather and Leather Products; SIC 32, Stone, Clay, and Glass Products; SIC 33, Primary Metal Industry; SIC 34, Fabricated Metal Products; SIC 35, Machinery Except Electrical; SIC 36, Electrical Machinery; SIC 37, Transportation, SIC 38, Instruments and Related Products; SIC 39, Miscellaneous Manufacturing Industries; and SIC 49, Natural Gas Transmission and Electric Power.

The questionnaire asked for physical output measure which would cover "thru-puts" of all product categories for one calendar month regardless of whether the products were sold. The firms were asked not to report raw inventory additions still in raw inventory status at end of month as these had not yet been applied to actual physical production, but rather had to await such processing. Where a process was initiated during a month but was not completed, the participants were asked to estimate the quantity that was put in process and the percentage of completion at the end of the month. Companies generating their own electrical power and using their own supply of natural gas were asked to report such internally produced supply, regardless of whether they were partially or totally sufficient for the needs of each participant. Companies whose output fell into more than one category were asked to insert data for each category.

The unit of measurement suggested was the one commonly used for the specific product. Whenever a physical output measure was not meaningful or impossible to obtain, the company was asked to report man-hour data. Man-hours were defined as those used in direct production of the commodity not including man-hours of administrative or maintenance personnel but including hours worked by supervisors. A complete set of the questionnaires used can be found in Appendix A.

Recording the Data

As soon as the data were received by the economics department of the Bank, the monthly output data were recorded on 8 x 5 index cards, a sample of which is shown in Appendix B. A different card was used for each product. Each card was identified by 17 code numbers as follow: First three numbers referred to the numerical sequence of the index cards; fourth and fifth numbers referred to the major SIC industry; sixth and seventh numbers, the sub-product within a major SIC industry; eighth, ninth, tenth and eleventh numbers, the individual product code and classification by product market (see Appendix C); twelfth number, the county in which the cooperating firm operates (see Appendix C); thirteenth, fourteenth and fifteenth numbers, the particular company reporting within the major industry identified with the fourth and fifth numbers; sixteenth and seventeenth numbers, the unit of measurement used to report output (see Appendix C).

After the data were recorded in the coded card, the questionnaire used by the cooperating company in reporting output was destroyed.

The information recorded in the index card was then transferred into IBM punched cards for computing purposes.

CHAPTER VI

COMPUTING THE INDEX

Total Monthly Production by Industry

The first step in computing the index is to calculate the total monthly production by industry. To do this, the reported quantities of physical output are reduced to a common denominator as tons, cubic feet, gallons, barrels and similar measures.

When more than one common denominator must be established for an industry, an individual index is computed for each product and a weighted average is taken of the resulting indexes. The weights used are obtained from the 1958 Census of Manufactures and are based on the relative importance of the SIC three-digit industry subgroups to the industry's total value added.

Until January, 1965, the base period used throughout the index computations has been January-June 1963. Since the beginning of the year 1965, the base period has been changed to a 1963-64 average.

Adjustments to the Man-Hour Series

The industries reporting man-hours data are: SIC 22, Textile and Mill Products; SIC 23, Apparel and Other Finished Products Made From Fabrics and Similar Materials; part of SIC 24, Lumber and Wood Products (See questionnaire in the Appendix); SIC 25, Furniture and Fixtures; SIC 27, Printing and Publishing; SIC 31, Leather and Leather Products; SIC 35, Machinery Except Electrical; SIC 36, Electrical Machinery; SIC 37, Transportation; SIC 38, Instruments and Related Products; and

SIC 39, Miscellaneous Manufacturing Industries.

These series should be adjusted to allow for estimated trends in productivity (output per man-hour). At the time of the computation of the index, the information available on Houston industries was not sufficient to warrant the formulation of reliable productivity factors and the indexes were left unadjusted. Two reasons suggested this decision: Firstly, too much arbitrary judgment was required; secondly, the indexes requiring productivity adjustments were representative of only 21 per cent of the total industrial activity in the chosen region.

It is expected that by the end of the year 1965, the necessary data will be collected for the Houston Economic Area and by the summer of 1966, adequate productivity factors will be computed.

The procedure that will be employed in making productivity adjustment will be patterned after the one used by the Federal Reserve Bank of Dallas for its Texas Industrial Production Index. Following is a description of such procedure as employed by the Federal Reserve Bank of Dallas. The productivity factors employed are computed mainly from shipments data in the Census of Manufactures, Texas, for 1947, 1954, and 1958.

For each of the index categories, available data on the value of shipments for Texas are obtained, broken down by four-digit standard industrial classifications. For the 1947-54 period, the values for 1947 and 1954 are deflated by the corresponding wholesale price indexes. Next, the deflated 1954 values are combined, using as weights the 1947 value-added figures for the four-digit classifications. The result is an indication of physical output for each of the categories. For the

1954-58 period, a similar method is used. Four-digit value of shipments data, however, are for 1954 and 1958 and the weights employed are based on 1958 value added.

Comparable man-hour data for 1947, 1954, and 1958 are obtained from the Census reports for the same four-digit classifications used above. In each of the classifications, the man-hour total reported for production workers is expanded to reflect total man-hours for all employees, because the man-hour portions of the index which require adjustments are based on total employment. The resulting man-hour estimates for the two terminal years and one intermediate year are then summed for each category. Next, constant dollar shipments in each category are divided by the corresponding man-hour totals. The quotients for 1947 are related to 1954, and 1954 to 1958. The result is an indication of percentage changes in real shipments per man-hour, or productivity, over the 1947-54 and 1954-58 periods.

Monthly productivity factors are calculated by dividing the percentage changes over the 7-year period 1947-54 by 84, the number of months in the period, and the 1954-58 period by 48. These factors represent index-point changes per month and reflect the assumption of straight-line arithmetic changes in productivity over the period. The factors are computed in this way because of the simplicity of the calculation and because there is no strong evidence to support the use of alternative geometric or variable rate of change. (See Appendix D for monthly productivity factors for 1947-54, 1954-58 and projections for later years).

The application of the monthly productivity factors to adjust the index is then calculated. First, the factors are converted to monthly productivity indexes, based on 1957-59 as 100. To do this, the productivity indexes are started with July, 1958, as 100, and the monthly factors for the prior period are subtracted going back through January, 1947, and are added going forward through December, 1958. Next, the monthly productivity indexes are multiplied by the corresponding man-hour indexes to yield production indexes for the categories using man-hour data.

For the period after 1958, tentative estimates of productivity changes are based on an analysis of the limited information available for Texas industries and on comparisons of the available 1947-58 and 1958-61 productivity trends for the United States. These estimated productivity factors (again representing monthly index-point changes on a 1957-59 period base) are added to the existing monthly productivity indexes beginning with January, 1959, and running through December, 1961. Extensions of the estimated productivity factor at a constant arithmetic rate will be made until revisions are made possible by publication of the 1963 Census of Manufactures.

There are some exceptions to the standard method of using shipments data to estimate the basic productivity factors. Shipments or production data for the 1947-54 period representing at least 55 per cent of the total value added for each category are available for 9 of the 17 index categories requiring productivity adjustment. In these cases, the estimated productivity trends are based directly on the shipments (production) data in the manner previously described. For the other

eight categories, the reported shipments data are inadequate to indicate productivity trends. The estimates for six of these are based, instead, upon trends in deflated value added per man-hour. This method is considered less reliable because of the possibility of wider differences between the trends of value added and gross production and because of the problems involved in deflating value added with the available price indexes. For these reasons, the deflated value-added trends are adjusted for the differences between the corresponding physical output and deflated value-added trends in the Nation. The productivity estimates are based on the adjusted trends of value added in the case of these categories: paper and allied products, textile mill products, and chemicals and allied products. Only the estimates for primary metals and transportation equipment are based directly on deflated value added, and the indications in these cases seemed reasonable in view of other information. The productivity estimates for the two remaining categories -- leather and leather products and "other nondurable goods" -- are based directly on the relevant national productivity trends. In all instances, the indicated productivity trends for Texas are compared with national trends computed from total man-hours for all employees and the Board's production index. Comparisons are also made with available productivity studies of the Bureau of Labor Statistics.

For the 1954-58 period, the conventional "value of shipments" method described above is used to estimate productivity factors for eight of the 17 categories. These components represent about one-half of the total weight of the groups for which man-hours were used in the computation. Deflated value added, modified by differences between

corresponding physical output and deflated value added in the Nation, is used for seven of the nine remaining categories; while for the two other components, relevant national productivity trends are utilized. Computational adjustments are made in each major category for changes in four-digit classifications between the 1954 and 1958 Censuses if they exist.

An example of the computation necessary under the conventional "value of shipments" method is given in Appendix D.

Weighting

After the above computions, indexes for the 21 categories must be weighted to combine them into three subindexes which reflect manufacturing, mining and utilities output. The construction for a total manufactures index is also based on subindexes reflecting the production of durable goods manufactures and non-durable goods manufactures.

The weights are based on the distribution of the value added by each of the components to industrial production in Harris County. The reason only Harris County value added data are used in the weight computation is that detailed statistics for the other counties are not complete. The "disclosure clause" with which the Bureau of Census guarantees the secrecy of the data for individual firms, impeded the publication of the data for many industries located in the smaller counties. However, approximately 76 per cent of the industrial establishments operating in the Houston Economic Area are located in Harris County and account for about 80 per cent of the area's total employment. Also, 80 per cent of the value added by manufactures located in the eight counties area is generated in Harris County. When the 1963 bench

marks are available, the use of the new HSMA data as mentioned before will insure a greater and more representative coverage.

Data for value added by manufactures were obtained from the 1958 Census of Manufactures. Value added by mineral industries and utilities had to be estimated.

The 1958 Census of Mineral Industries reports value added, value of shipments and payroll data for the State of Texas; but for Harris County only value of shipments and payroll data are given. The assumption is made that the ratio of value added in mining less payroll over value of shipments in mining less payroll in the State of Texas is the same for Harris County, and an estimate of Harris County value added in mining is obtained.

For estimating value added by utilities, it is assumed that the value added per employee in the Houston Lighting and Power Company is representative of the per capita value added in the utility industry in the Houston Economic Area. The HL & P Company employed 52.9 per cent of all employees in the industry in 1958. During the same year, the HL & P Company accounted for 56.9 per cent of the total utility payroll paid.

Value added data for the Houston Lighting and Power Company were computed, adding wages, profit and depreciation figures for 1958.

Per capita value added data for the HL & P Company times the number of employees in the industry resulted in an estimate of the value added by utilities in Harris County for the year 1958.

For practical purposes and in order to create the subindexes, the value added of each of the categories in the various major groups

(manufacturing, utilities, etc.) and subgroups (durable and non-durable goods) is divided by the total value added by that group or subgroup. Thus, for each component, a percentage of its respective subindex is assigned, and these percentages are used as a weight to combine the index numbers of the categories into the subindexes (see Appendix E).

Corrections for Days Worked During the Month

For continuous industries[1] corrections for days worked are not necessary when seasonal adjustements are calculated from a long period of time. Because the index will be computed on a permanent basis from the year 1963, the amount of work necessary to make days-worked corrections in this case was considered out of proportion with the advantages resulting from the computation.

For discontinuous industries[2] seasonal factors cannot discount the variations on days worked each month over a period of years. Therefore, days-worked adjustments are necessary. They have been computed monthly by calculating average daily output or, where applicable, average man-hours per day. Then, the present month is adjusted to the previous month with a leveling factor derived by dividing the present monthly average daily output or man-hours by the preceding monthly average daily output or man-hours.

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[1]Continuous industries are those whose production continues without interruption for holidays and weekends (e.g., chemical industries).

[2]Discontinuous industries are those whose operations are interrupted on weekends, holidays and stops at a set time every day (e.g., apparel, fabricated metals, etc.).

Seasonal Adjustments

Seasonal adjustments are derived by using an adaptation of a ratio-to-moving-average approach (Census Method II) on the computer of the Texas National Bank of Commerce.

Seasonal factors have been applied only since January, 1965. A complete recalculation of the index with seasonal adjustments back to January, 1963, is planned for the summer of 1965 when new bench marks and productivity adjustments will be used.

CHAPTER VII

CONCLUSIONS

The construction of an index of industrial production for the Houston Economic Area was motivated by the general concern over the absence of useful information on the behavior of regional economies. Although limited in its scope and still in need of more statistical sophistication, it is believed that it could serve as a useful tool of analysis and stimulate further research in regional economics.

For the business manager, the index permits an improved understanding of overall production output trends in the area, the overall growth of the region over several years, and the seasonal behavior of output. The quality of decisions affecting internal operating efficiency and thereby profitability should be considerably enhanced. Further, the business manager should become acquainted in a defined way with the impact of local output changes on his own operation, as well as having a better understanding of the nature that output changes in his firm and industry have on economic development elsewhere in this region. The comparison of seasonal and business cycle trends for each sub-industry can be helpful to those studying diversification programs within the same major industry for the purpose of mitigating irregularity of earnings in one of the sub-groups. Evaluation of market potential and the firm's competitive position can be made by relating

the output of the firm's customers to the company's production and sales.

Also, an industrial production index affords a host of potentialities for research into: labor productivity in the various industries; structural changes and shifts among industries in the area; correlation of output changes to seasonal variations in the demand for working capital; the nature and consequence of short-term and long-run employment changes; long-term capital demands and supplies as production increase or as output shifts among industries in the area; periodical correlation with census data as in the case of production changing at a different rate than value of shipments to give some indication of the price pattern prevailing in a given industry.

Theories of growth, especially those based on development stages, consider the industrial sector as the relevant one in determining and in qualifying the level of growth of a region.[1] J. Marczewski in a recent study on the economic growth of France,[2] devises an analytical tool to distinguish different types of growth, using a weighted average rate of growth of industrial product, a simple average rate of growth of industrial product and the relative movements of the two.

The three parameters of the different types of growth are based on the general reservation that over time individual industries follow a pattern of growth in which the rate of growth tends to rise less quickly as the industry increases in size. During an industry's infancy,

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[1]See Walter G. Hoffmann, The Growth of Industrial Economics, Manchester University Press, Manchester, 1958.

[2]J. Marczewski, "Some Aspects of Economic Growth of France, 1660-1958," Economic Development and Cultural Changes, Vol. IX, April, 1961, p. 385.

when its rate of growth tends to be highest, it has the least impact on the overall growth of the economy. But if the industry is a large one, the fall of its rate of growth with maturity may have great bearing on the rate of growth of the region -- both through its direct contribution to the growth of the national product and by its indirect effect through structural interdependence linkage.

Marczewski's study draws attention to the utility of disaggregating broad industrial sectors, such as manufacturing, so as to reveal significant diverse rates of growth in the component industries. Such analysis may well reveal critical trends which are masked when using a highly aggregative approach. An acceleration of overall growth in manufacturing might give a false sense of well-being. The growth may be limited to few large "old" industries and may be a prelude to a condition of structural obsolescence. To avoid such a state of affairs, there would have to be development of new industries.

Also, we can argue that, if we assume optimality in the location of the existing industries within the region and if demand coefficients, leakages in the system, and the point of capacity of single firms are known, industrial production information can then be used to determine the time and place where new capital expenditures would be needed and to estimate its effect on regional service industries and on regional income, employment, housing requirements and buying power.

In this conceptual framework, an industrial production index ceases to be historical data and becomes powerful tool in the difficult art of planning and prediction.

The index is an evolving concept and tool. Continued refinements and improvements are necessary to increase its usefulness and accuracy. The limitations of the present index are mainly related to its lack of statistical sophistication caused by the shortness of the period within which production data have been collected.

One valuable attribute of the index is that except for a few industries, it measures actual output transferred to finished inventory. Man-hours are used to reflect value added in production for a few industries that account for about 21 per cent of the index's content. Actually, man-hours are a superior measurement of value added in those industries where finished output transferred to inventory is either highly erratic due to the custom nature of the product, or where finished output does not mirror real production because of wide changes in jobsites each month that cause drastic variations in the time necessary to finish one unit of product. For such non-general cases, man-hours produces a better guide to industrial activity. Actual output, however, is a more desirable measure of all other industries and is so used.

With the change in the base period (from January-June 1963 average, to 1963-64 average) and the introduction of seasonal adjustments, the reliability of the index was enhanced for interpreting underlying trends in regional production. However, in comparing the index with State and National Industrial Production Indexes, it should be pointed out that monthly fluctuations will be generally larger than is the case in the industrial indexes covering either the state or the nation.

Consequently, the number or range of offsets is more restricted. Loss of production, for instance, cannot be readily offset where a plant is shut down for repair, or when labor strikes are in existence. A resumption of production, on the other hand, tends to raise the index in the same proportion as the decline, both of which may be large.

Also, the importance of industries vary between a small region, a larger one, and the entire economy. Therefore, weights assigned to each industry would be different in the indexes. Trends in production are not identical in the three geographic areas. The standard of production unit reported by the participants is often different. And, finally, base periods are different.

The Index of Industrial Production of the Houston Economic Area is presently released monthly to all the participating firms. A release to the general public will follow the planned revisions and refinements of the index -- namely, the use of new weights based on the 1963 Census of Manufactures, the introduction of productivity factors, and the computation of new seasonals.

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APPENDIXES

APPENDIX A

QUESTIONNAIRES FOR PRODUCTION DATA REPORTS

Questionnaire I

PHYSICAL OUTPUT RECORD

SIC 13 - Products Recovered from Natural Gas

Month _____

0011 Cycle Condensate _____(Barrels)

0012 Liquified Petroleum Gases _____(Barrels)

0013 Natural Gasoline _____(Barrels)

0014 Other (Please identify produce and unit of measurement)

_____

Questionnaire II

PHYSICAL OUTPUT RECORD

SIC 20 - Food & Kindred Products

Month _____

7010	Cookies, Crackers	(Man Hours[1])
7011	Rice Bran & Polish	(Cwt.)
7012	Rice Cleaning, Processing & Milling	(Cwt.)
7013	Bacon	(Pounds)
7014	Pork Processed	(Pounds)
7015	Peanut Butter	(Pounds)
7016	Packaged Tea & Tea Bags	(Pounds)
7017	Coffee, Roasted	(Pounds)
7018	Animal Foods, Pet	(Pounds)
7019	Carbonated Drinks	(Bottles, Cans)
7020	Ice Cream, Sherberts, & Mellorine	(Gallons)
7021	Sour Cream, Buttermilk, Chocolate Milk, Milk and Cream	(Gallons)
7022	Flavoring Extracts, Fountain Syrups, Fountain Fruits	(Gallons)
7023	Seafood, Processed - Fish	(Pounds)
7024	Seafood - Oysters	(Barrels)
7025	Seafood - Shrimp	(Pounds)
7026	Poultry, Dressed	(Pounds)
7027	Tallow, Grease	(Pounds)
7028		
7029	Canned Olives	(Pounds)
7030	Canned Cherries	(Pounds)
7031	Canned Peppers	(Pounds)
7032	Canned Onions	(Pounds)
7033	Hides	(Man Hours)
7034	Bakery Products, Bread	(Man Hours)
7035	Bakery Products, All other except Cookies & Crackers & Bread	(Man Hours)
7036	Salad Dressings, Mayonnaise, Relish Spreads, Worcestershire	(Man Hours)
7037	Potato Chips	(Man Hours)
7038	Blackstrap Molasses	(Gallons)
7039	Refined Cane Sugar	(Pounds)
7040	Sausage Packing	(Pounds)
7041	Canned Meat	(Pounds)
7042	Smoked Meat	(Pounds)
7043	Shortening & Salad Oils	(Pounds)
7044	Rice, Precooked	(Pounds)
7045	Meat Packing, Beef	(Pounds)
7046	Meat Packing, Sheep	(Pounds)
7047	Beer	(Gallons)

Questionnaire II

(Continued)

7048	Cotton Seed Oil Meal Products _____	(2)
7049	Feeds: Mixed, Livestock, Poultry _____	(Pounds)
7050	Flour Milling _____	(Milling)
7051	Jams, Jellies, Preserves, Apple Butter _____	(Man Hours)
7052	Vegetable Oils _____	(Gallons)

1) Man-Hours are defined as those used in direct production of the commodity. They do not include those of administrative or maintenance force personnel. They do include hours worked by supervisors.

2) Express in common units of measurement, but please identify the unit.

Questionnaire III

PHYSICAL OUTPUT RECORD

SIC 22 - Textile Mill Products

Month _____

4010 Cotton Blankets _____(Man Hours)

4011 Synthetic Fibers _____(Man Hours)

4012 Cotton Felt _____(Pounds)

4013 Cotton Packing _____(Man Hours)

4014 Wool Packing _____(Man Hours)

4015 Cotton Wrapping & Tying Twine _____(Man Hours)

4016 Linen Bags and Bagging _____(Man Hours)

4017 Jute Bags and Bagging _____(Man Hours)

4018 Bonded Fiber Bags and Bagging _____(Man Hours)

4019 Jute and Flat Twine _____(Man Hours)

(Productive man-hours includes all direct labor, including supervisory man-hours. Excluded are administrative and maintenance man-hours.)

Questionnaire IV

PHYSICAL OUTPUT RECORD

SIC 23 - Apparel and Other Finished Products Made from Fabrics and Similar Materials

Month _____

(The unit of measurement is productive man-hours. Productive man-hours includes all direct labor, including supervisory man-hours. Excluded are administrative and maintenance man-hours.)

4030	Bags, Burlap _____	(Man Hours)
4031	Bags, Cotton _____	(Man Hours)
4032	Bags, Other Textile (Urn, sand, sausage, etc.) _____	(Man Hours)
4033	Belts _____	(Man Hours)
4034	Blouses, Women's _____	(Man Hours)
4035	Bowling Shirts, Men's _____	(Man Hours)
4036	Bowling Shirts, Women's _____	(Man Hours)
4037	Dresses, Women's _____	(Man Hours)
4038	Hats, Western _____	(Man Hours)
4039	Gym Ware, Boys' _____	(Man Hours)
4040	Gym Ware, Girls' _____	(Man Hours)
4041	Jackets _____	(Man Hours)
4042	Mops _____	(Man Hours)
4043	Pillows, Down _____	(Man Hours)
4044	Pillows, Feather _____	(Man Hours)
4045	Pillows, Foam Rubber _____	(Man Hours)
4046	Pillows, Synthetic Fiber _____	(Man Hours)
4047	Separates, Women's _____	(Man Hours)
4048	Shirts, not Gym _____	(Man Hours)
4049	Skirts, Women's _____	(Man Hours)
4050	Slacks, Women's _____	(Man Hours)
4051	Suits, Women's _____	(Man Hours)
4052	Trousers, Slacks, Men's _____	(Man Hours)
4053	Work Pants, Boys' _____	(Man Hours)
4054	Work Pants, Men's _____	(Man Hours)
4055	Work Shirts, Boys' _____	(Man Hours)
4056	Work Shirts, Men's _____	(Man Hours)
4057	Work Clothing; all other _____	(Man Hours)

Questionnaire V

PHYSICAL OUTPUT RECORD

SIC 24 - Lumber and Wood Products

Month _____

2011	Corrugated Shipping Containers _____	(Man Hours[1])
2012	Crates and Boxes _____	(Man Hours)
2083	Industrial Wood Parts _____	(Man Hours)
2038	Lumber and Hardwoods _____	(Man Hours)
2014	Lumber, Rough Green _____	(Man Hours)
2015	Millwork, Cabinets _____	(Man Hours)
2028	Millwork, Doors _____	(Man Hours)
2029	Millwork, Frames _____	(Man Hours)
2030	Millwork, Moulding _____	(Man Hours)
2031	Millwork, Sash _____	(Man Hours)
2032	Millwork, Specialty and Industrial _____	(Man Hours)
2033	Millwork, Trim _____	(Man Hours)
2034	Millwork, Windows _____	(Man Hours)
2035	Millwork, Other _____	(Man Hours)
2036	Prefabricated Buildings and Structures _____	(Man Hours)
2037	Sawmills and Planing Mills _____	(Man Hours)
2024	Wood Preserving & Creosoting, Guard Rail _____	(Cubic Feet)
2017	Wood Preserving & Creosoting, Fences & Gates _____	(Number)
2018	Wood Preserving & Creosoting, Piling & Poles _____	(Cubic Feet)
2025	Wood Preserving & Creosoting, Plywood _____	(Cubic Feet)
2019	Wood Preserving & Creosoting, Posts _____	(Cubic Feet)
2020	Wood Preserving & Creosoting, Poles Pressure Treated ___	(Cubic Feet)
2021	Wood Preserving & Creosoting, Tamping Poles _____	(Cubic Feet)
2026	Wood Preserving & Creosoting, X-Arms _____	(Cubic Feet)
2023	Wood Preserving & Creosoting, Other Treated Lumber _____	(Cubic Feet)
2027	Wood Preserving & Creosoting, Misc. Services _____	(Cubic Feet)
2084	Wooden Fences _____	(Man Hours)
2085	Wood Poles, All _____	(Man Hours)
2080	Wooden Tanks _____	(Man Hours)
2039	Wooden Towers _____	(Man Hours)
2082	Wooden Turnings _____	(Man Hours)
2081	Wooden Vats _____	(Man Hours)

1) Man-hours are defined as Productive Man-hours. This includes all direct labor, including that of supervisors. It excludes administrative overhead as well as hours worked by maintenance employees.

Questionnaire VI

PHYSICAL OUTPUT RECORD

SIC 25 - Furniture & Fixtures

Month _____

3010	Bank and Store Fixtures	(Man Hours)
3011	Bedding	(Man Hours)
3012	Beds, Bunk	(Man Hours)
3013	Beds, Hospital	(Man Hours)
3014	Beds, Rollaway	(Man Hours)
3015	Beds, Sofa	(Man Hours)
3016	Blinds, Aluminum outside	(Man Hours)
3017	Blinds, Venetian	(Man Hours)
3018	Boards, Bulletin	(Man Hours)
3019	Cabinets, Kitchen	(Man Hours)
3020	Carts, Serving	(Man Hours)
3021	Cots, Folding	(Man Hours)
3022	Dinettes, Metal and Plastic	(Man Hours)
3023	Display Stands-Racks, Metal	(Man Hours)
3024	Filing Equipment, Metal	(Man Hours)
3025	Furniture, Upholstered	(Man Hours)
3026	Innerspring & Cushion Units	(Man Hours)
3027	Mattresses, Innerspring	(Man Hours)
3028	Mattresses, Foam Latex	(Man Hours)
3029	Shelving, Steel	(Man Hours)
3030	Springs, Bed	(Man Hours)
3031	Springs, Box and Upholstery	(Man Hours)
3032	Springs, Mattresses	(Man Hours)
3033	Tables, Steel Utility	(Man Hours)
3034	Table Tops, Marble and Plastic	(Man Hours)

Man-Hours are here defined as Productive Man-Hours, and include all direct labor plus supervisory hours. Excluded are hours worked by administrative and maintenance personnel.

Questionnaire VII

PHYSICAL OUTPUT RECORD

SIC 26 - Paper and Allied Products

Month _____

5012 Corrugated Shipping Containers _____(Tons)

5014 Magazine Stock _____(Tons)

5015 Paper _____(Tons)

5016 Paperboard _____(Tons)

5017 Paper Pulp _____(Tons)

5018 Paper Broke, or Flat _____(Tons)

5019 Multi-Wall Bags _____(Tons)

5020 Fiber Drums _____(Tons)

5021 Folding Paper Boxes _____(Tons)

5022 Jute and Flat Twine _____(Tons)

5023 Open Mesh and Waterproof Bags _____(Tons)

5024 Paper Cups _____(Tons)

5025 Paper and Glassline Bags _____(Tons)

5026 Polyethylene and Paper Bags _____(Tons)

5027 Fiber Cans _____(Pounds)

Other _____ 1)

1) Please specify product and unit or measurement.

Questionnaire VIII

PHYSICAL OUTPUT RECORD

SIC 27 - Printing & Publishing

Month _____

5110 Binders, Loose Leaf _____(Man Hours[1])

5111 Bookbinding _____(Man Hours)

5112 Catalogues _____(Man Hours)

5113 Engraving _____(Man Hours)

5114 Forms, Carbon Interleaved _____(Man Hours)

5115 Forms, Ruled _____(Man Hours)

5116 Newsprint _____(Tons)

5117 Photolithographing, Including Color _____(Man Hours)

5118 Printing, Commercial _____(Man Hours)

5119 Stereotyping _____(Man Hours)

5120 Typesetting and Typography _____(Man Hours)

5121 Art Department Production _____(Man Hours)

1) Man-Hours are here defined as Productive Man-hours, and include all direct labor as well as supervisory hours. Excluded are hours worked by administrative and maintenance personnel.

Questionnaire IX

PHYSICAL OUTPUT RECORD

SIC 28 - Chemical and Allied Products

Month _____

6011	Synthetic Rubber	(Pounds)
6012	Caustic Soda	(Tons)
6013	Hydrogen	(Cu. Ft. MM SCF M Cu. Ft.)
6014	Turpentine	(Gallons)
6015	Tall Oil	(Tons)
6016	Emulsifiers	2)
6017	Sulfonates	(Pounds)
6018	Styrene Monomer	(Pounds)
6019	Carbon Black	(Pounds)
6020	Paints, Enamels, etc.	(Gallons)
6021	Dry Color & Cement Additives	2)
6023	Sulphur, Mined	(Long Tons)
6024	Epoxy Resins	(Pounds)
6025	Ethyl Chloride	(Pounds)
6026	Fumigants	(Pounds)
6027	Glycerol	(Pounds)
6028	Hydrochloric Acid	(Pounds)
6029	Phenol	(Pounds)
6030	Sulphur	(Short Tons)
6031	Synthetic Organic Chemicals	(Pounds)
6032	Agriculture Chemicals	(Short Tons)
6033	Sodium Hypochlorite	(Gallons)
6034	Acetylene	(SCF)
6035	Arglon, liquid	(SCF)
6036	Nitrogen, liquid	(SCF)
6037	Oxygen, liquid	(SCF)
6038	Nitrogen, Gaseous	(SCF)
6039	Oxygen, Gaseous	(SCF)
6040	Propylene	(Pounds)
6041	Polyethylene Resins	(Pounds)
6042	Acet Aldehyde	2)
6043	Acrylonitride Monomer	2)
6044	All Agriculture Pesticides	2)
6045	Alums	2)
6046	Aluminum Floride	2)
6047	Ammonium Phosphate	2)
6048	Ammonium Sulphate	2)
6049	Anhydrous Aluminum Chloride	2)
6050	Anhydrous Hydrogen	2)
6051	Anilene Dyes and Pigments	2)

Questionnaire IX

(Continued)

6052 Antimony Trichloride _____ 2)
6053 Anti-knock compounds _____ 2)
6054 Automobile Cleaners & Waxes _____ 2)
6055 Benzine Concentrates _____ 2)
6056 Benzine Hexochloride _____ 2)
6057 Butadiene and Butylene _____ 2)
6058 Butene - 1 _____ 2)
6059 Butene - 2 _____ 2)
6060 Bleaching Compounds _____ 2)
6061 Calcium Carbide _____ 2)
6062 Caprolactam _____ 2)
6063 Carbon Dioxide, liquid _____ 2)
6064 Chloral _____ 2)
6064 Chlorine _____ 2)
6066 Chlorine liquid _____ 2)
6067 Cleaning Compounds, floor & wall, upholstery and rug shampoos _____ 2)
6068 Other Cleaning Compounds, e.g., detergents _____ 2)
6069 Defoliants _____ 2)
6070 Defluorinated Phosphate _____ 2)
6071 Detergents, liquid _____ 2)
6072 DDT _____ 2)
6073 Diisobutylene _____ 2)
6074 Disinfectants _____ 2)
6075 Drilling Mud Additives _____ 2)
6076 Ethyibenzene _____ 2)
6077 Ethylene Dibromide _____ 2)
6078 Ethylene Dichloride _____ 2)
6079 Ethylhexanol _____ 2)
6080 Evaporated Salt _____ 2)
6081 Fertilizers, Mixed _____ 2)
6082 Glycols _____ 2)
6083 Helium _____ 2)
6084 Herbicides _____ 2)
6085 Hexane _____ 2)
6086 Hydrofluoric Acid _____ 2)
6087 Industrial Solvents _____ 2)
6088 Inks, Printing _____ 2)
6089 Iso-butanol, and normal _____ 2)
6090 Isobutylene _____ 2)
6091 Isocyanates _____ 2)
6092 Metallic Sodium _____ 2)
6093 Methanal Vinyl Acetate Monomer _____ 2)
6094 Methylvinylpyridine _____ 2)
6095 Morpholene _____ 2)
6096 Muriatic Acid _____ 2)
6097 Oil Well Completion Fluids _____ 2)

Questionnaire IX

(Continued)

6098 Perchloraethylene _____ 2)
6099 Pharmaceuticals _____ 2)
6310 Phosphoric Acid _____ 2)
6311 Polyethylene _____ 2)
6312 Polyethylene, high density & linear _____ 2)
6313 Polypropylene _____ 2)
6314 Polyvenyl Chloride _____ 2)
6315 Propylene Oxide _____ 2)
6316 Resins, synthetic for surface coating and reinforced plastics _____ 2)
6317 Resins, Polyester _____ 2)
6318 Resins, Vinyl _____ 2)
6319 Scale & Corrosion Inhibitors _____ 2)
6320 Sodium Methylate _____ 2)
6321 Sodium Siliocofluoride _____ 2)
6322 Sodium Sulfhydrate _____ 2)
6323 Sodium Sulfide _____ 2)
6324 Styrene _____ 2)
6325 Sulphuric Acid _____ 2)
6326 Sulphuric Acid Alkylation _____ 2)
6327 Superphospate, Triple _____ 2)
6328 Tetraethyl Lead _____ 2)
6329 Triisobutylene _____ 2)
6330 Vinyl Chloride Monomer _____ 2)
6331 Styrene Maleic Anyhdride Resins _____ (Pounds)
6333 Alkylate(s) _____ (Pounds)
6332 Polybutadiene Oils _____ (Pounds)
6334 Solvents, Various _____ (Pounds)

2) Use Common Unit of Measurement, but please notify and identify the unit.

Questionnaire X

PHYSICAL OUTPUT RECORD

SIC 29 - Petroleum Refining

Month _____

Refinery Charges and Blending Components

6112 Crude _____(Barrels)

6113 Other Raw Materials and Cracking Stock[1] _____(Barrels)

Refined Products

6115 Distillate Fuels _____(Barrels)

6114 Fuel Oil, Heavy _____(Barrels)

6116 Gasoline _____(Barrels)

6117 Kerosene _____(Barrels)

6118 Lubricating Oils, Including Stock Oils _____(Barrels)

6119 Road Oils, Asphalt & Fluxes _____(Tons)

6121 Solvents _____(Barrels)

6122 Other Products, e.g., Waxes _____(Tons)

Own supplies of Natural Gas (mcf), Processed or Refinery Gas (barrels), and Fuel Oils (Barrels) used in the refining process in reported month. _____

6111 White Mineral Oil _____(Gallons)

1) Other Raw Materials include: Natural Gasoline, Isobutane, Normal Butane, Isopentane, other. Please show on a net basis, i.e., add all cracking components purchased outside the refinery, and subtract cracking components sold to others outside the refinery.

Questionnaire XI

PHYSICAL OUTPUT RECORD

SIC 30 - Rubber and Plastic Products

Month _____

6213	Compounding, Molding, Extruding and Mandrel Wrapping of Rubber	2)
6214	Compression & Injection Plastic Molding	2)
6215	Corrosive Inhibitive Mastics and Pipeline Prods.	2)
6212	Corrugated and Flat Building Panels	(Thousand Sq. Ft.)
6216	Custom Molded Plastic Products	2)
6217	Custom Molded Rubber Products	2)
6218	Custom Thermaplastic Compounding	2)
6219	Decorator Pillows	(Man Hours[1])
6220	Ethylene & Polyvinyl Chloride Sheeting & Film	2)
6211	Fiber Glass Tanks	(Pounds)
6221	Foam Rubber Slab Stocks	2)
6222	Formica	2)
6223	Industrial and Mechanical Rubber Goods	2)
6224	Laminated Polyvinyl Chloride Pipeline Wrapping Tapes	2)
6225	Molded and Extruded Plastic Products	2)
6226	Plastic Containers	2)
6227	Plastic Extruding	2)
6229	Plastic Laminations	2)
6230	Polymerite Tile	2)
6231	Polyethylene Laminated Tapes	2)
6232	Rings, "O"	2)
6233	Rubber Hose	2)
6234	Rubber Molding	2)
6235	Rubber and Neoprene Molding	2)
6236	Rubberized Fabrics	2)
6237	Sheet Packing	2)
6238	Specialties and Sundries, Rubber	2)
6239	Specialties and Sundries, Plastic	2)
6240	Teflon Plastic Parts	2)
6241	Urethane Foam Pads	2)
6242	Vinyl Upholstery	2)
6243	Vulcanized Rubber Clothing	2)
	Other (Identify the Product)	2)

1) Man-hours are here defined as those consisting only of direct and supervisory labor. Administrative and maintenance labor time are excluded.

Questionnaire XI

(Continued)

2) Use common unit of measurement, but please identify the unit. In lieu of a physical measurement, one may use direct and supervisory labor hours as defined in footnote 1).

Questionnaire XII

PHYSICAL OUTPUT RECORD

SIC 31 - Leather & Leather Products

Month _____

4080 Saddles _____ (Man Hours[1])

4081 Bridles _____ (Man Hours)

4082 Collars, Horse & Mule, & Other Kinds _____ (Man Hours)

4083 Holsters _____ (Man Hours)

4084 Harness Parts _____ (Man Hours)

4085 Other (Please identify product and unit of measurement)

_____

1) Man-Hours are here defined to include only direct and supervisory labor. Administrative and maintenance labor are excluded.

Questionnaire XIII

PHYSICAL OUTPUT RECORD

SIC 32 - Stone, Clay, & Glass Products

Month _____

2051	Aluminum Sliding Doors & Windows _____	2)
2052	Asbestos and Cement Siding _____	2)
2053	Asbestos Insulation _____	2)
2054	Asbestos Oil Brakelining _____	2)
2066	Barite _____	2)
2044	Brick, Common Face, Building & Acid Proof _____	(Number)
2045	Brick, Fire _____	(Number)
2065	Clays, Foundry _____	2)
2050	Cement, Hydraulic and/or Portland _____	(Sacks)
2055	Clutch Facing _____	2)
2064	Concrete Aggregates _____	(Tons)
2049	Concrete Brick & Block _____	(Tons)
2048	Concrete Pipe, Septic Tanks, Posts _____	(Tons)
2041	Concrete, Ready Mix _____	(Tons)
2046	Floor, Glazed, and Building Tile _____	(Number)
2056	Gaskets, Soft _____	2)
2057	Glass Blowing _____	(Man Hours[1])
2058	Glasswear for Chemical Assays _____	(Man Hours)
2059	Industrial Brake Lining _____	2)
2063	Industrial Glasswear _____	2)
2043	Lightweight Aggregates _____	(Tons)
2060	Mirrors _____	2)
2061	Packings, Metallic _____	2)
2042	Shell, Oyster _____	(Cubic Yards)
2047	Sulphur, Processed _____	(Tons)
2062	Wallboards _____	2)

1) Man-Hours are here defined to include only direct and supervisory labor. Administrative and Maintenance labor time are excluded.

2) Use common unit of measurement, but please identify unit. If physical unit measurement is not used, direct and supervisory labor time in total monthly hours are then requested.

Questionnaire XIV

PHYSICAL OUTPUT RECORD

SIC 33 - Primary Metal Industry

Month _____

0111 Tungsten Carbide, Surfacing Materials and Castings _____(Tons)
0112 Welding Rods _____(Tons)
0113 Specialty Forgings _____(Tons)
0114 Railroad Brake Shoes _____(Tons)
0115 Aluminum Castings _____(Tons)
0116 Structural Steel _____(Tons)
Molybdenum _____(Tons)
Titanium _____(Tons)
Tantalum _____(Tons)
0117 Zinc Base Alloys _____(Tons)
0118 Copper Base Alloys _____(Tons)
0119 Lead and Tin Base Alloys _____(Tons)
0121 Aluminum Extruding _____(Tons)
0122 Magnesium Base Alloys _____(Tons)
0123 Fabricated Lead Products _____(Tons)
0124 Castings, Low Alloy _____(Tons)
0125 Castings, Steel _____(Tons)
0126 Line Pipe _____(Tons)
0127 Limited Service Pipe _____(Tons)
0128 Wire Weaving _____(Tons)
0129 Wire Drawing _____(Tons)
0130 Roll Forming _____(Tons)
0131 Barium Alloys _____(Tons)
0132 Bolt and Nut Products _____(Tons)
0133 Low Carbon Alloys _____(Tons)
0134 Steel Alloys _____(Tons)
0135 Magnesium _____(Tons)
0136 Nails _____(Tons)
0137 Oil Field Equipment _____(Tons)
0138 Reinforcing Bars _____(Tons)
0139 Structural Panels and Shapes _____(Tons)
0140 Castings, Stainless _____(Tons)
0141 Tin _____(Tons)
0142 Tin Alloys _____(Tons)
0143 Wire Mesh _____(Tons)
Other (Please identify product and unit of measurement)
_____

Table II

Measurement Code

Code	Measurement
99	Barrels
98	Cwt (Hundred Weight)
97	Cubic Yards
96	Dozen, Thousand
95	Gallons
94	Long Tons (2,240 lbs. each)
93	MCF (Thousand Cubic Feet)
92	Million Pounds
91	M Sq. Ft. (Thousand Square Feet)
90	Number of Items
89	Pounds
88	Productive Man Hours
87	Sacks, Number of
86	Short Tons (2,000 lbs. each)
85	SCF (Standard Cubic Feet @ 14.5 pressure, 60 degrees Fahrenheit Temperature)
84	Undefined
83	Cubic Feet
82	KWH (Kilo Watt Hour)

Table III

County Code

Code	County
1	Brazoria
2	Chambers
3	Fort Bend
4	Galveston
5	Harris
6	Liberty
7	Montgomery
8	Waller

APPENDIX D

COMPUTATION OF MONTHLY PRODUCTIVITY FACTOR FOR SIC 20 (FOOD & KINDRED PRODUCTS) FOR THE TEXAS INDUSTRIAL PRODUCTION INDEX

Man-hours (Σ of each four digit SIC group)
1958 - 143,619
1954 - 138,654

Value of shipments (Σ of each four digit SIC group)
1958.....2,377,364
1954 (Inflated by price indexes for each four digit SIC group).....1,968,053

Value of shipments per man hour

1958

$$\frac{2,377,364}{143,619} = 16.5533$$

1954

$$\frac{1,968,053}{138,654} = 14.1940$$

$$\frac{16.5533}{14.1940} = 16.6218$$

$$\frac{16.6218}{48} = .35$$

MONTHLY PRODUCTIVITY FACTORS OF
TEXAS INDUSTRIAL PRODUCTION INDEX

(Monthly increases in productivity indexes,
1957-59 = 100)

Industry group	Period		
	1947-54	1955-58	1959-61[1]
Lumber and wood products	0.10	0.52	0.70
Furniture and fixtures	.08	.24	.30
Stone, clay, and glass products	.35	.26	.30
Primary metals	.27	.37	.48
Fabricated metal products	.08	.18	.24
Machinery	.18	.10	.14
Transportation equipment	.13	.28	.33
Other durable goods	.23	.16	.17
Food and kindred products	.17	.30	.35
Textile mill products	.22	.30	.35
Apparel and allied products	.18	.24	.27
Paper and allied products	.00	.30	.35
Printing and publishing	.02	.18	.22
Chemicals and allied products	.39	.54	.74
Leather and leather products	.00	.12	.09
Other non-durable goods	.18	.15	.16
Metal, stone, and earth minerals	.29	.04	.07

[1]To be continued for later years until new estimates are available.

APPENDIX E

APPLICABLE WEIGHTS TO THE INDEXES OF INDUSTRIAL PRODUCTION - SEPTEMBER 1963

THE HOUSTON ECONOMIC AREA

Industry Groupings	Percentage Weights
Total Industrial Production	100.0000000
Manufacturing and Total	85.6829000
Durable Manufactures	34.2855000
Primary and Fabricated Metals	13.1422000
33 Primary Metals	5.6364000
331 Blast Furnaces, Steel Works, & Rolling & Finishing Mills	4.4798107
332 Iron and Steel Foundries	.4413301
333 & 334 Primary Smelting & Refining of Nonferrous Metals; Secondary Smelting & Refining	.0631277
335 Rolling, Drawing and Extruding or Nonferrous Metals	.2378561
336 Nonferrous Foundries	.1307645
339 Miscellaneous Primary Metal Industries	.2835109
34 Fabricated Metals	7.5058000
341 Metal Cans	1.5810990
344 Fabricated Structural Metal Products	3.5852783
347 Coating, Engraving, and Allied Services	.3926389
348 Miscellaneous Fabricated Wire Products	.3598198
349 Miscellaneous Fabricated Metal Products	1.5869640
Machinery and Related Products	16.1054000
35 Machinery Except Electrical	13.2788000
353 Construction, Mining, and Materials Handling Machinery and Equipment	12.0837080

APPENDIX E

(Continued)

Industry Groupings	Percentage Weights
354 Metalworking Machinery and Equipment	.2376905
355 Special Industry Machinery, Except Metalworking Machinery	.1739523
356 General Industrial Machinery and Equipment	.7834492
36 Electrical Machinery	.8652000
361 Electric Transmission and Distribution Equipment	.4588156
362 Electrical Industrial Apparatus	.1180998
364 Electric Lighting and Wiring Equipment	.1886136
369 Miscellaneous Electrical Machinery, Equipment, and Supplies	.0996710
37 Transportation Equipment	.9074000
373 Ship and Boat Building and Repairing	
371-2-9 Motor Vehicles & Eqpt., Aircraft & Parts, and Misc. Transportation Equipment	.9074000
38 Instruments and Related Products	1.0540000
382 Instruments for Measuring, Controlling, & Indicating Physical Characteristics	1.0540000
383 Optical Instruments and Lenses	
384 Surgical, Medical, and Dental Instruments & Supplies	
Clay, Glass and Lumber	3.7614000
32 Stone, Clay and Glass Products	3.1288000
324 Cement, Hydraulic	1.2495238
325 Structural Clay Products	.1155021
327 Concrete, Gypsum and Plaster Products	1.6886228
329 Abrasive, Asbestos, and Misc. Nonmetallic Mineral Products	0.0000000
321-2-3-6-8 Flat Glass, Glass & Glassware, Glass Products, Pottery & Related Products, & Cut Stone and Related Products	.0751513

APPENDIX E

(Continued)

Industry Groupings	Percentage Weights
24 Lumber and Wood Products	.6323600
243 Millwork, Veneer, Plywood & Prefabricated Structural Wood Products	.2728214
244 Wooden Containers	.1585422
249 Miscellaneous Wood Products	.2012364
Furniture and Miscellaneous Products	1.2765000
25 Furniture and Fixtures	.9504000
251 Household Furniture	.6542554
254 Partitions, Shelving, Lockers, & Office & Store Fixtures	.2441578
259 Miscellaneous Furniture & Fixtures	.0519868
39 Miscellaneous Manufacturing	.3261000
Non-Durable Manufactures	51.3974000
Textile, Apparel, and Leather Products	.9905000
22 Textile Mill Products	.2319000
23 Apparel and Related Products	.7366000
31 Leather and Leather Products	.0220000
Paper and Printing	5.8314000
26 Paper and Allied Products	3.0941000
265 Paperboard Containers and Boxes	3.0941000
27 Printing and Publishing	2.7373700
271 Newspapers: Publishing, Publishing & Printing	1.4535063
275 Commercial Printing	.8433621
278 Bookbinding and Related Industries	.0774656
279 Service Industries for the Printing Trade	.1472667

APPENDIX E

(Continued)

Industry Groupings	Percentage Weights
273-6 Books and Manifold Business Forms Manuf.	.2156993
Chemical, Petroleum, and Rubber Products	34.7229000
28 Chemicals and Allied Products	19.4390000
281 Industrial Inorganic and Organic Chemicals	11.9277704
282 Plastics Materials & Synthetic Resins	2.4901359
283-4-6 Drugs, Soap & Detergents, & Gum & Wood Products	1.0360987
287 Agricultural Chemicals	2.9139061
289 Miscellaneous Chemical Products	1.0710998
29 Petroleum and Coal Products	14.5704000
291 Petroleum Refining	14.3562151
295 Paving and Roofing Materials	.1806730
299 Miscellaneous Products of Petroleum & Coal	.0335119
30 Rubber and Plastic Products	.7135000
306 Fabricated Rubber Products, Not Elsewhere Classified	.4729078
307 Miscellaneous Plastics Products	.2405922
Food and Beverages	9.8526000
20 Food and Kindred Products	9.8526000
201 Meat Products	.4689837
202 Dairy Products	1.4379870
203 Canning & Preserving Fruits, Vegetables & Sea Foods	.2640984
204 Grain Mill Products	1.3966060
205 Bakery Products	2.1389994
208 Beverage Industries	.6709261

APPENDIX E

(Continued)

Industry Groupings	Percentage Weights
209 Miscellaneous Food Preparations and Kindred Products	3.4750120
Mining	7.7643000
Utilities	
49 Electric and Gas Utilities	6.5528000
491 Electric Companies and Systems	3.7423041
492 Gas Companies and Systems	2.8104959

APPENDIX F

TABLE I

INDUSTRIAL PRODUCTION INDEX - HOUSTON ECONOMIC AREA - 1963

(Not Seasonally Adjusted, January-June 1963 = 100)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Total Industrial Production Index	93.9	88.6	99.8	105.5	111.2	100.8	107.4	113.9	99.1	102.0	91.5	94.0
Total Manufacturing	93.5	87.7	99.7	106.6	111.8	100.4	108.1	115.3	98.8	102.7	91.2	94.1
Durable Manufacturing	87.4	78.9	92.1	113.9	124.4	103.4	121.2	129.8	95.4	96.0	79.3	82.2
Primary & Fabricated Metals	62.9	57.6	92.0	134.5	138.2	115.0	144.2	132.3	84.0	69.6	46.7	52.0
Machinery & Related Products	107.9	89.9	92.8	96.0	116.5	97.0	104.5	111.6	98.0	117.4	104.3	105.8
Clay, Glass and Lumber	82.8	100.4	88.0	122.3	115.9	91.1	115.1	206.4	119.2	87.1	79.6	85.1
Furniture & Miscellaneous	95.5	94.9	97.6	103.4	107.3	101.3	112.6	106.0	109.7	125.2	97.8	87.1
Non-Durable Manufacturers	97.5	93.5	104.8	101.7	103.5	98.5	99.3	105.6	101.0	107.2	99.1	102.1
Textile, Apparel, and Leather	93.8	91.5	90.2	127.8	105.4	91.3	97.3	94.0	95.5	112.2	111.2	112.3
Paper and Printing	97.3	91.6	100.7	103.2	109.8	96.6	102.1	115.9	108.9	106.0	97.4	102.5
Chemical, Petroleum & Rubber	96.4	91.7	106.3	100.8	103.6	101.2	97.4	102.0	97.7	103.7	97.8	103.4
Food and Beverages	102.0	101.0	103.3	101.2	99.2	90.6	104.7	113.1	108.6	120.0	103.8	96.1
Mining	98.2	95.0	101.5	98.4	106.7	100.1	101.2	101.7	96.8	89.7	84.6	91.0
Utilities (Gas and Electric)	95.0	92.5	98.7	100.0	107.4	106.3	105.9	111.7	106.4	106.7	104.4	96.0

INDUSTRIAL PRODUCTION INDEX - HOUSTON ECONOMIC AREA - 1963

(Continued)

INDUSTRY INDEXES	Jan	Feb	Mar	Apr:	May	June	July	Aug	Sept	Oct	Nov	Dec
SIC 13 Products from Natural Gas	98.2	95.0	101.5	98.4	106.7	100.1	101.2	101.7	96.8	89.7	84.6	90.9
20 Food and Kindred Products	102.0	100.9	103.3	101.2	99.2	90.6	104.6	113.1	109.0	119.6	103.8	96.1
22 Textile Mill Products	55.6	100.5	74.2	192.8	67.2	109.7	97.7	47.1	68.9	110.1	105.0	108.5
23 Apparel & Related Products	106.0	88.3	95.3	107.9	117.6	84.9	97.2	108.5	103.3	113.2	112.7	113.7
24 Lumber and Wood Products	107.5	91.3	89.9	85.8	109.3	116.1	132.8	107.9	100.1	129.1	96.9	101.1
25 Furniture & Fixtures	92.3	96.3	98.4	101.5	108.2	103.3	118.7	112.3	117.9	132.0	99.8	89.2
26 Paper and Allied Products	100.2	92.8	98.4	102.7	108.9	96.3	107.2	112.6	98.4	102.3	96.1	99.4
27 Printing and Publishing	94.0	91.0	103.2	103.8	110.7	96.9	96.4	119.6	120.5	110.2	99.0	106.0
28 Chemical & Allied Products	90.2	83.7	104.3	106.1	109.6	105.2	97.8	105.3	103.2	101.1	109.2	109.4
29 Petroleum & Coal Products	105.2	99.5	107.1	93.9	95.8	98.8	98.9	99.9	91.9	96.4	94.8	97.2
30 Rubber and Misc. Plastics	90.4	151.9	119.1	96.9	98.2	43.4	56.5	56.1	67.9	103.4	66.7	68.3
31 Leather & Leather Products	90.5	104.0	88.2	109.5	97.3	110.5	97.3	100.9	114.5	102.7	123.6	106.8
32 Stone, Clay & Glass Products	77.8	102.2	87.6	129.6	117.2	86.1	111.6	226.3	123.1	78.6	76.1	81.8
33 Primary Metals Industry	21.1	21.6	80.1	163.3	167.4	145.5	202.5	144.3	59.5	20.8	20.9	26.6
34 Fabricated Metal Products	94.4	84.6	100.9	112.8	116.4	91.3	100.3	123.7	102.4	106.2	66.0	71.1
35 Machinery, Except Electrical	108.5	90.3	92.9	94.9	117.5	95.9	100.9	108.8	97.9	116.8	102.6	101.4
36 Electrical Machinery	102.7	88.2	94.7	108.3	109.9	134.6	143.7	138.2	123.5	96.1	120.0	127.0
37 Transportation Equipment	101.0	97.9	107.3	113.8	118.8	61.4	119.5	116.2	98.2	111.8	90.5	88.3
38 Professional Instruments	111.5	80.0	77.1	94.6	107.4	129.4	114.5	116.9	66.6	124.6	124.0	158.1
39 Miscellaneous Manufacturers	105.0	90.0	98.6	108.7	104.8	95.5	94.9	87.6	86.0	103.0	91.9	80.8
49 Electric and Gas Services	95.0	92.5	98.7	100.1	107.4	106.3	105.9	111.7	106.4	106.7	104.4	96.0

*The Index applies to Industrial Output in the Texas Counties of Brazoria, Chambers, Fort Bent, Galveston, Harris, Liberty, Montgomery, & Waller.

TABLE II

INDUSTRIAL PRODUCTION INDEX - HOUSTON ECONOMIC AREA - 1964

(Not Seasonally Adjusted, January-June 1963 = 100)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Total Industrial Production Index	107.6	94.6	100.8	106.4	106.3	104.8	105.6	104.4	103.1	103.7	91.1	92.0
Total Manufacturing	109.8	97.7	101.3	107.6	106.4	105.0	105.4	103.3	102.2	103.3	89.8	92.0
Durable Manufacturing	113.5	90.7	101.5	118.2	121.8	121.4	117.7	111.8	109.1	108.0	84.7	89.1
Primary & Fabricated Metals	132.8	77.5	97.7	133.4	137.6	141.6	120.7	116.6	106.1	92.3	52.6	54.5
Machinery & Related Products	108.1	104.3	108.7	113.9	115.5	113.7	123.8	114.7	117.3	126.1	110.8	119.4
Clay, Glass and Lumber	73.6	77.2	85.4	87.8	102.4	92.0	86.8	83.3	82.3	80.6	78.8	75.8
Furniture & Miscellaneous	99.5	93.4	98.4	105.3	97.1	98.1	101.4	109.9	116.2	123.5	102.0	102.2
Non-Durable Manufacturers	107.3	97.4	101.1	100.4	96.1	94.1	97.1	97.6	07.6	100.1	93.3	93.9
Textile, Apparel, and Leather	114.2	103.2	106.8	110.7	92.9	99.6	101.3	101.6	123.0	118.0	119.8	137.1
Paper and Printing	102.3	97.3	106.2	111.8	114.9	109.6	113.2	110.6	110.0	110.7	115.0	117.4
Chemical, Petroleum & Rubber	105.8	97.1	101.9	98.9	94.3	97.6	94.3	95.0	93.8	97.2	89.0	86.6
Food and Beverages	115.8	98.2	94.8	98.2	79.6	83.7	85.4	98.4	100.6	102.2	93.0	101.5
Mining	89.9	86.8	94.2	94.5	101.3	97.3	97.6	101.3	97.8	95.0	82.6	69.9
Utilities (Gas and Electric)	99.8	101.8	101.9	105.6	111.3	110.9	118.4	122.7	121.7	119.7	117.1	118.3

INDUSTRIAL PRODUCTION INDEX - HOUSTON ECONOMIC AREA - 1964

(Continued)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
INDUSTRY INDEXES												
SIC 13 Products from Natural Gas	89.9	86.8	94.2	94.5	101.3	97.2	97.6	101.3	97.8	95.0	82.6	69.9
20 Food and Kindred Products	115.8	98.2	94.8	98.2	79.6	83.7	85.4	98.4	100.6	102.2	93.0	93.0
22 Textile Mill Products	151.1	106.9	127.2	111.3	76.8	103.8	98.2	91.7	124.6	125.7	117.6	112.4
23 Apparel & Related Products	102.1	101.5	100.5	110.1	97.4	97.8	102.1	104.4	123.0	115.5	120.4	145.2
24 Lumber and Wood Products	104.3	78.7	108.9	114.1	130.3	104.8	112.2	118.2	129.1	99.5	94.2	93.7
25 Furniture & Fixtures	94.3	93.1	95.0	104.4	94.5	97.8	98.9	114.9	116.9	132.6	102.4	97.1
26 Paper & Allied Products	107.3	97.0	99.5	101.2	105.6	102.7	112.2	102.7	103.5	98.9	106.3	109.5
27 Printing and Publishing	96.7	97.6	113.8	123.7	125.3	117.3	114.1	119.4	119.5	123.9	124.9	126.2
28 Chemical and Allied Products	111.9	102.5	109.1	101.9	100.0	95.1	98.5	90.7	91.9	96.8	93.4	87.2
29 Petroleum & Coal Products	93.4	90.5	92.8	95.4	95.7	94.0	97.1	101.0	96.6	99.2	84.0	99.5
30 Rubber & Misc. Plastics	71.9	81.7	91.4	86.3	77.2	79.1	83.1	90.4	84.8	70.3	74.2	77.0
31 Leather & Leather Products	127.7	122.7	106.0	123.2	112.3	116.4	108.6	109.5	107.7	122.7	127.3	126.4
32 Stone, Clay and Glass Products	67.4	76.8	80.6	82.4	96.7	89.4	81.7	76.3	72.8	76.8	75.6	71.2
33 Primary Metals Industry	214.4	80.7	127.1	217.3	202.1	214.1	168.2	153.3	101.6	93.9	19.4	22.12
34 Fabricated Metal Products	71.5	75.1	75.5	70.3	89.2	89.2	85.0	89.1	109.5	91.1	77.5	78.8
35 Machinery, Except Electrical	108.1	103.2	106.5	109.9	115.4	112.9	122.9	114.4	118.2	125.3	109.6	115.8
36 Electrical Machinery	100.4	110.4	114.6	101.3	117.2	124.0	125.6	134.8	137.5	140.3	127.6	140.5
37 Transportation Equipment	88.8	80.6	97.6	117.4	100.2	104.4	80.9	79.0	87.8	85.1	83.5	99.5
38 Professional Instruments	131.3	133.6	141.3	171.3	127.9	123.8	171.1	131.6	114.9	160.2	135.9	164.9
39 Miscellaneous Manufacturers	114.8	94.3	108.2	108.1	104.7	98.8	108.5	95.3	114.0	97.2	101.0	117.0
49 Electrical and Gas Services	100.0	101.8	101.9	105.6	111.3	110.9	118.4	122.7	131.7	119.7	117.1	118.3

*Index applies to Industrial Output in the Texas Counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery , & Waller.

TABLE III

INDUSTRIAL PRODUCTION INDEX - HOUSTON ECONOMIC AREA - 1965

(Seasonally Adjusted, 1963-64 = 100)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Total Industrial Production Index	96.4	100.3	107.8	110.5	110.3	111.2	105.2	113.5				
Total Manufacturing	95.5	98.8	106.1	109.6	110.8	112.4	106.2	117.2				
Durable Manufacturing	113.2	108.7	111.9	122.5	108.9	111.3	127.3	124.3				
Primary & Fabricated Metals	66.9	122.8	110.9	141.0	128.4	115.8	143.4	132.5				
Machinery & Related Products	113.4	114.3	126.1	116.7	118.5	124.2	121.9	121.6				
Clay, Glass and Lumber	112.5	93.9	95.2	103.3	89.9	97.4	98.3	105.9				
Furniture & Miscellaneous	103.1	104.5	111.1	97.9	101.9	101.6	95.4	101.5				
Non-Durable Manufacturers	95.5	93.3	103.9	102.6	104.9	106.8	96.1	109.3				
Textile, Apparel, and Leather	68.2	92.6	98.5	98.3	157.1	130.0	111.6	204.7				
Paper and Printing	113.0	114.5	115.0	99.5	110.2	127.4	120.3	100.4				
Chemical, Petroleum & Rubber	98.3	95.5	103.3	101.6	104.8	101.2	94.9	107.6				
Food and Beverages	76.5	75.5	101.0	90.9	130.5	176.2	141.3	108.1				
Mining	78.1	94.6	98.8	100.5	98.1	91.7	91.9	91.4				
Utilities (Gas and Electric)	119.2	118.2	121.8	122.0	115.0	119.5	113.8	100.9				

INDUSTRIAL PRODUCTION INDEX - HOUSTON ECONOMIC AREA - 1965

(Continued)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
INDUSTRY INDEXES												
SIC 13 Products from Natural Gas	78.1	94.6	99.9	100.5	98.1	91.7	91.9	91.4				
20 Food and Kindred Products	76.5	72.5	101.0	91.0	130.5	176.2	141.3	108.1				
22 T xtile Mill Products	61.4	58.4	92.1	100.7	126.6	90.4	111.3	210.3				
23 Apparel & R lated Products	110.5	93.8	123.1	94.4	113.4	144.9	95.4	97.9				
24 Lumber and Wood Products	96.6	114.5	178.3	126.9	121.3	150.6	95.0	177.9				
25 Furniture & Fixtures	109.6	105.6	104.5	101.4	101.6	93.6	89.0	93.1				
26 Paper & Allied Products	104.4	103.4	110.2	108.0	107.3	132.5	115.7	113.0				
27 Printing and Publishing	118.4	125.0	121.4	98.5	114.3	118.5	119.3	90.6				
28 Chemical and Allied Products	102.2	99.6	111.3	102.8	105.2	102.2	94.4	109.8				
29 Petroleum & Coal Products	99.5	94.6	98.9	98.0	102.2	97.3	99.6	100.4				
30 Rubber & Misc. Plastics	95.9	97.0	105.5	93.0	99.9	85.0	89.6	87.9				
31 Leather & Leather Products	97.1	104.3	136.0	115.3	127.9	88.7	96.6	93.4				
32 Stone, Clay and Glass Products	112.5	89.0	82.4	96.2	84.0	146.1	173.0	188.6				
33 Primary Metals Industry	63.2	120.3	154.6	134.8	149.3	123.1	115.8	104.6				
34 Fabricated M tal Products	72.0	115.5	81.1	135.2	109.3	120.5	120.8	120.1				
35 Machinery, Except Electrical	103.5	108.7	154.6	116.0	116.2	153.8	89.2	90.1				
36 Electrical Machinery	113.9	119.1	125.8	131.8	118.7	120.8	117.4	109.2				
37 Transportation Equipment	139.2	139.9	109.2	89.6	123.3	123.9	120.1	170.9				
38 Professional Instruments	142.6	135.1	122.5	106.4	123.1	98.9	137.9	122.4				
39 Miscellaneous Manufacturers	82.4	98.6	127.4	87.2	100.4	123.9	148.4	173.9				
49 Electrical and Gas Services	119.2	118.2	121.8	122.0	115.0	119.5	113.8	110.9				

*Index applies to Industrial Output in the Texas Counties of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, & Waller.