REGRESSION ANALYSIS OF MONETARY RESTRAINT AND INDUSTRIAL LOAN DISCRIMINATION 1953-57

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1954

Submitted to the Faculty of the Graduate School
of the Oklahoma State University
in partial fulfillment of
the requirements for
the degree of
MASTER OF SCIENCE
May, 1963

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CHAPTER I

THE PROBLEM

The writer's interest in the subject of the impact of monetary actions upon various industries has been stimulated by the differences of opinion which are evident in government, business, and the academic world. The study is designed to explore the possibilities that some industries are discriminated against as credit is rationed, thus affecting their profit positions during periods of monetary restraint.

Criticism of Monetary Restraint

The Board of Governors of the Federal Reserve System publicly states through its spokesman, Board Chairman William McChesney Martin, Jr., that general credit restraints are logical and proper tools to use in the promotion of economic stability during boom periods.[1] Critics of the use of general credit controls during boom periods to promote economic stability believe these controls are unwarranted. One of the chief criticisms is that monetary

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[1]William McChesney Martin, Jr., Statement to the Committee on Finance, United States Senate, Federal Reserve Bulletin, 43 (August, 1957), pp. 866-877.

restraint is highly selective in its impact upon various industries, i.e., some industries are discriminated against by monetary restraint.[2] These industries, thus, cannot be expected to meet the growth rate and profit positions of those industries which are not subject to monetary restraint.

Statement of the Problem

The problem to be explored in this paper is that of determining if statistical evidence corroborates the thesis that general monetary restraint is highly selective in its impact. Further, the study is designed to determine if regression curve analysis lends itself to an investigation of this type.

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[2]Professor Arthur F. Burns was cited as believing general credit controls are discriminatory in an article which appeared in The New York Times, February 17, 1957, p. 46.

CHAPTER II

SELECTION OF INDUSTRIAL CLASSIFICATIONS

The Board of Governors of the Federal Reserve System has, over the years, prepared a group of related studies concerned with commercial bank loans to industry and their changes over time. The Federal Reserve Bank of Kansas City has also published research related to the subject.

The greater portion of the studies conducted concerning commercial bank loans to industry, especially those dealing with the effects of monetary policy, have used analyses based upon explanations of relationships rather than the use of empirical data for drawing conclusions.

Although the following citations do not deal directly with the problem selected for the study, it is believed that they set the stage for the investigation of the problem. These citations deal with changes in loans over time among various industries but do not relate them, to any appreciable degree, to the monetary climate over the business cycle.

Term Lending to Business, 1955-57[1]

This study by the Federal Reserve System is concerned with term loans to small businesses during the period 1955 through 1957. Although the study is limited to term loans to small businesses, while the present study is aimed at bank credit available to selected industries industry, the study provides examples of industry groupings for which loan and other data are available.

The industry groupings used in the Federal Reserve study are outlined below. Identical groupings were selected for the present study, with the exception that Real Estate and Sales Finance were omitted.

Food, Liquor, and Tobacco
Textiles, Apparel, and Leather
Metal and Metal Products
Petroleum, Coal, and Chemicals
Transportation, Communications, and
Public Utilities
Construction
Real Estate
Sales Finance

The study concluded that the greatest loan growth, in absolute terms, occurred in Metals, Petroleum and Chemical,

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[1]Board of Governors of the Federal Reserve System, "Member Bank Term Lending to Business, 1955-57," Federal Reserve Bulletin, 45 (1959).

and Public Utilities by industry groupings. In contrast, the greatest relative growth occurred in the Construction and Real Estate industry groupings.

Business Loans of Member Banks[2]

This study indicates a broad redirection of resources within the economy between 1946 and 1956. During this period the proportion of loans to manufacturing industries declined, while that to Finance, Construction, and Real Estate industrial groupings increased, along with that to the service trades.

During the boom periods after World War II and the Korean action the average size of all businesses increased. This increase in business size renders analysis based upon the size factor difficult because of the incomparability of data between time periods.

During the period of 1946 through 1956 the proportion of business loans extended by commercial banks to firms engaged in the sale and processing of food, liquor, and tobacco declined fifty per cent. This follows the relative decline for food-related industries as per capita real income rose. As in the study cited previously, large increases occurred in loans to real estate firms as compared to relatively minor changes in the other

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[2]Board of Governors of the Federal Reserve System, "Business Loans of Member Banks," Federal Reserve Bulletin, 42 (1956), pp. 327-340.

industry groupings.

Further, the article shows that firms having quite large sales volume and capital outlays use bank loans for interim financing as they await periods of low interest rates to obtain long-term funds from the capital markets.

Member Bank Lending to Small Business, 1955-57[3]

This study concluded that loan growth was greater in those industries in which large individual firms predominated. During this period loan expansion was greater in large banks than in small banks. Also, within a given industry the rate of loan expansion tended to be greater for larger firms than for smaller firms.

By industry classification tremendous changes in loan volume took place. During this period fifty per cent of total loan growth occurred in three industries, (1) Metals and Metal Products, (2) Petroleum, Coal, Chemical, and Rubber, and (3) Communication and Other Public Utilities. The rate of loan growth for small firms was greatest in the Metals and Metal Products industrial complex than that found in any other. The greatest relative increases during this period occurred in Trade, Construction, and Real Estate, which are industries dominated by smaller firms.

A conclusion which is of value to the present study

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[3]Board of Governors of the Federal Reserve System, "Member Bank Lending to Small Business, 1955-57," Federal Reserve Bulletin, 44 (1958), pp. 393-410.

is that monetary restraint was greater in larger banks, which tend to make the larger loans, than it was in the smaller banks.

Patterns of Change in Business Loans[4]

This study applied only to the Tenth Federal Reserve District but is valuable in the present study in that it provides a format for an analytical frame of reference.

The industries selected for study in this article are essentially those used in the previous citations. However, seasonal and cyclical factors are introduced in the Federal Reserve study and are concluded to be of major importance to some industries and of little importance to others. Firms engaged in food processing faced marked seasonal variations in business loans while Metals and Metal Products experienced wide cyclical variations in business loans and little seasonal variation.

Summary

The above cited articles provide a base point for further investigation in terms of industry classifications for which data are available. In addition, some insight is given concerning cyclical and seasonal variations in business loans made by commercial banks to various industry classifications.

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[4]Federal Reserve Bank of Kansas City, "Patterns of Change in District Loans," Monthly Review, May, 1961, pp. 10-14.

CHAPTER III

LIMITATIONS OF THE STUDY

The purpose at this point is to define the limits of the study. This definition of limits includes both the scope of the study and the analytical tools and procedures used.

Selection of the Time Period

Since the study is designed to determine if some industries are discriminated against during restrictive credit periods, it becomes necessary to define the time limits of the monetary periods selected. Two time periods were selected for the study, one of which is a period of monetary ease and the other a period of monetary restraint.

In the determination or selection of the time periods to be used in the study, Gross National Product and the Federal Reserve Index of Industrial Production were used in the preliminary stages of period definition. During recessionary periods, orthodox monetary theory calls for easing of money by the Federal Reserve System as a stimulant to business activity. Conversely, during boom periods orthodox monetary theory calls for credit restraint

to reduce inflationary tendencies.[1] Thus, it is plausible to roughly define periods of monetary ease during recessionary periods and periods of monetary restraint during periods of expanding business activity. However, domestic political considerations and balance of payment difficulties, or even slow reading of economic signs along with indecision by the monetary authorities, could conceivably produce periods of monetary ease during boom periods and periods of credit restraint during recessionary periods.

Figure 1 shows the level of business activity as measured by the Federal Reserve Index of Industrial Production and Gross National Product from 1952 through 1961. Low points in both curves occur approximately at the same time, as indicated by vertical lines drawn through the low points of the economic indicators, Gross National Product and the Federal Reserve Index of Industrial Production.

Business cycles are measured, in terms of time, from crest-to-crest or from trough-to-trough. Thus, each cycle contains a period of economic decline and a period of economic recovery separated, quite often, by a period of hesitancy at the crest or at the trough. From Figure 1 it can be seen that the duration and rate of change of each cycle differs from every other cycle, although they possess some common characteristics.

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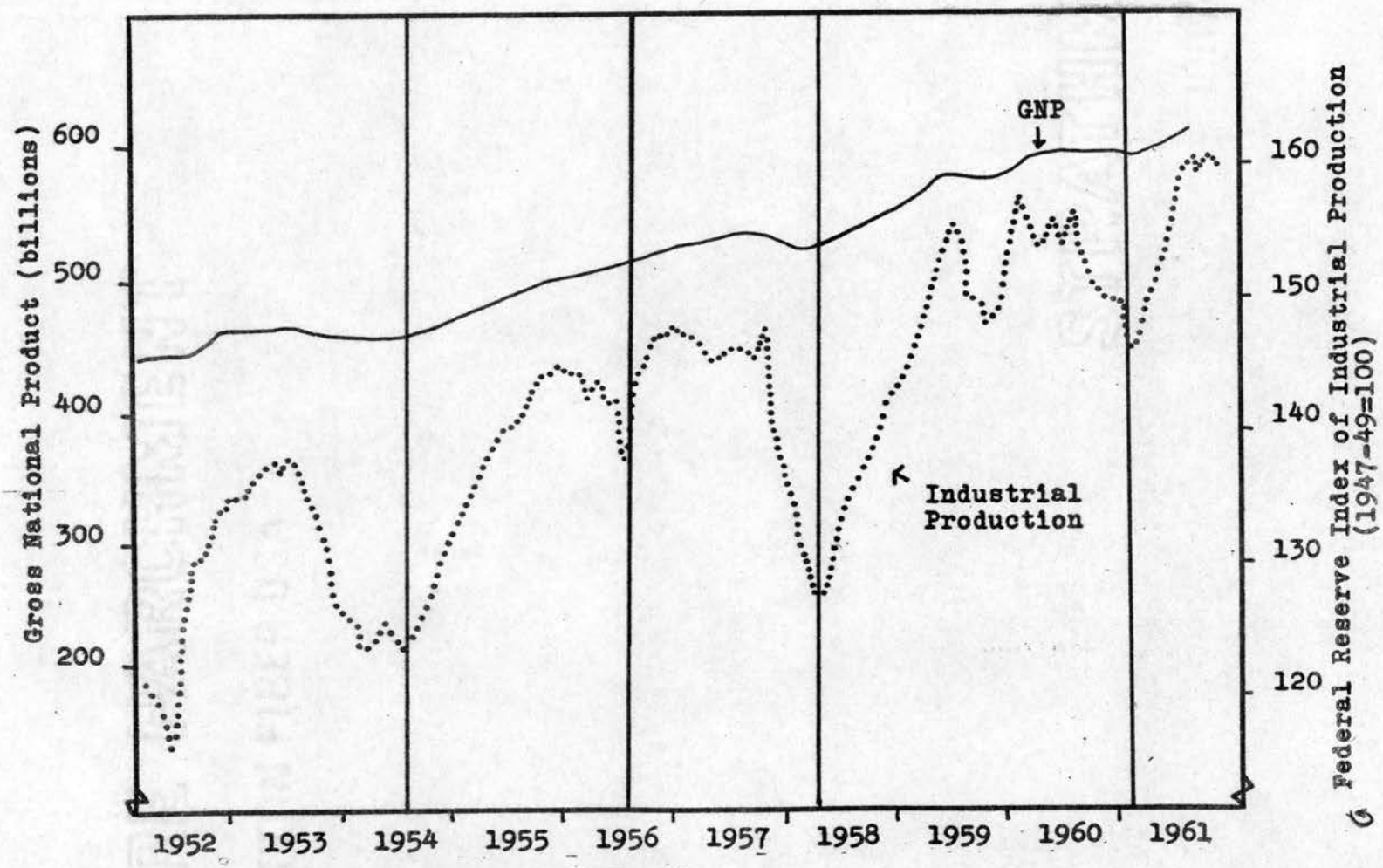
[1] George N. Halm, Monetary Theory (Philadelphia, 1942), p. 436.



Source: Federal Reserve Bulletin

Figure 1. Gross National Product and Industrial Production, 1952-1961

Thus, a recessionary period would be the period between a crest of a cycle and the following trough. Conversely, a recovery phase of any given business cycle is that period between the trough and the following crest. It does not necessarily follow, however, that during the entire recovery phase of any given business cycle that credit restraint will be prescribed, i.e., at some point in the recovery phase mere recovery may be replaced by inflation as full resource utilization is approached. However, credit ease could reasonably be expected throughout the recessionary period and through part of the recovery phase as monetary restraint becomes necessary to prevent economic excesses.

Figure 2 has the free reserve positions of Reserve City Banks plotted along with Federal Reserve holdings of United States Securities; the latter being a measure of Federal Reserve Open Market Operations.[2] The free reserve positions of Reserve City Banks were used in that fluctuations from deficit to surplus in free reserve positions for this bank class are quite responsive to monetary actions implemented by the Federal Reserve System.[3]

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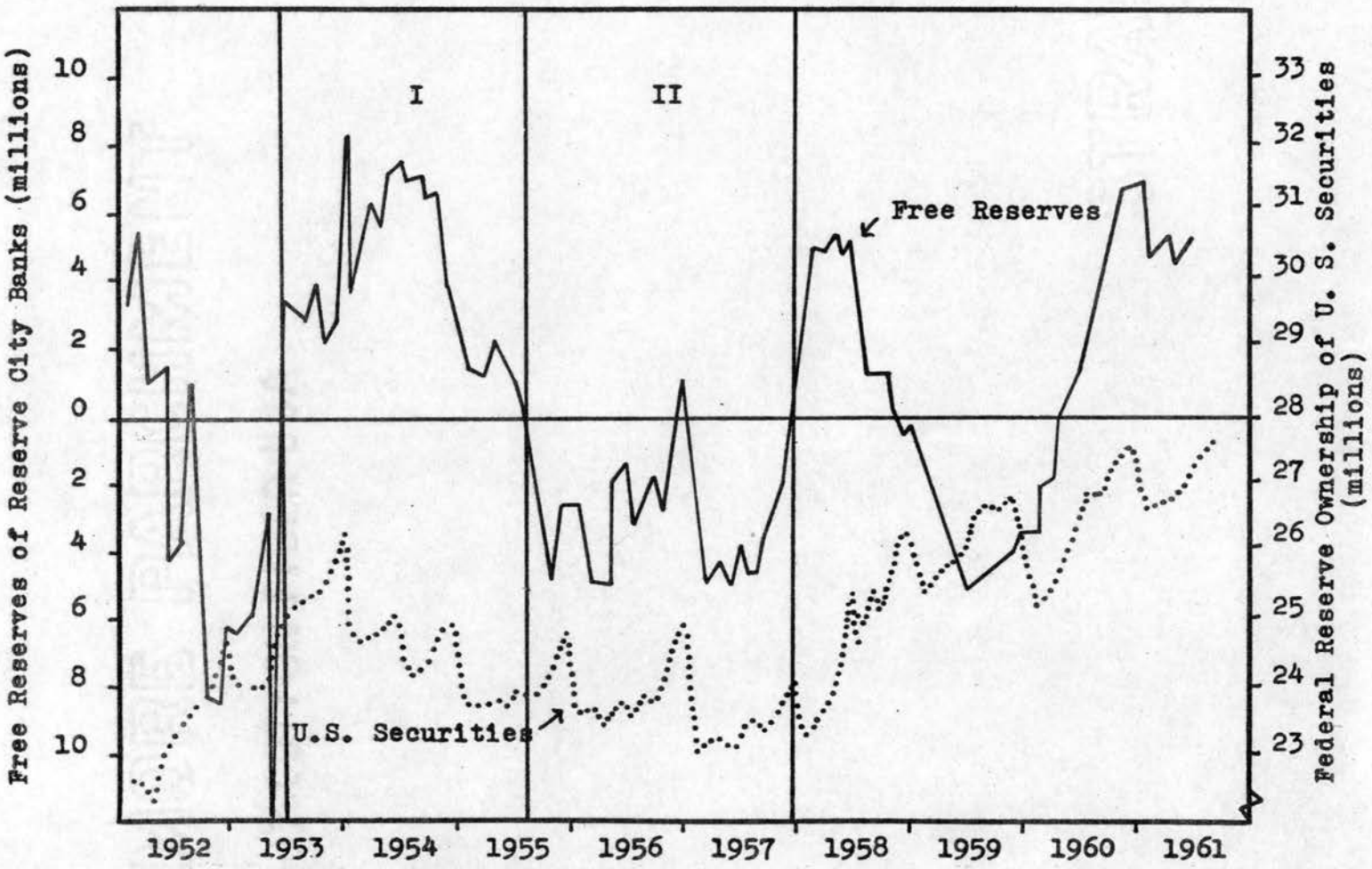
[2]The classification 'central reserve cities' was terminated July 28, 1962. New York City and Chicago, formerly classified as central reserve cities, are separated from other reserve cities in Federal Reserve Bulletin, "Reserves and Borrowings of Member Banks."

[3]Examination of excess and free reserve positions along with borrowings at Federal Reserve Banks easily reveals this relationship. These figures are published monthly in the Federal Reserve Bulletin under "Reserves, Deposits, and Borrowings of Member Banks, By Classes."



Source: Federal Reserve Bulletin

Figure 2. Free Reserves and Federal Reserve's U. S. Securities

Central Reserve City Banks tend to be under such pressure from loan demand that free reserve positions tend to be negative, i.e., borrowings are greater than excess reserves. On the other hand, Country Banks characteristically maintain high excess and free reserve positions. In contrast, Reserve City Banks are responsive to changes in reserves in that they maintain high loan-and-investment-deposit ratios and are, thus, responsive to fluctuations in total reserves in the monetary system as effected by the Federal Reserve System.

The lines of demarcation between periods of monetary ease and monetary restraint, for purposes of the present study, are those points in which the free reserve position of Reserve City Banks passes through the "zero" free reserve change line in Figure 2. Periods in which free reserve positions of Reserve City Banks are positive are considered to be periods of monetary ease. Conversely, periods in which the free reserve positions of Reserve City Banks are negative, i.e., borrowings are greater than excess reserves, are considered to be periods of monetary restraint.

It is interesting to note that an almost perfect inverse relationship exists between the Federal Reserve Index of Industrial Production in Figure 1 (page 10) and the free reserve curve of Reserve City Banks in Figure 2 (page 12). Also, it is interesting to note that the Federal Reserve System's holdings of United States

securities, a measure of open-market operations, roughly parallels the free reserve position of Reserve City Banks. This indicates that open-market operations influence the direction and magnitude of movements in the free reserve curve in Figure 2 (page 12). Perhaps this buying and selling of securities in the open market by the Federal Reserve System reinforces the direction of free reserve movement. In periods of economic slack declines in loan demand lead to deposit declines, which produce excess reserves. This, in turn, produces excess and, thus, free reserves in that borrowings of Federal Funds also decrease. In attempting to promote monetary ease and economic recovery, the Federal Reserve, through the use of open-market operations, injects new reserves into the monetary system. This, in turn, augments the movement initially brought about by decreasing economic activity, of which one measure is the Federal Reserve Index of Industrial Production.

Available Federal Reserve data did not cover the free reserves for Reserve City Banks for the entire period selected for the study. To arrive at this, borrowed reserves for Reserve City Banks were deducted from excess reserves, yielding positive or negative free reserve positions, by month.

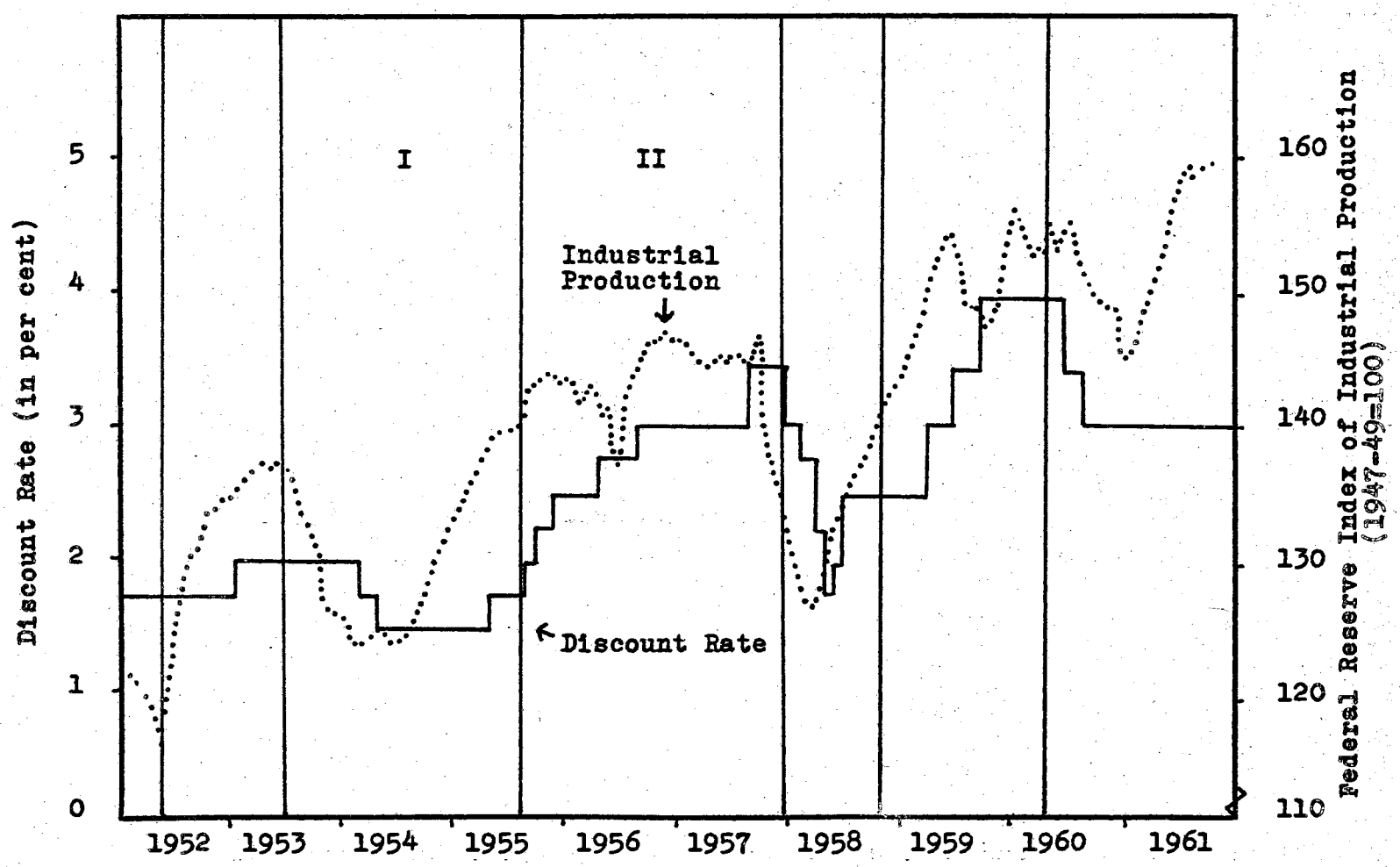
Using this technique for delineating periods of monetary ease and restraint, vertical lines have been drawn at the "zero" free reserve position shown in Figure 2 at three points. Thus, a period of monetary ease, July, 1953

through August of 1955 has been selected. The period from September, 1955, through December, 1957, has been determined to be a period of monetary restraint, although not so clearly indicated as the period of ease preceding it.

The period of monetary ease, July, 1953, through August, 1955, has been labeled in Figure 2 (page 12) as I and will be referred to through the paper as Phase I. The period of monetary restraint has been labeled II in Figure 2 and will be referred to as Phase II. These same periods have been labeled identically throughout the graphic presentations in this paper which show various aspects concerning the industries under study. Figures 3 and 4 show the overt actions of Federal Reserve monetary policy. Figure 3, the Federal Reserve Discount Rate, indicates that this monetary tool's use tends to lag behind that of the free reserve position of commercial banks. This is also true of Federal Reserve Legal Reserve Requirements, as shown in Figure 4. Comparison of these overt monetary actions with free reserve positions, shown by the vertical phase lines, indicates that the time lag is somewhat greater as monetary restraint is applied than when monetary ease is promoted. In addition, the regression curves to be introduced below will be labeled I and II and will represent regression data within the Phase I and Phase II definitions.

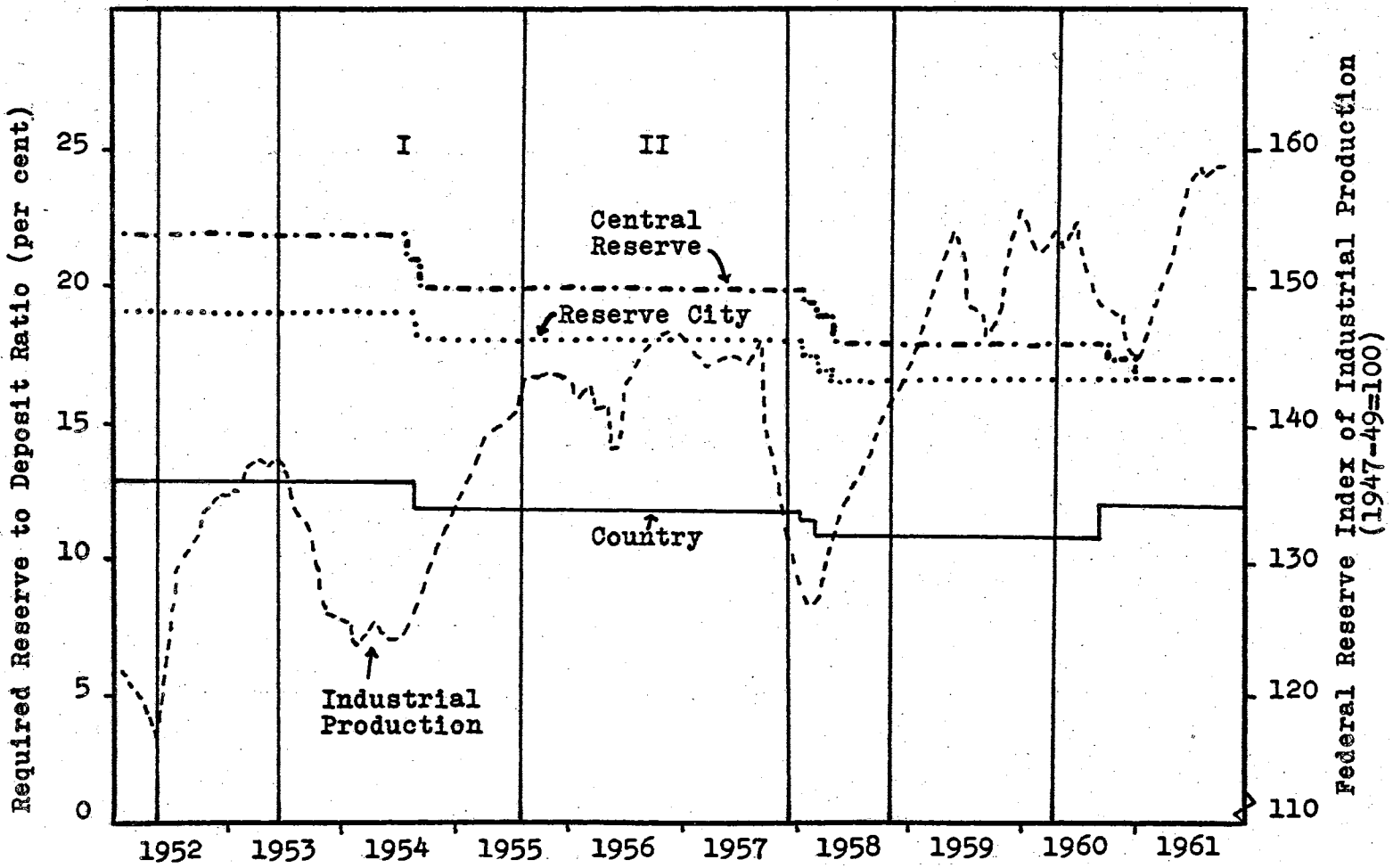
Industries Selected

The industries selected for the study are essentially



Source: Federal Reserve Bulletin

Figure 3. Federal Reserve Bank of New York Discount Rate



Source: Federal Reserve Bulletin

Figure 4. Federal Reserve Legal Reserve Requirements

those used by the previously cited studies, partially because of data availability. These industries are as follows:

Food, Liquor, and Tobacco
Textiles, Apparel, and Leather
Metals and Metal Products (includes machinery and transportation equipment)
Petroleum, Coal, Chemical, and Rubber
Public Utilities (includes transportation)
Construction.

The industries selected produce the major portion of the industrial output of the economy. However, the very important industries of Agriculture and Automobiles have been omitted because of the lack of loan data. The latter's loan data are included in Metals and Metal Products, but should be separated in view of the position the Automobile Industry holds in the nation's economic life.

Loan Data Selected

These data were compiled by the Federal Reserve System and come from about 200 reporting banks holding about 95 per cent of the total commercial and industrial loans and 70 per cent of all loans made by commercial banks.[4] The reporting banks use their larger loans only for

[4]This information is found in each issue of the Federal Reserve Bulletin in the table entitled "Changes in Commercial Loans of Weekly Reporting Member Banks, by Industry."

reporting purposes. In view of the fact that the larger banks are the reporting banks and that the greater part of monetary impact is felt in the larger banks, many of which are Reserve City Banks, the selection of loan data and monetary periods should be almost ideal for the study of monetary impact upon various industries.[5]

These business loan data have been plotted to show their cumulative changes for each month during Phases I and II, the time periods selected for the study. The mechanics of obtaining the cumulative total, for graph plotting purposes, inasmuch as changes only are reported, is described below. Beginning with "zero," the monthly changes were added or subtracted, depending upon whether the change was positive or negative, then subtotaled, yielding monthly cumulative changes in loan totals. For computing the loan-profit regression curves, a slightly different technique was employed. The monthly changes in loans for each industry were added, or subtracted, yielding monthly cumulative loan totals. The low point in loans for each industry was determined and assigned a value of $100 millions. Then, the monthly cumulative loan totals were recalculated. The base assigned the $100 million value occurred during Phase I for each of the selected industries.

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[5]Board of Governors of the Federal Reserve System, "Member Bank Lending to Small Business, 1955-57," Federal Reserve Bulletin, 44 (1958), 405 ff.

By plotting the loan data over longer periods than Phases I and II, it is possible to observe seasonal and cyclical variations which characterize the selected industries.

These loan data were not seasonally adjusted because seasonal variation in a given industry's output may alter its seasonal borrowing requirements. It seems plausible that if the credit brakes are applied during the seasonal upswing in an industry's borrowing, the impact might be greater for this industry than for one which experiences little seasonal variation in output and borrowing.

Profit Data Used

Profits after taxes were selected as the measure of possible loan discrimination among the selected industries. This was done because profit levels ultimately determine the success or failure of an individual firm and, in a collective sense, an industry.

The rationale for the use of profit data in conjunction with loan data is that firms within an industry borrow bank funds with the expectation that the use of these funds will add to profits. Thus, if an industry has sufficient demand for its output so that expansion financed by bank funds can add to its profits, it is logical to assume that firms within the industry will want to borrow.

Inasmuch as comparable profit data with loan data by industry are not available, corrections were made by the

process of consolidation of the profits of two or more industrial groupings. These data have been compiled, in part, by the Federal Reserve System and are defined as profits after taxes of large corporations.[6]

Food, Liquor, and Tobacco loan data are to be related to profit data for Food and Kindred Products.

Metals and Metal Products are to be related to the total profits of several groups. Fabricated Metal Products (except ordnance, machinery, and transportation) and Machinery and Transportation Equipment are used as the profit group.

Loan data for Petroleum, Coal, Chemical, and Rubber are to be related to the profit data for Chemical and Allied and Petroleum Refining.

Construction loans are related to the total profits of Lumber and Wood Products (except furniture) and Structural Non-Metallic Building Materials. These include stone, clay, and glass products used in the construction industry.

For Public Utilities, the total of Electric Utilities and Public Transportation profits was used.

The profit data used for all the industrial groupings

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[6]Board of Governors of the Federal Reserve System, Federal Reserve Bulletin. These data are found each month in the table entitled "Sales, Profits, and Dividends of Large Corporations." Information from various numbers of corporations are used; with 14 for Automobiles and Equipment and 25 for Food and Kindred Products.

are found in quarterly totals only. Inasmuch as the loan data were monthly, the quarterly profit data were converted to monthly data for use in the regression analysis. This was accomplished by dividing the totals obtained in the profit consolidations for each industrial grouping by three, the number of months in each quarter. Next, a three month moving average was used to correct the monthly data so that movement of data from one quarter to the next would not be so abrupt. This should add realism to the monthly movements of the profit data, although it is recognized that some distortion is introduced.

Determining Relationships

The statistical tool of regression curve analysis using loan and profit data has been chosen for use in the study.

The monthly data for loans and profits have been selected for each industrial grouping, for both Phases I and II, and were plotted. Since no curvilinear relationships appeared to exist, no tests for curvilinearity were made.

An equation was computed for each curve and the lines representing the average relationships between the loans and profits of each industry for Phases I and II were plotted.

After the loan-profit regression curve was plotted for each of the selected industries, an area was marked

off on the abscissa of each industry's regression curve graph to represent a given change in loans. From the two points representing the marked off area, a given change in loans, two lines were extended upward to each regression curve. From the points of intersection between the vertical lines and the regression curves, lines were extended to the ordinate, giving the change in profits for a given change in loans for each industry for both phases.

For a given change in loans, the independent variable, the resulting change in profits was measured on the vertical axis for each of the selected industries. Next, the change in profits for each curve, in dollars, was divided by the given change in loans, also in dollars, the result of which was expressed as a decimal. Reduced in this manner, the dollars in profits resulting from a dollar change in loans can be expressed in cents or as a decimal. This result has been labeled the marginal profit rate per loan dollar, and was computed for each of the selected industries. This marginal profit rate per loan dollar is the coefficient of X found in each regression curve equation.

At this point, each industry's percentage share of the marginal profit total received by all the selected industries was computed. This was done by summing the marginal profit rates of the six selected industries to arrive at a Phase I total, and the same was done for Phase II. The marginal profit total was then divided into each industry's marginal profit rate for each phase to arrive

at each industry's percentage share of total marginal profits. The identical procedure was used to obtain each industry's Phase I and Phase II percentage share of total loans extended to the six selected industries. This was done by summing the arithmetic means for Phases I and II, and dividing the sum of the means into each industry's mean loan level for each phase.

The percentage share of total marginal profits for Phases I and II were labeled PMP^{xi} and PMP^{xii}, respectively. In a like manner, each industry's percentage share of total loans outstanding to the six selected industries was computed and labeled PL^{xi} and PL^{xii}.

A simple proportion equation was set up for each industry using PMP^{xi}, PMP^{xii}, PL^{xi}, and Z^{xii}, the latter being the unknown factor, the anticipated Phase II loan percentage share of loans for Industry X. When computed, this unknown factor, Z^{xii}, is designed to serve as a base point for determining if loan discrimination has occurred as Industry X changed from its Phase I environment to that of Phase II. The resulting general formula is:

$$PMP^{xi} : PMP^{xii} = PL^{xi} : Z^{xii} .$$

Those industries in which Z^{xii}, the anticipated Phase II loan percentage share, is greater than that actually received, PL^{xii}, are considered to have been discriminated against by credit restraint processes. The basis for this statement is that each industry's Phase I regression curve

slope, percentage share of marginal profits, and percentage loan share are considered to be the "norm." If this is true, each industry should maintain at least the same percentage of Phase II loans as that of Phase I, corrected proportionally for changes in regression curve slope and, thus, marginal profit rate changes. Thus, the level of the Phase I marginal profit percentage share, the "norm," should determine the Phase II loan percentage share in that any change in the marginal profit percentage share should be accompanied by a proportional change in the percentage share of loans.

CHAPTER IV

THE HYPOTHESIS

The first assumption in setting the analytical scene is that during a period of monetary ease, there exists no monetary pressure which would cause one industry to receive more loanable funds than another. That is, the environment in which a given industry exists during a period of monetary ease has no element of credit restraint present. A period of monetary ease is, by definition in this paper, a period in which free reserves are available, thus allowing potential credit expansion to meet legitimate and prudent credit needs of all industry. The ways in which available loan funds are allocated during a period of monetary ease is dependent upon the credit needs of individual industries and the credit-worthiness of the individual firm within the industry.

A period of monetary restraint is, by definition in this paper, a period in which aggregate free reserves of Reserve City Banks is negative. That is, the demand for loanable funds, as expressed by the desires of commercial banks to meet the credit wants of loan customers, is such that reserves are unavailable to support this demand. This reserve limitation is either allowed to occur, or is

actively pursued, by the Federal Reserve System to promote economic stability.

The second assumption in setting the analytical scene is that those industries characterized by loan-profit regression curves having the larger slopes, within limits described below, should receive the larger share of available loan funds. The reasoning for this assumption is that those industries having the larger loan-profit regression curve slopes face market demand situations, resource supply costs, technological factors, and management attitudes such that they can earn more profit per loan dollar expended than those industries characterized by loan-profit regression curves having lesser slopes. Thus, the industries having the greater slopes in their loan-profit regression curves are capable of purchasing additional loan increments, dollars, until the cost of each loan dollar, the interest cost, is equal to the marginal profit earned. At this point, the individual firm, or collectively, the industry, maximizes profits, thus, the marginal physical product of each dollar's worth of input resource would move toward equality throughout the economy. This equality of all resource costs then would maximize the satisfaction of society. The interest cost of a loan dollar is the marginal cost factor and the use to which the input resource is put determines its marginal physical product.

During a period of monetary ease, wide variation in

the slopes of computed loan-profit regression curves is evident. During this period, since no element of monetary restraint is present, by definition, the variation in regression curve slopes results from various inter-related factors. These include such factors as the demand situations faced by the industries, the technology characteristic of the industries, agressive or conservative managements, and traditional risk allowances characteristic in the industries. An industry which faces wide cyclical variations in output and prices, or which faces high-risk type operations, may characteristically maintain high, wide risk margins in the allocation of resources.

The third assumption is that after a given industry's loan-profit regression curve has shifted from its position in the environment of monetary ease to that of monetary restraint all causative factors other than loans remain stationary. Thus, for either monetary period all variables except loans, the independent variable, and industry profits, the dependent variable, are considered to be inoperative for purposes of analysis. With this assumption, changes or movements along a given curve can be made without shifting the regression curve. It is recognized large changes in the independent variable would alter the regression curve position in that borrowed funds would be used to purchase input resources, which would alter resource allocation and possibly resource prices, or output prices,

which would alter prices received and profits earned. Implicit in this reasoning is that resources are reasonably mobile and that restraint of trade practices are not flagrant.

The fourth assumption is that the relative shift of an industry's loan-profit regression curve from a period of monetary ease to a period of monetary restraint, along with shifts in the industry's loan volume, constitutes valid measurement of possible loan discrimination, when compared with curve shifts and loan volumes of other industries. The reasoning is that an industry characterized by a loan-profit regression curve having a large slope is influenced by technological and management factors in a monetarily neutral environment during a period of monetary ease. As the industry shifts its regression curve to the environment of monetary restraint, changing markets, technological, and management characteristics are altered; in addition to the industry being exposed to monetary restraint pressures. However, even during the restraint period, the basic industry factors are still present, although their influences may be somewhat altered. For this reason, the mere comparison of the differences in regression curve slope shifts among industries as the environment changes from monetary ease to monetary restraint cannot be used as a measurement of loan discrimination among industries. This conclusion results from the fact that the same basic characteristics of an industry, such

as demand, resource costs, technological, and management factors, are still present during the period of monetary ease, although probably somewhat altered. The same is true for an industry having a characteristic low-sloped regression curve during the period of monetary ease in that the same factors which cause it to possess the low slope during the period of monetary ease will also be likely to cause a low sloped curve during the restraint period. However, it must be kept in mind that the monetary restraint factor may influence the relative shift in the curve upward or downward during the restraint period.

For these reasons the relative shift in regression curve slopes and the relative change in loan volumes of each industry must be compared with that of every other industry.

Effects of Slope Shift

Figures 5 and 6 have four hypothetical loan-profit regression curves plotted; Figure 5 having Industry X during a period of monetary ease and a period of monetary restraint, and Figure 6 having Industry Y for these same two periods. Curve X^{I} represents Industry X during Phase I, the period of monetary ease, and curve X^{II} for the period of monetary restraint. Curve Y^{I}, in Figure 6 represents Industry Y during the period of monetary ease, while curve Y^{II} represents Industry Y during the period of monetary restraint. During Phase I curve X^{I} is

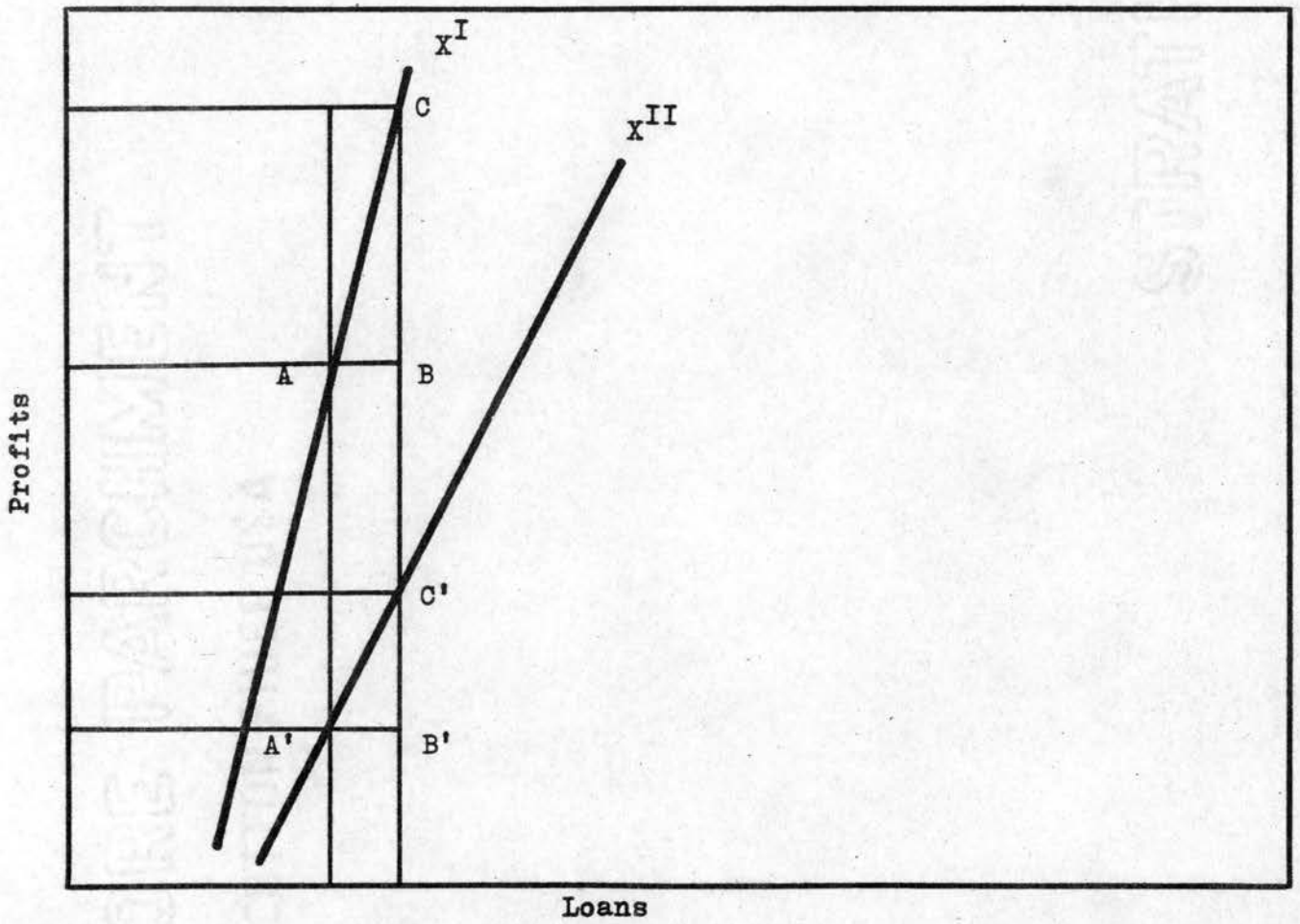


Figure 5. Industry X-Loan-Profit Regression Curves

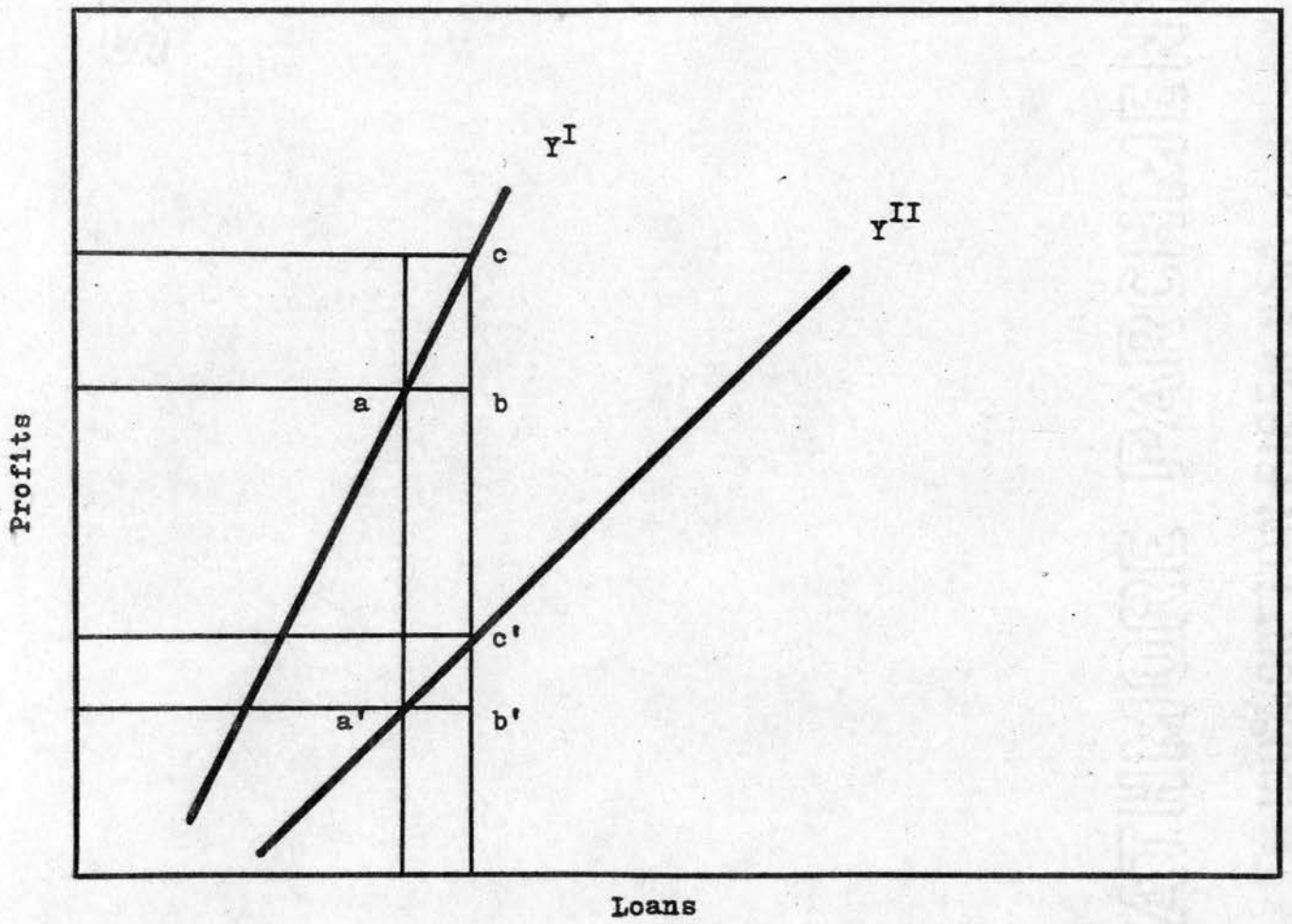


Figure 6. Industry Y-Loan-Profit Regression Curves

characterized by a slope of four, which shifted to a slope of two, curve X^{II}, during Phase II. Thus, a loan dollar, AB, is capable of producing four dollars in profits, BC, for Industry X during Phase I. After the downward shift in curve slope, curve X^{II}, a loan dollar, A'B', is capable of producing two dollars, B'C', in profits for Industry X. Industry Y, as shown in Figure 6, is characterized by a loan-profit regression curve slope of two during Phase I, which is reduced to a slope of one for Phase II. Thus, during Phase I, a loan dollar, ab, is capable of producing two dollars in profits, bc, while during Phase II a loan dollar is capable of producing one dollar, b'c', in profits.

Assume that the mean of the Phase I loan level for Industry X, $\bar{X}^{i}$, is 280 and that the mean for Phase II, $\bar{X}^{ii}$, is 300. These numbers represent dollars and may be any multiple of ten. Assume also that the Phase I mean loan level for Industry Y, $\bar{Y}^{i}$, is 300 and that the Phase II mean loan level, $\bar{Y}^{ii}$, is 325. The summation and percentages for Industries X and Y for Phase I are:

$$\bar{X}^{i} + \bar{Y}^{i} = 280 + 300 = 580$$

$$PL^{xi} = \frac{280}{580} = 48.3\%$$

$$PL^{yi} = \frac{300}{580} = 51.7\% .$$

For Phase II:

$$\bar{X}^{ii} + \bar{Y}^{ii} = 300 + 325 = 625$$

$$PL^{xii} = \frac{300}{625} = 48.0\%$$

$$PL^{yii} = \frac{325}{625} = 52.0\% .$$

Using the regression curve slopes given above and assuming equal scales on the vertical and horizontal axes, the marginal profit rate for Industry X for Phase I, MPR^{xi}, is 4.0 while that for Industry Y, MPR^{yi}, is 2.0. The Industry X Phase II marginal profit rate, MPR^{xii}, is 2.0 and that for Industry Y, MPR^{yii}, is 1.0. To determine the percentage shares of Industries X and Y for Phase I:

$$\Sigma MPR^{i} = 4.0 + 2.0 = 6.0$$

$$PMP^{xi} = \frac{4.0}{6.0} = 66.6\%$$

$$PMP^{yi} = \frac{2.0}{6.0} = 33.4\% .$$

For Phase II:

$$\Sigma MPR^{xiiyii} = 2.0 + 1.0 = 3.0$$

$$PMP^{xii} = \frac{2.0}{3.0} = 66.6\%$$

$$PMP^{yii} = \frac{1.0}{3.0} = 33.4\% .$$

In setting up the proportion equation, the general formula is:

$$PMP^{i} : PMP^{ii} = PL^{i} : Z^{ii} .$$

For Industry X, the equation is:

$$66.6 : 66.6 = 48.3 : Z^{xii}$$

$$Z^{xii} = 48.3\% .$$

For Industry Y the equation is:

$$33.4 : 33.4 : 51.7 : Z^{yii}$$

$$Z^{yii} = 51.7\% .$$

To determine whether discrimination has occurred, a comparison is made between the estimated loan percentage share for Industries X and Y and that percentage share of loans actually held for the Phase I period.

Industry X $PL^{xii} = 48.0\%$ $Z^{xii} = 48.3\%$

Industry Y $PL^{yii} = 52.0\%$ $Z^{yii} = 51.7\%$.

For Industry X the actual percentage share of loans for Phase II, 48.0%, is below the anticipated percentage share, 48.3%, indicating that the industry did not maintain a relatively higher or equal percentage share of Phase II loan funds in order to maintain its relative percentage share position and remain proportional to the marginal profit percentage. Thus, this industry was discriminated against by monetary restraint.

For Industry Y the actual percentage share of loans for Phase II, 52.0%, is greater than the anticipated percentage share, 51.7%, indicating that loan discrimination did not occur as the industry shifted from an environment of monetary ease to that of monetary restraint.

This example of the effects of slope change upon the loan-profit regression curves along with relative changes in marginal profit percentages and loan share percentages can be used in the development of the hypothesis.

Statement of the Hypothesis

If the relative change in a given industry's marginal profit percentage share, as the environment changes from that of monetary ease to monetary restraint, is accompanied by a more than proportional change in the industry's percentage share of total loans, then the industry has been discriminated against by the processes of monetary restraint.

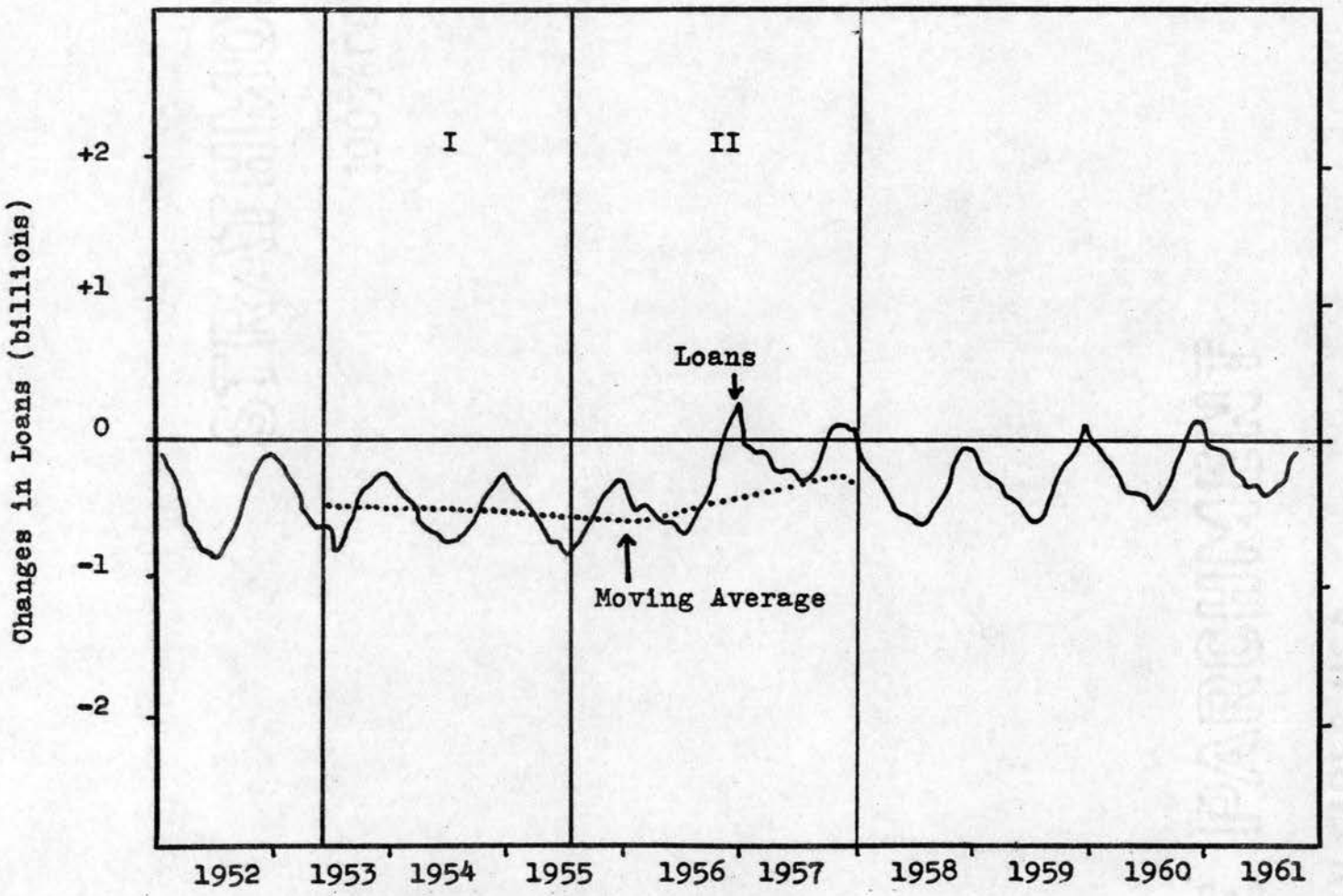
CHAPTER V

ANALYSIS OF THE PROBLEM

The testing of the hypothesis is divided into three sections for analysis. First, characteristics of the selected industries were described. This description includes seasonal and cyclical variations in loans, profits, prices, and output for each industry. Second, the shift in each industry's loan-profit regression curve from a period of recession, Phase I, to a period of monetary restraint, Phase II, was described and their ramifications examined. Third, the shifts in loan-profit regression curves from Phase I to Phase II for each industry were compared with that of every other industry's loan-profit regression curve, along with the volume of bank credit used by each.

Food and Kindred Products

Figure 7 shows that business loans of this industrial complex vary widely in terms of seasonal variation with peaks occurring during the last quarter of one year and the first quarter of the following year. This results from the fact that manufacturers and processers of food and related products purchase their input resources as



Source: Federal Reserve Bulletin

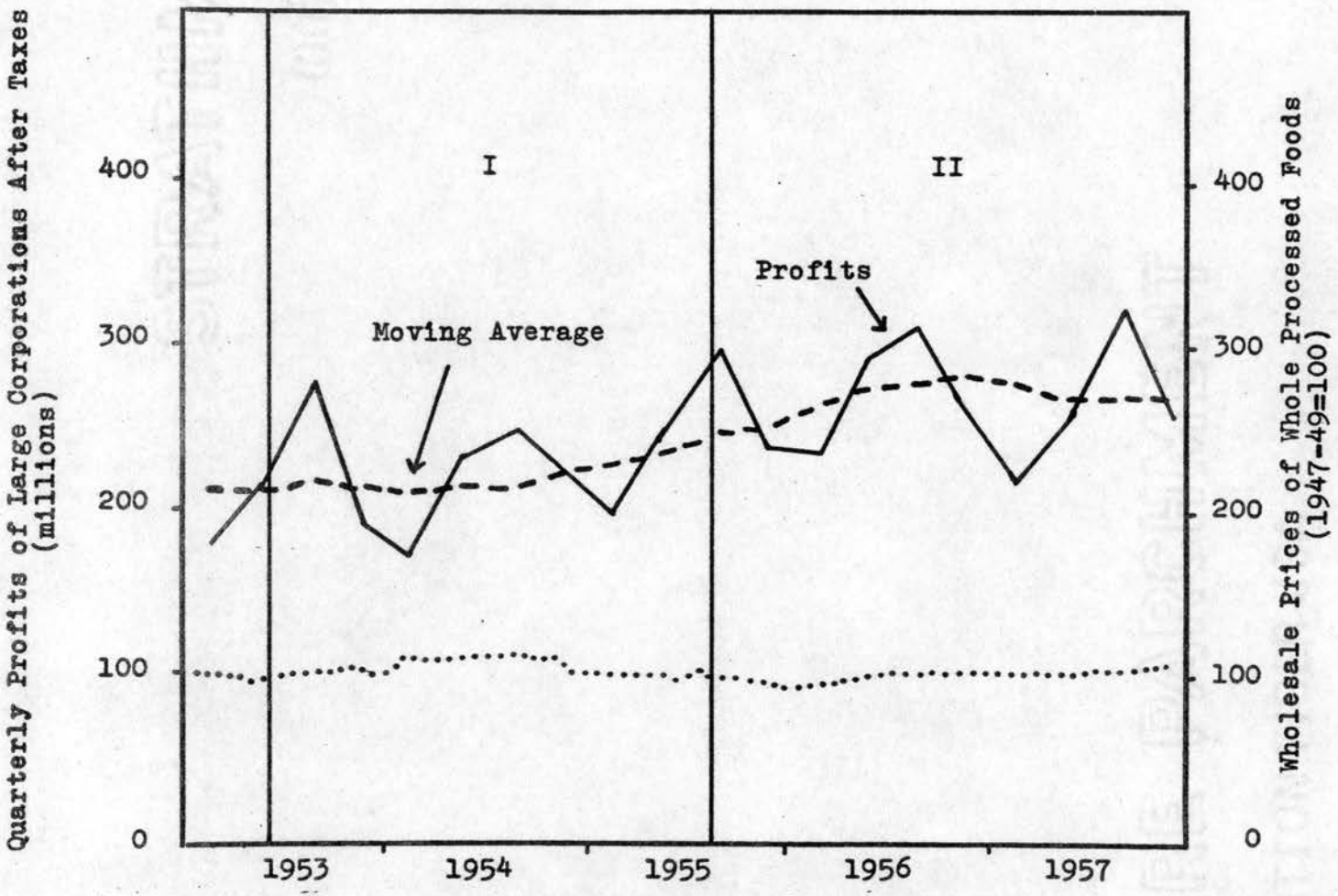
Figure 7. Cumulative Changes in Business Loans - Food, Liquor, and Tobacco

they are harvested, using bank credit to finance the purchases.

During Phase I the amplitude of seasonal swings in bank loans was approximately constant, i.e., the seasonal variation was approximately $625 millions. During Phase II, however, the amplitude of the largest seasonal variation in loans is about $1 billions. A line was drawn by plotting a moving average to show the cyclical movement of bank loans for the industry. This line, in Figure 7, indicates that a cyclical increase occurred during Phase II of approximately $400 millions. This is in addition to the widening in seasonal swings in Phase I from $625 millions to about $1 billions in Phase II.

Figure 8 shows that profits also fluctuated widely on a seasonal basis. However, the profit variations tended to move in a direction opposite to that of loans, seasonally speaking. While loans tended to peak at the last quarter of one year and the first quarter of the following year, profits tended to peak in the middle two quarters of the year. As the manufacturing and processing output is marketed the proceeds are used to repay bank loans secured to purchase input materials purchased at harvest time.

During Phase I the amplitude of seasonal variation in profits was about $75 millions but increased during Phase II to just under $100 millions. In addition, a cyclical increase in profits appears to have occurred in Phase II, as shown by the moving average curve in Figure 8.



Source: Federal Reserve Bulletin

Figure 8. Profits and Prices of Processed Foods and Kindred Products

From Figure 8 it appears that prices increased slightly during Phase I and decreased slightly during Phase II. Figure 9 shows that the output of manufactured and processed foods and related products remained fairly constant throughout both periods, in terms of seasonal variation. However, as might be expected, output increased slightly during Phase II. It is assumed that the price decreases which occurred during Phase II resulted from the effects of increased supply of food products and the relatively inelastic demand faced by food and related products. Thus, demand for the output of this industry is considered to be on the low side of adequate.

The loan-profit regression curve, as shown in Figure 10, for this industrial complex shifted considerably from its Phase I to its Phase II position.[1] During Phase I each loan dollar, AB, was capable of producing $0.152 in profits, BC. During Phase II the slope of the loan-profit regression curve declined resulting in a marginal profit rate of $0.110 for each loan dollar expended, i.e., a loan dollar, A'B', is capable of producing but $0.110 in profits, B'C', during Phase II.

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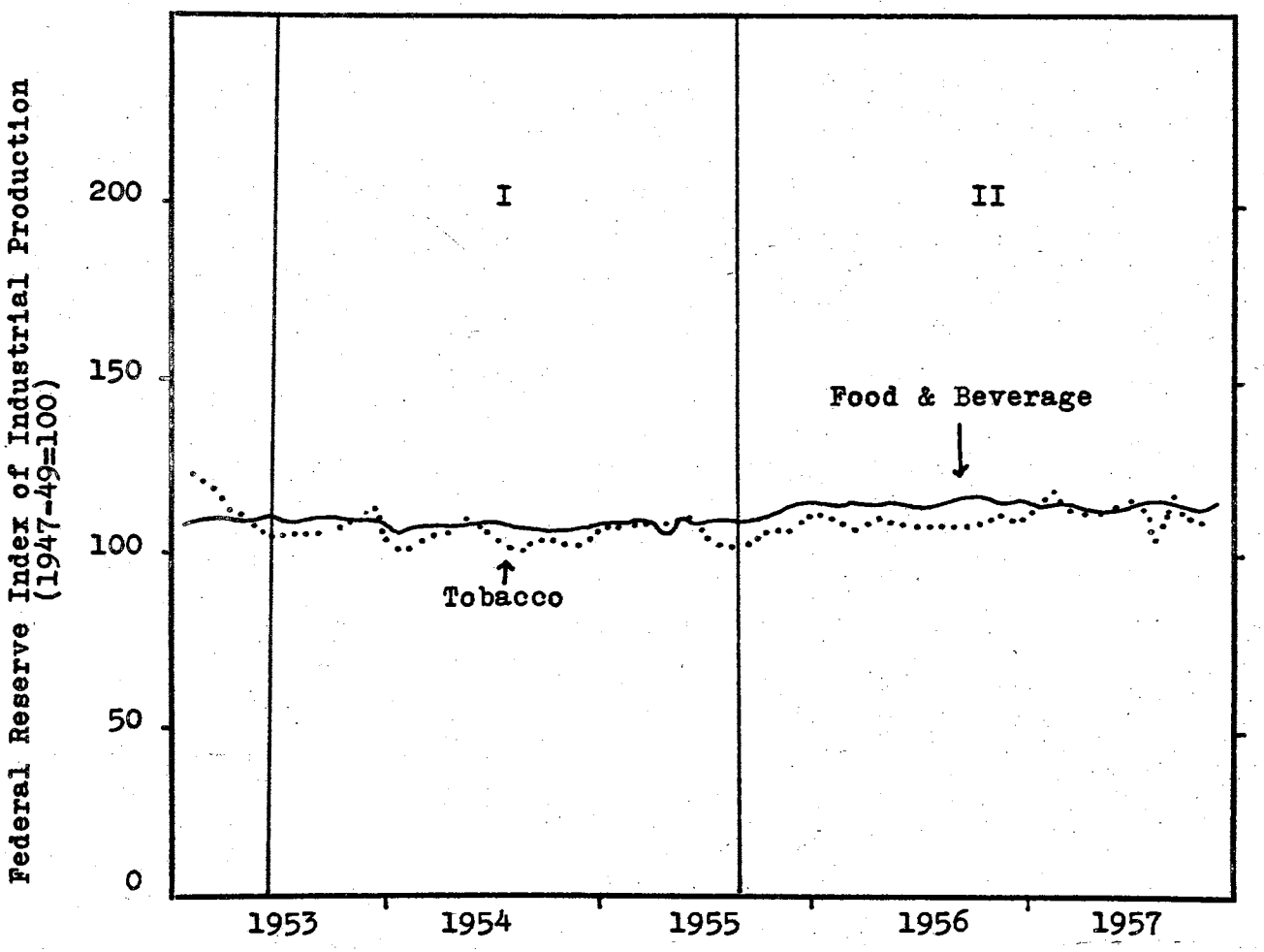
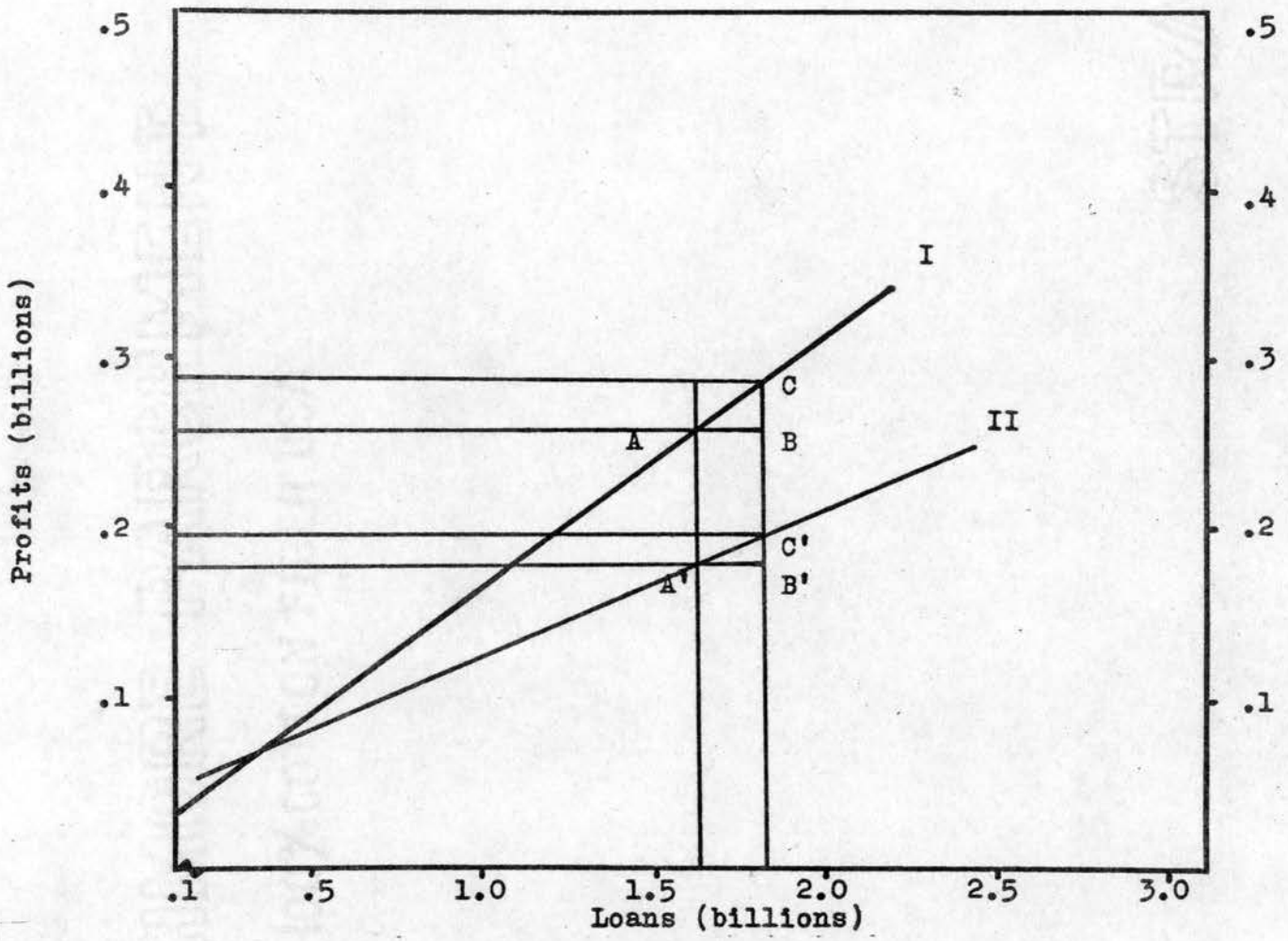
[1]The equation for the Phase I loan-profit regression curve is: $Y = 15.99 + .152X$, where X is the monthly loan level and Y is the monthly profit level. The equation for Phase II is: $Y = 16.00 + .11X$.



Source: Survey of Current Business

Figure 9. Industrial Output of Food and Kindred Products



Source: Federal Reserve Bulletin

Figure 10. Relationship Between Loans and Profits of Foods and Kindred Products

Textiles and Related Products

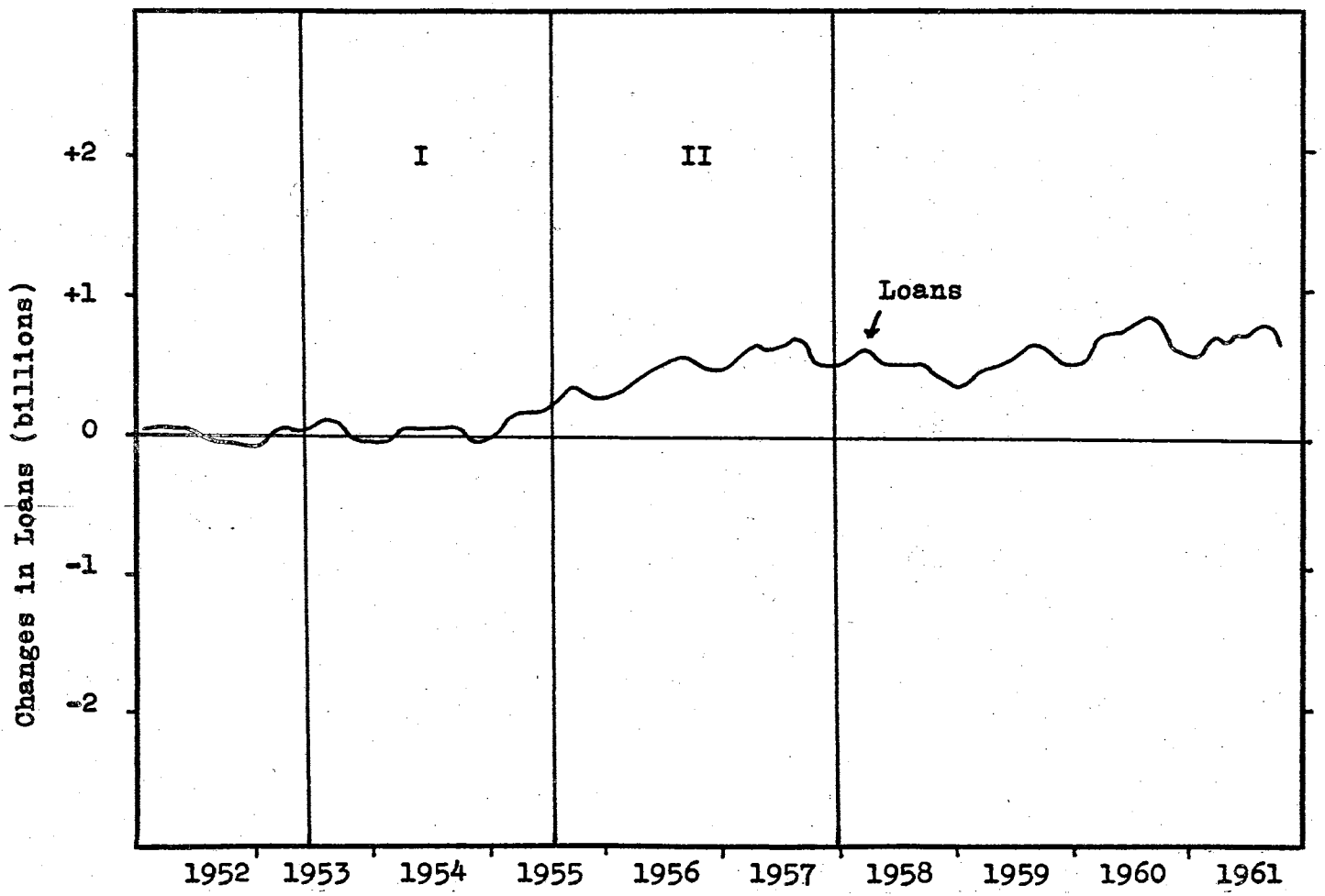
Figure 11 shows that business loans of this industrial complex declined slightly during the year-end periods indicating that limited seasonal variation occurred. During Phase I the amplitude of seasonal variation was approximately $125 millions, while during Phase II the amplitude reached a maximum of approximately $250 millions.

In addition to the seasonal swings in loans, an apparent cyclical increase in loans occurred in Phase II.

Examination of Figure 12 yields no apparent seasonal variation pattern in profits, although quite large variations did occur. However, as shown by the moving average curve, a definite cyclical pattern emerges, with Phase I profits reaching their low-point in mid-1954, beginning their cyclical rise, and topping-out in 1956.

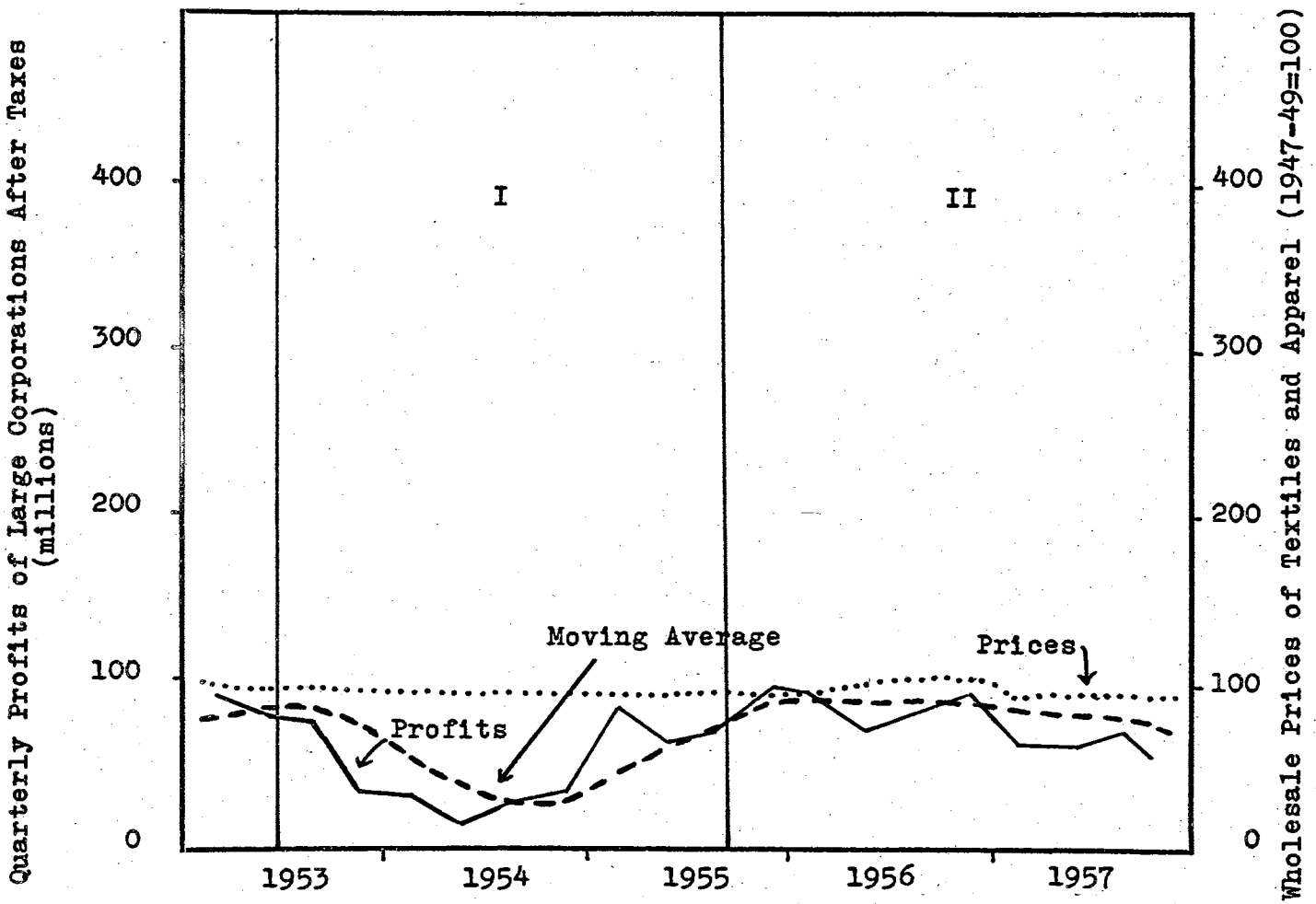
Output of these products declined through the first part of Phase I and rose during the second part, as might be expected during the down-turn and the recovery stages of the business cycle, as shown in Figure 13. However, during Phase II output declined slightly throughout the period and, as shown in Figure 12, prices strengthened during the first half of Phase II, declined, and remained steady. This indicates that demand for the output of this industrial complex is adequate during Phase II.

From Figure 14 it can be seen that the slope of the



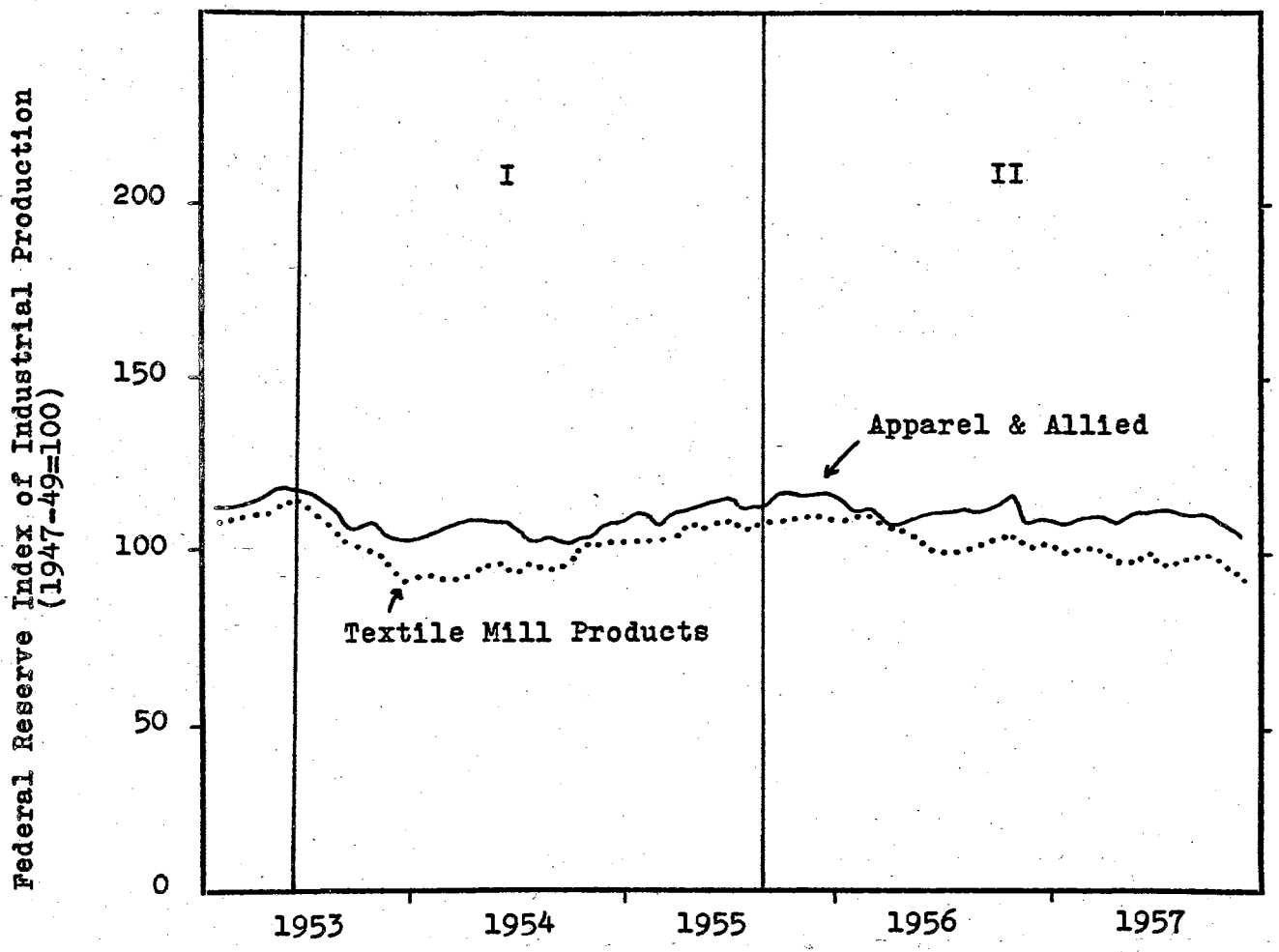
Source: Federal Reserve Bulletin

Figure 11. Business Loans of Textiles, Apparel, and Leather



Sources: Profits - Survey of Current Business
Prices - Federal Reserve Bulletin

Figure 12. Profits and Prices of Textile Products and Apparel



Source: Survey of Current Business

Figure 13. Industrial Output of Textiles, Apparel, and Related

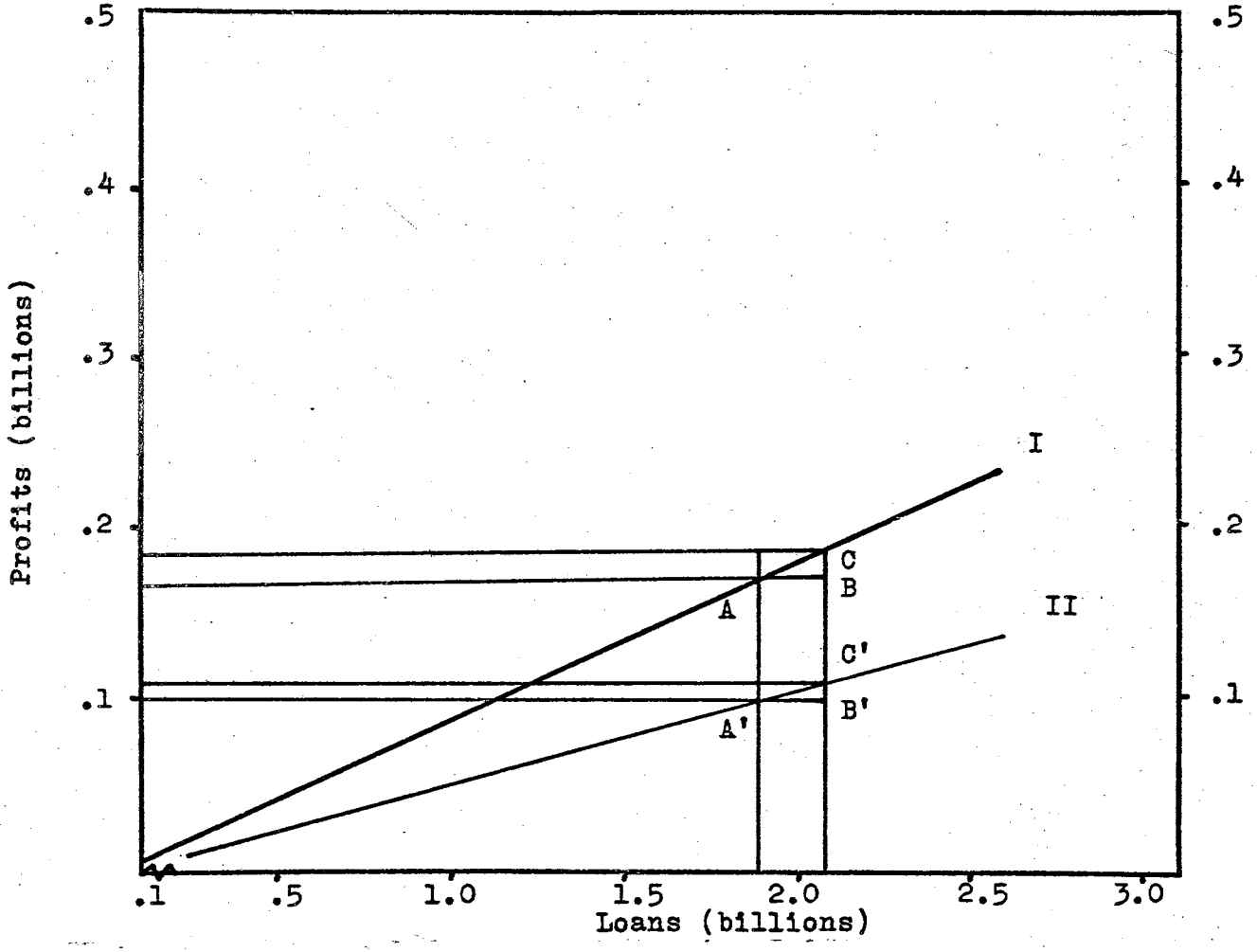


Figure 14. Relationship Between Loans and Profits of Textiles and Related

loan-profit regression curve for the Textiles and Related Industry grouping declined during Phase II from Phase I. During Phase I a loan dollar, AB, was capable of producing $0.074 in profits, BC.[2] After the decline in slope caused by the curve shift, a loan dollar, ab, was capable of producing $0.037, a decline of 50 per cent from the Phase I marginal profit rate.

Metals and Metal Products

From Figure 15 it can be determined that seasonal variation is not an important factor in loans for the metals industrial complex. However, pronounced cyclical variation is apparent. During Phase I bank loans declined through most of the period and rose sharply during Phase II. The Phase I loan decline was approximately $1.5 billions and the Phase II increase was approximately $2.4 billions.

From Figure 16 it appears that profits also were strongly influenced by cyclical variation. In addition, wide variation in profits are apparent, although these fluctuations do not appear to form seasonal patterns. Thus, these variations are assumed to be random in nature.

Prices were strong throughout both periods, with some

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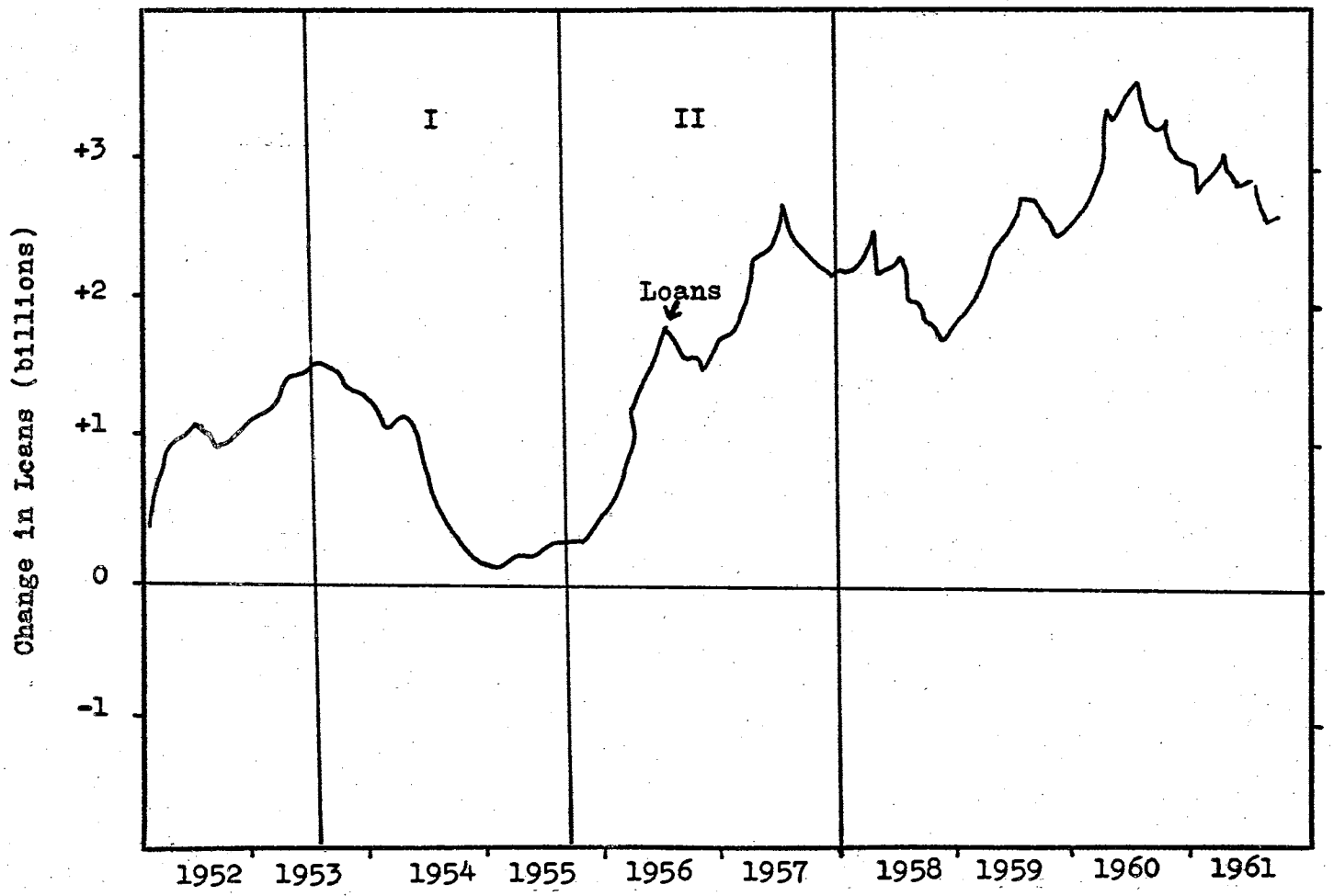
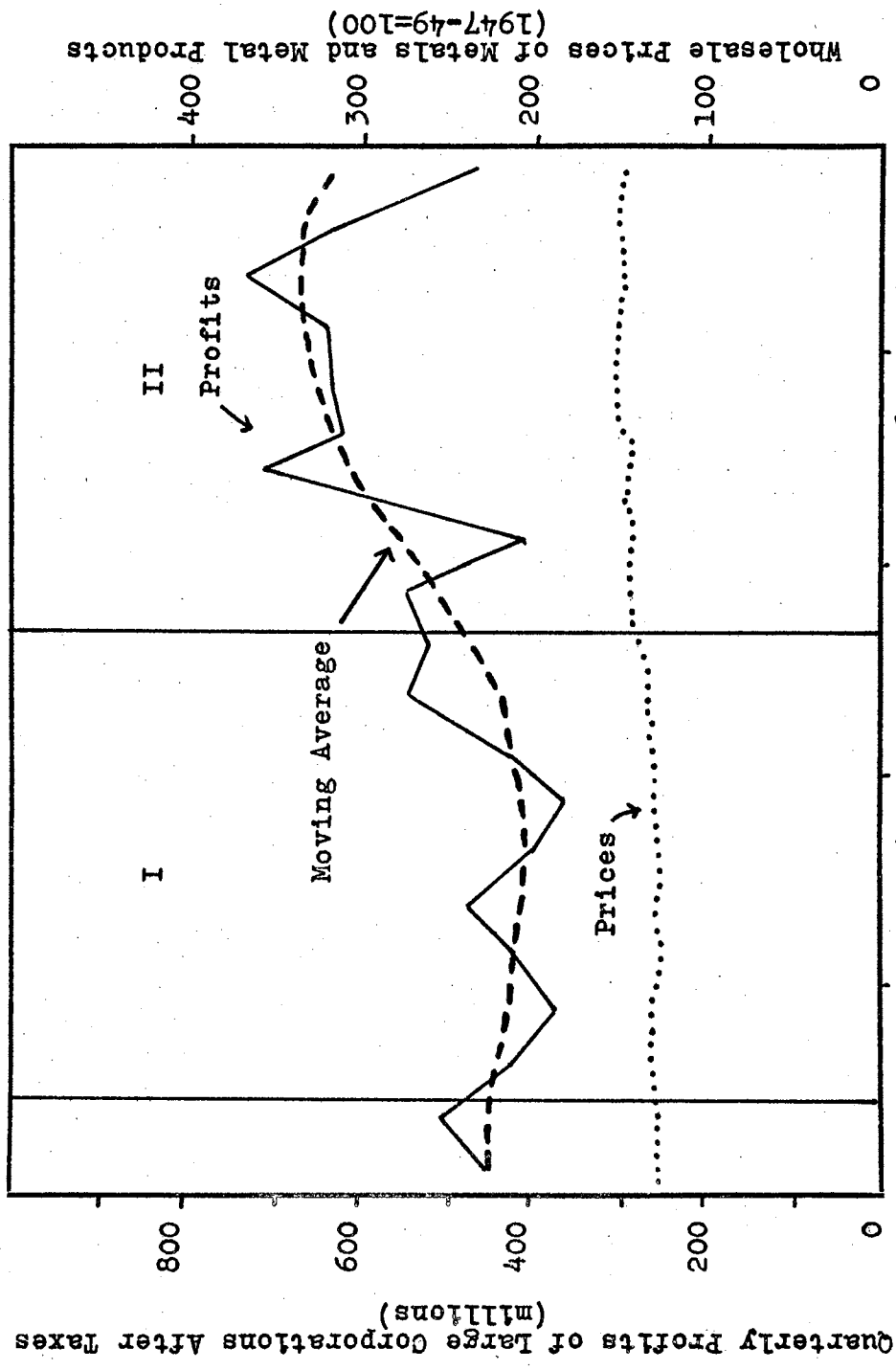
[2]The Phase I equation is: $Y = .34 + .074X$, where X is the monthly loan level and Y is the monthly profit level. The equation for the Phase II equation is: $Y = 2.03 + .037X$.



Source: Federal Reserve Bulletin

Figure 15. Cumulative Changes in Loans - Metals, and Metal Products



Source: Federal Reserve Bulletin

Figure 16. Profits and Prices of Metals and Metal Products

weakness apparent during Phase I, as shown in Figure 16. Industrial output of these products showed market cyclical decline during Phase I, as shown in Figure 17, and only limited strength during Phase II. However, demand appears to have been strong during the period of expanding economic activity, Phase II.

As shown in Figure 18, the slope of the regression curve for the metals industrial complex declined slightly from Phase I to Phase II.[3] During Phase I a loan dollar, AB, was capable of generating $0.132, BC, while during Phase II a loan dollar was capable of earning but $0.107, a decline of 18.9 per cent in the marginal profit rate.

Petroleum, Coal, and Chemical

From Figure 19 it can be seen that bank loans of this industrial complex are not noticeably influenced by seasonal factors. However, marked cyclical patterns are evident in both Phase I and Phase II. During Phase I the cyclical decline consisted principally of a pause in the rate of loan growth, although a slight decline did occur, in absolute terms, during the middle of the period. During Phase II loans increased sharply by approximately $1.5 billions.

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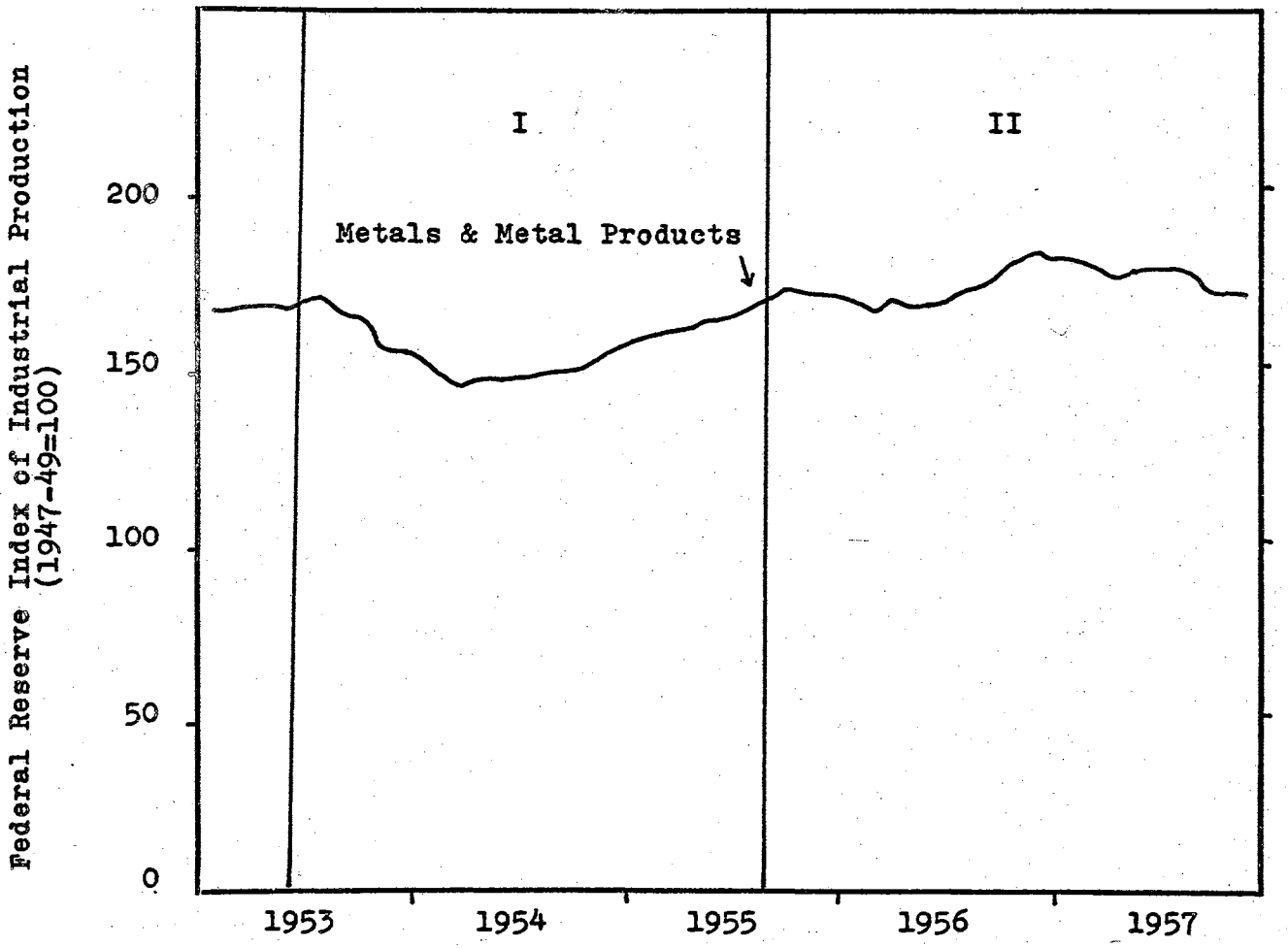
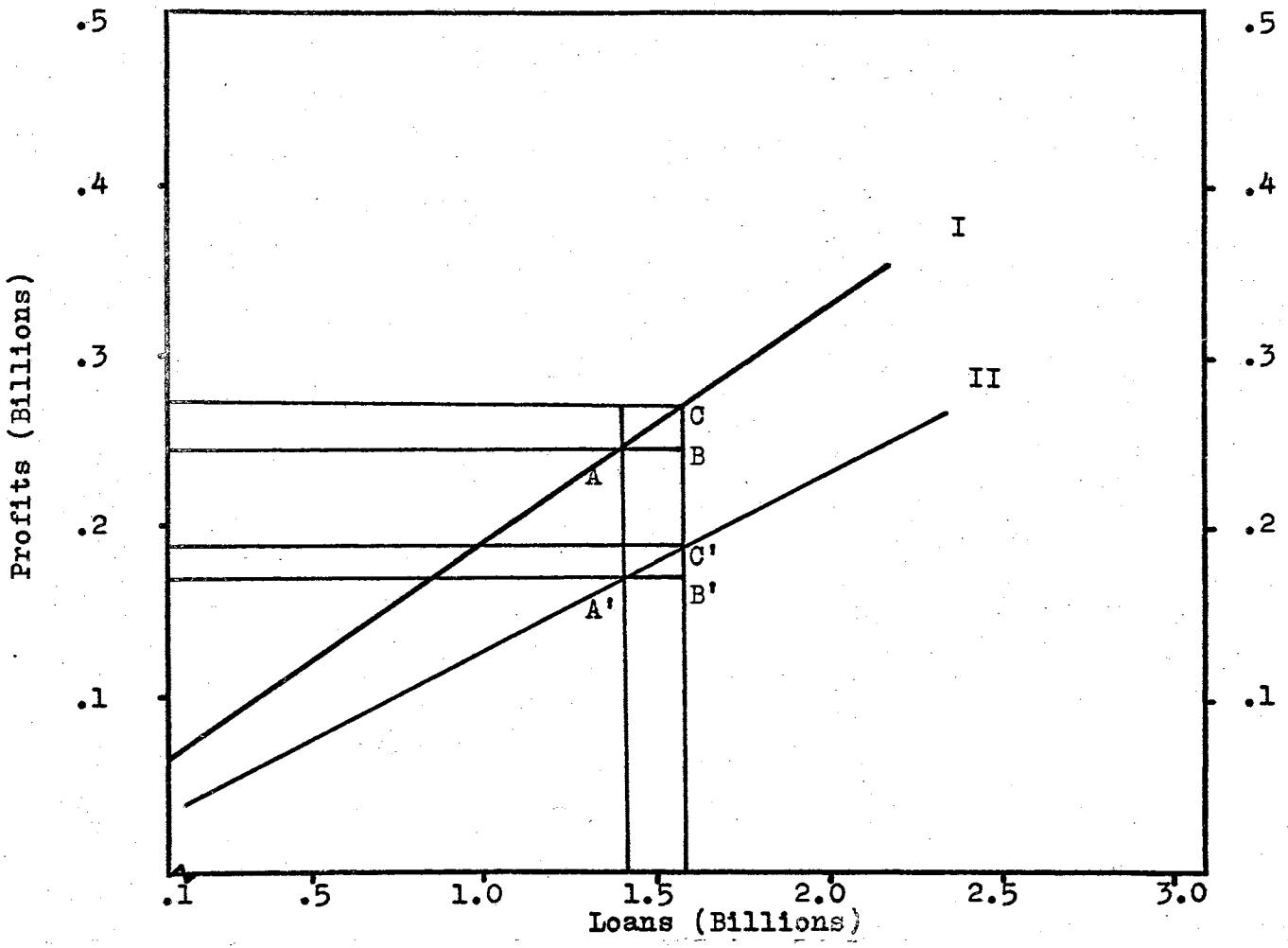
[3]The Phase I equation is: $Y = 55.53 + .132X$, where X is the monthly loan level and Y is the monthly profit level. The equation for the Phase II equation is: $Y = 25.75 + .107X$.



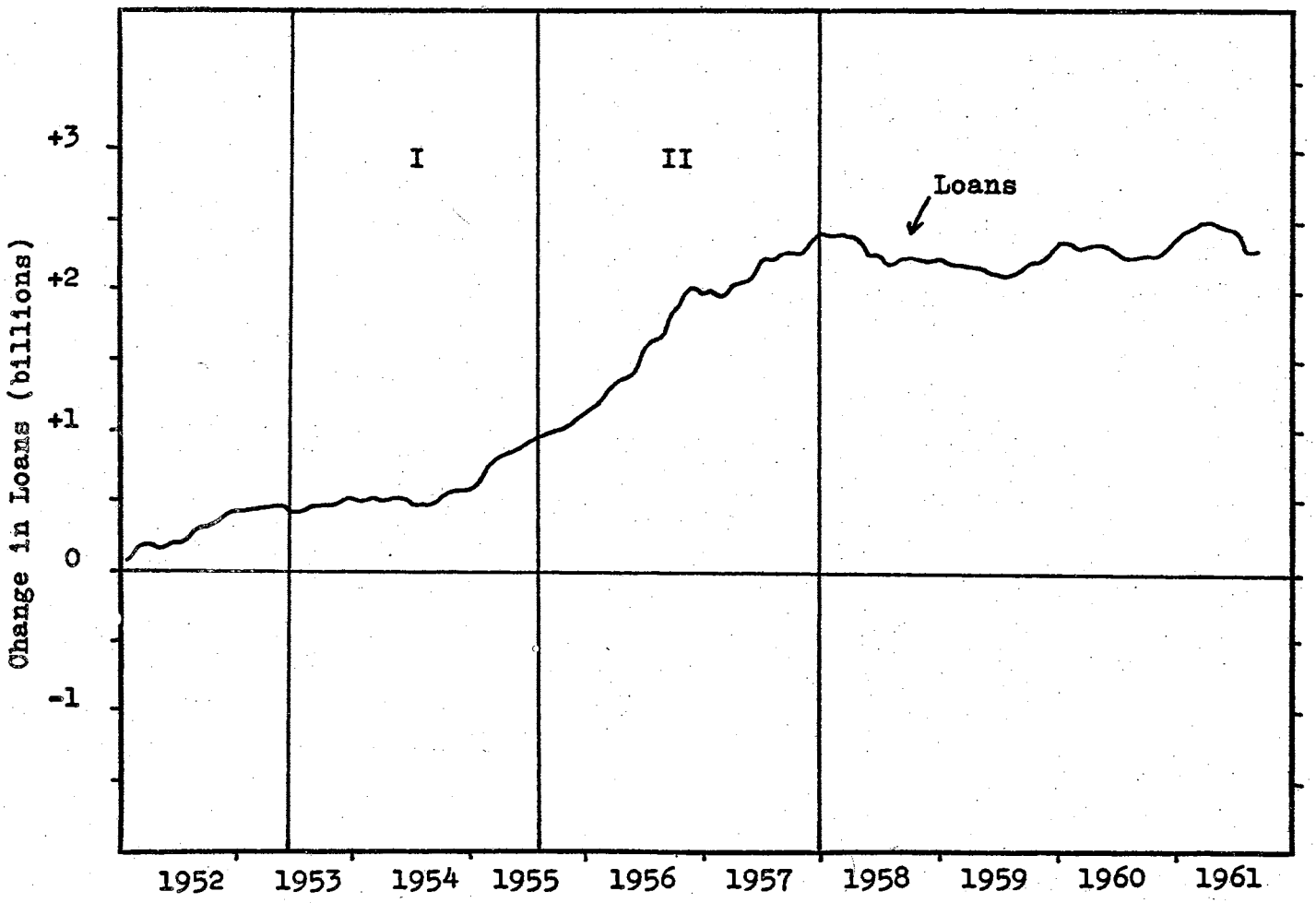
Source: Survey of Current Business

Figure 17. Industrial Output of Metals and Metal Products



Source: Federal Reserve Bulletin

Figure 18. Relationship Between Metals and Metal Products Loans and Profits



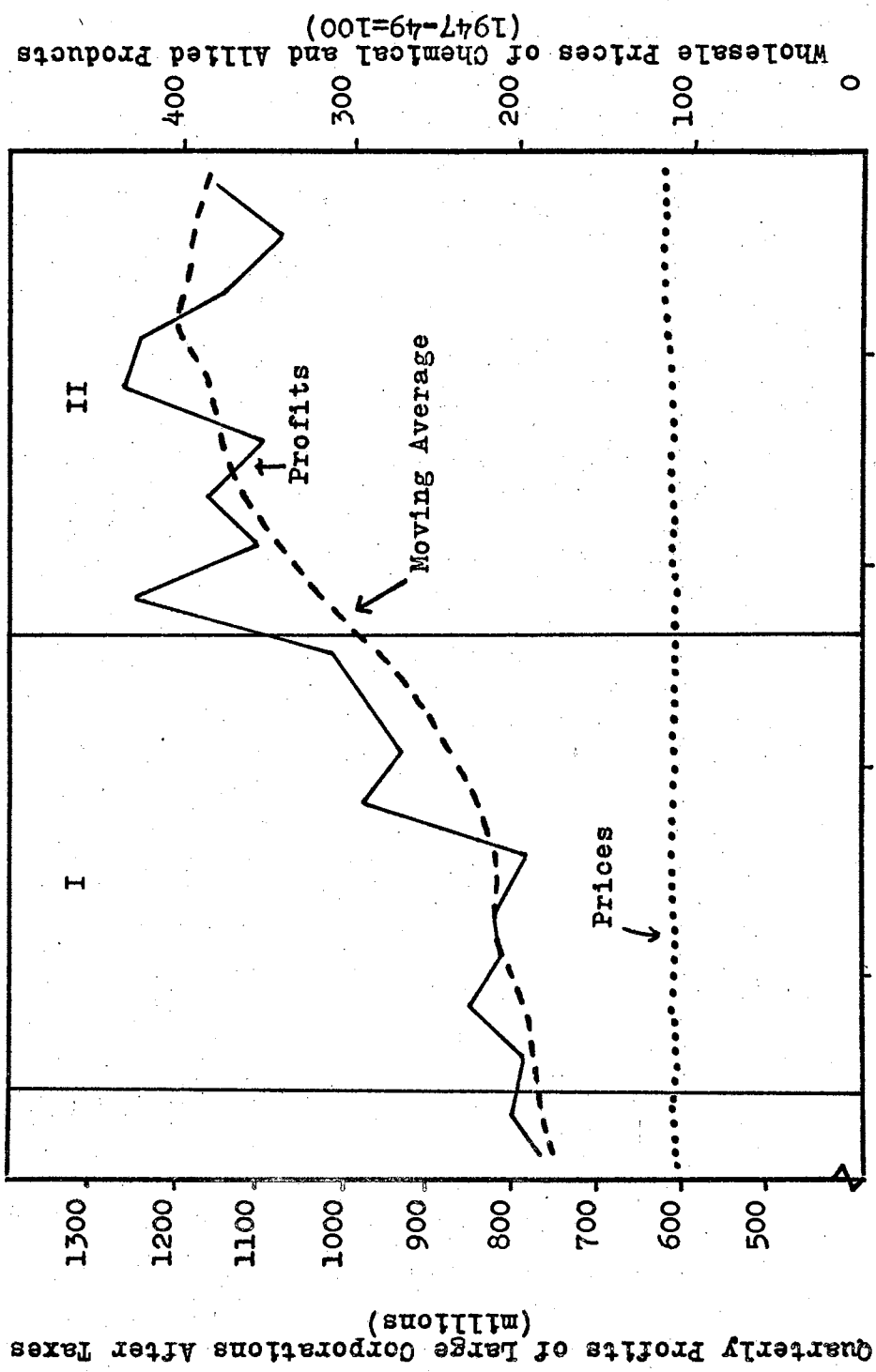
Source: Federal Reserve Bulletin

Figure 19. Business Loans of Petroleum, Coal, and Chemical

Profits for this industrial complex showed no apparent seasonal traits, although some wide swings did occur. In all probability the variations are random or erratic. From the moving average curve in Figure 20 it can readily be seen that strong cyclical patterns in profits are characteristic of the chemical and allied industrial complex. During Phase I the rate of profit growth declined, with little absolute decline even at the bottom of the period, as was true for loans. During Phase II profits increased well into the period before beginning their decline.

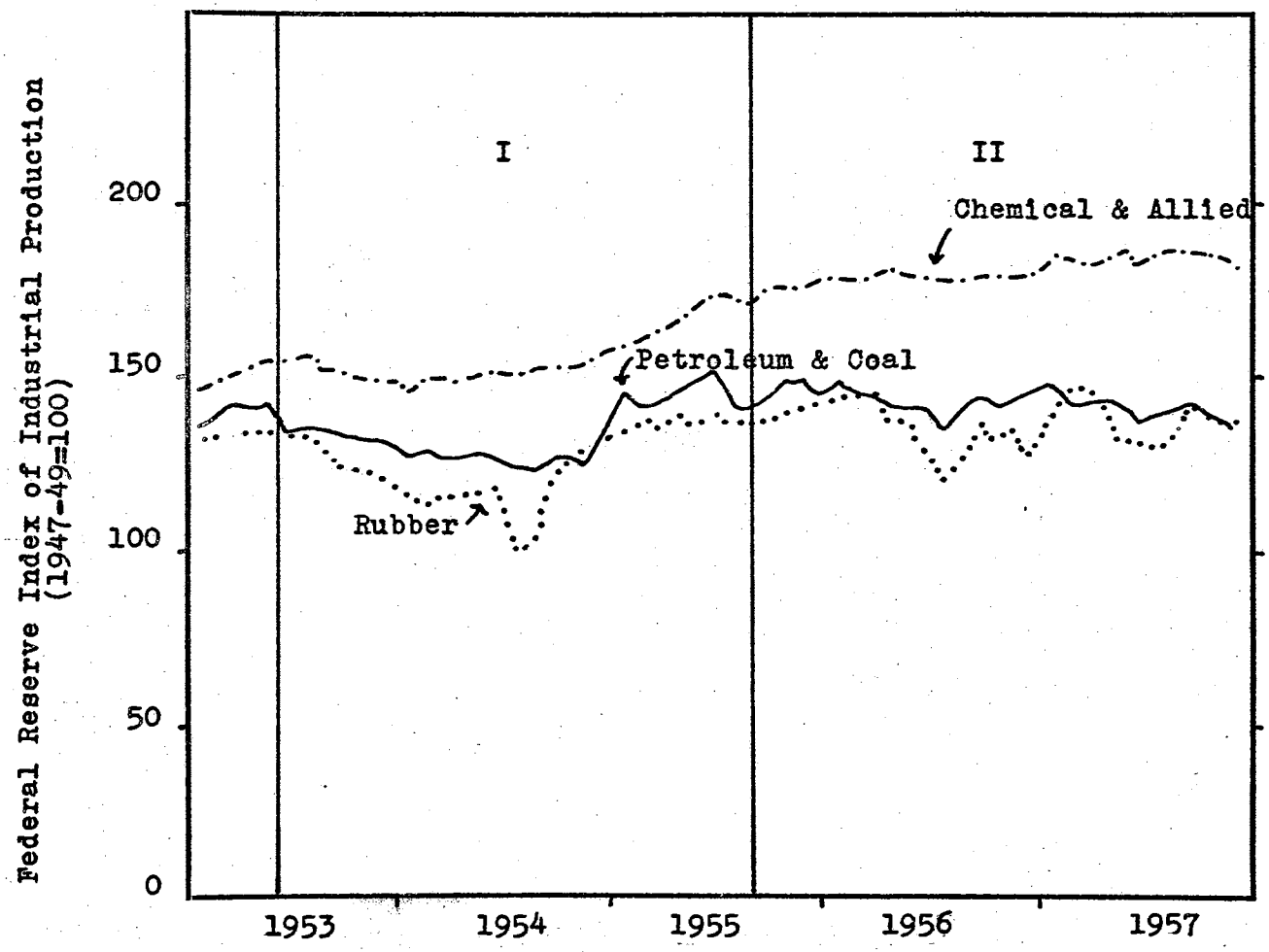
Physical output of goods from this industrial complex declined during Phase I, with Chemicals and Allied Products declining the least, as shown in Figure 21. During Phase II there existed some reduction in output of Petroleum, Coal, and Rubber Products. Chemical Products slowed their rate of growth, but did increase slightly during this period. Figure 20 shows that prices of Chemical and Allied Products increased at an almost constant rate throughout both periods. Thus, with increasing prices, and fairly stable output, it appears that demand for the output of this industrial complex was strong through Phase II.

This industrial complex was characterized by having an extremely large marginal profit rate per loan dollar in both Phases I and II. During Phase I a loan dollar was capable of earning $0.759, which declined to $0.240 during



Source: Federal Reserve Bulletin

Figure 20. Profits and Prices of Chemicals and Allied



Source: Survey of Current Business

Figure 21. Industrial Output of Petroleum, Chemical, and Allied

Phase II, a reduction of 68.3% in the marginal profit rate, as shown in Figure 22.[4]

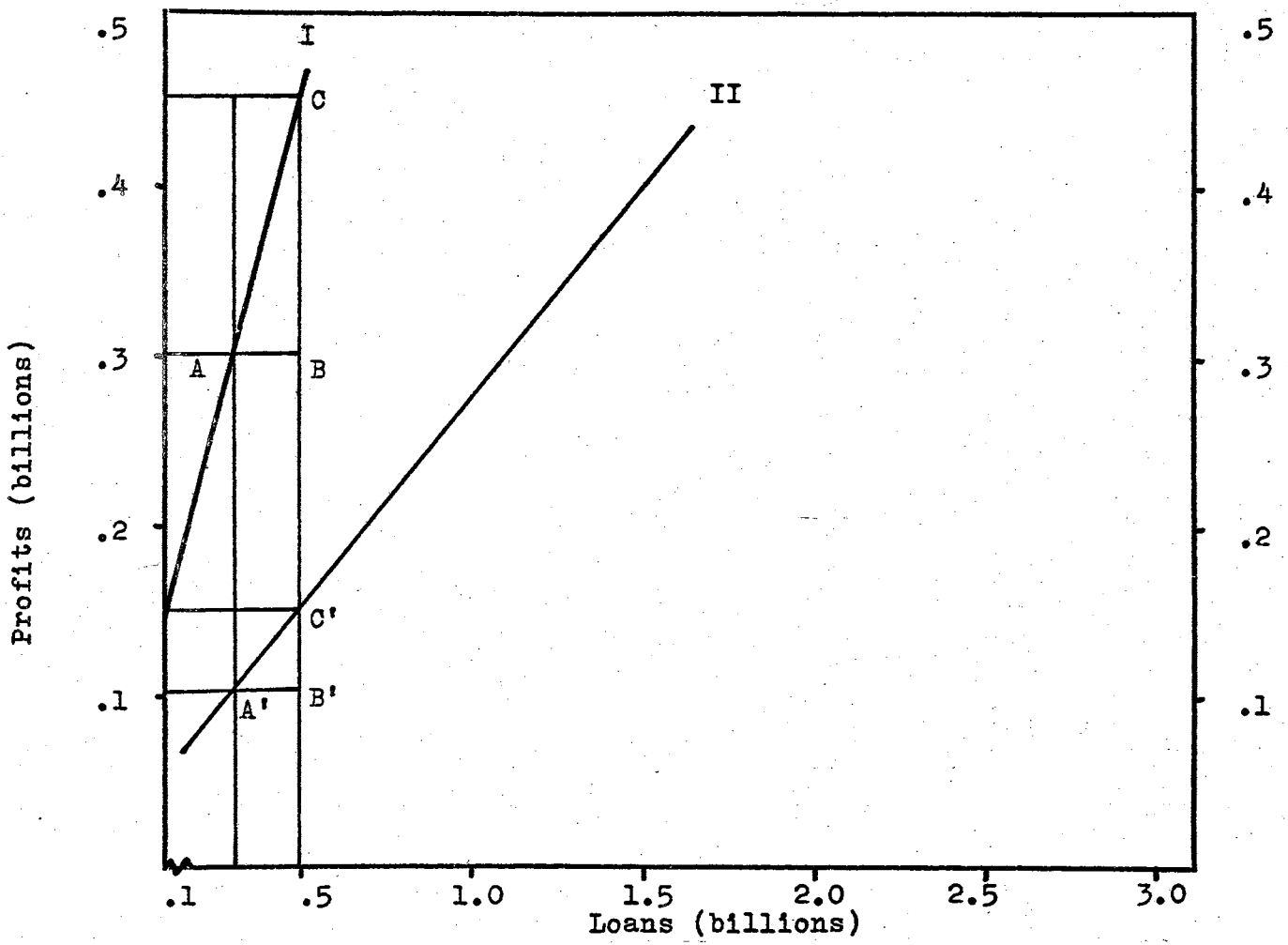
Construction

Figure 23 shows that bank loans for this industrial complex fluctuated cyclically and showed no pronounced seasonal variation. This lack of apparent seasonal variation is unexpected in that construction projects are slowed by adverse weather conditions, which would tend to impart seasonal variation to the industrial complex. However, both loan and profit figures are also composed of bank loans secured by suppliers of materials required for construction projects. Thus, the continuous production by suppliers may obscure the seasonal variation found in construction projects. During Phase I bank loans increased throughout the period by approximately $325 millions. During Phase II total loans extended to businesses involved in the Construction industry increased by approximately $125 millions, and then declined during the latter part of the period.

Profits, as shown by Figure 24, showed marked cyclical variation, with peaks occurring near the middle two quarters of each year. These wide swings in profits were of great amplitude, many being near the $100 millions mark, and may well be seasonal fluctuations which are not evident in the loan data. During Phase I profits increased by approximately $90 millions and declined throughout Phase II.

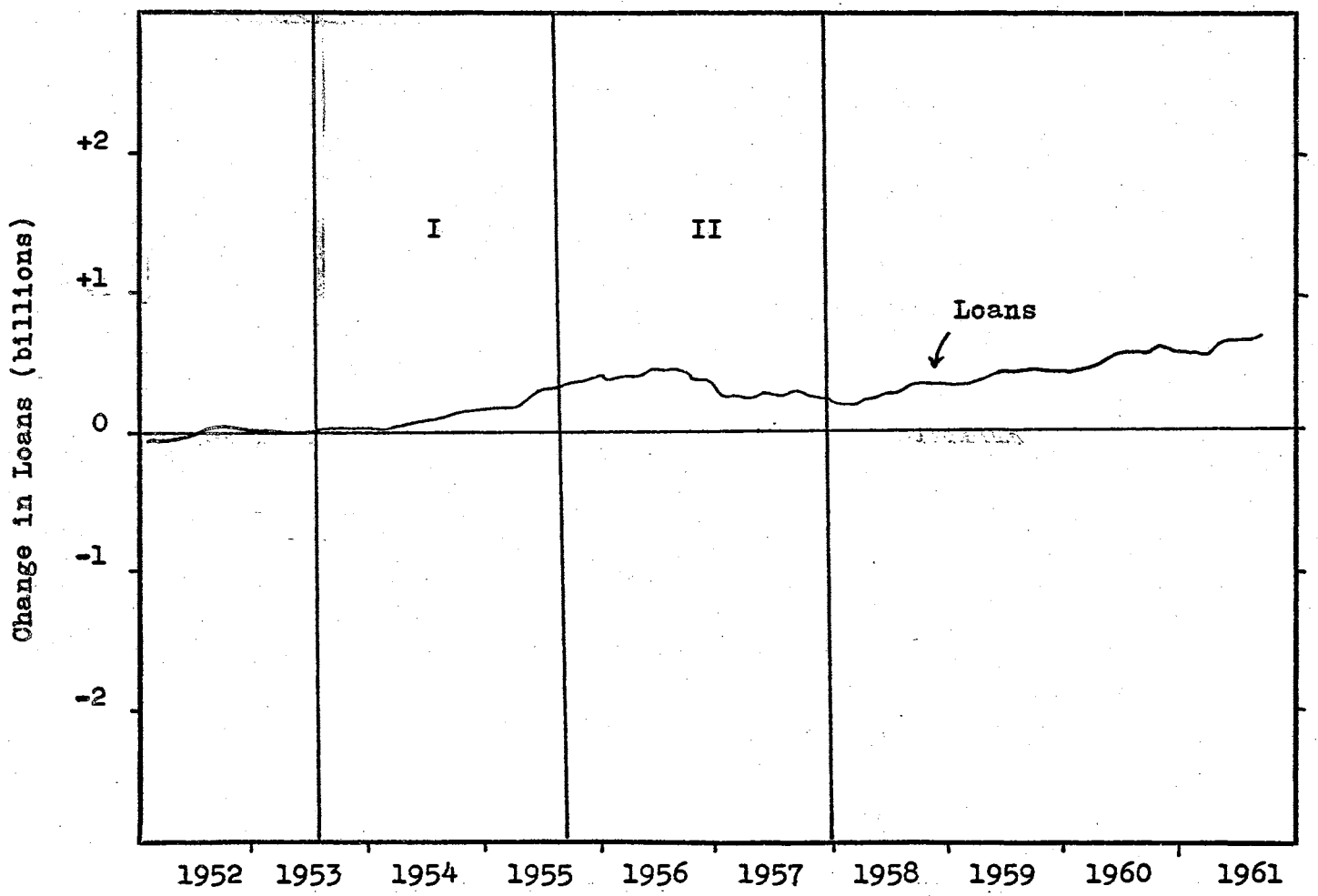
---

[4]The equation for the Phase I loan-profit regression curve is: $Y = 71.67 + .759X$, where X is the monthly loan level and Y is the monthly profit level. The equation for the Phase II curve is: $Y = 33.95 + .24X$.



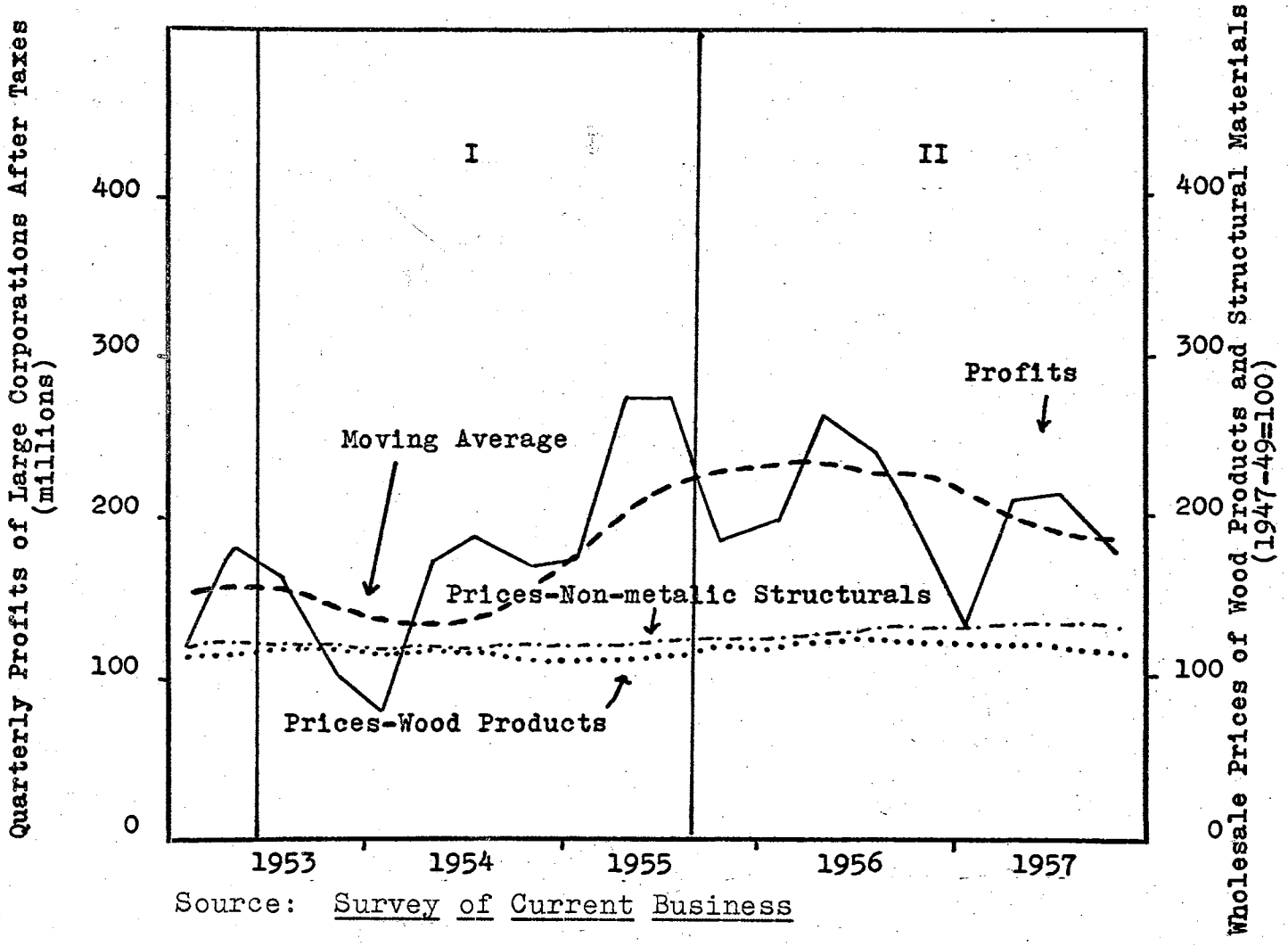
Source: Federal Reserve Bulletin

Figure 22. Relationship Between Loans and Profits of Chemical and Related



Source: Federal Reserve Bulletin

Figure 23. Business Loans of Construction Industry



Source: Survey of Current Business

Figure 24. Profits and Prices of Construction Material Profits

Output of stone, clay, and glass, as shown in Figure 25, increased during Phase I, showing a typically cyclical pattern and topped-out in Phase II after rising slightly. Lumber and wood products output were generally erratic and exhibited some seasonal variation during the winter months. Prices, as shown in Figure 24, were generally stable throughout both periods, although some softness did appear, especially for wood products.

It appears that demand for construction materials peaked just before the beginning of Phase II and then declined, indicating possible softness in demand, although for purposes of analysis it appears to be adequate.

As shown in Figure 26, the loan-profit regression curve for this industrial complex declined in slope markedly from Phase I to Phase II.[5] The marginal profit rate declined from $0.247 during Phase I to $0.154 during Phase II, a reduction of 37.6 per cent.

Public Utilities

Figure 27 shows that little seasonal fluctuation in bank loans to this industrial complex is evident. However, cyclical variation is apparent, especially during Phase II, during which loans increased by approximately $1.3 billions.

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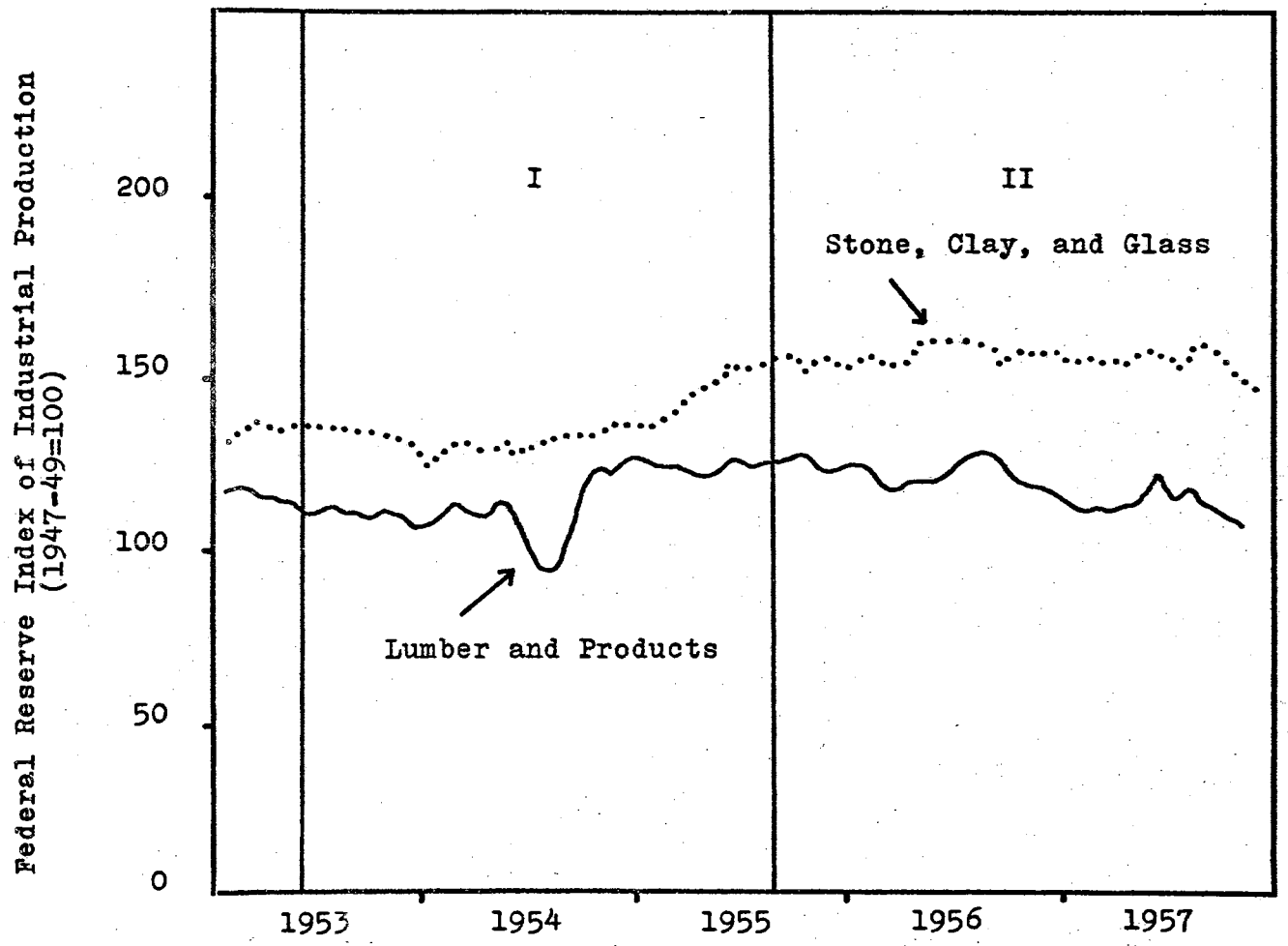
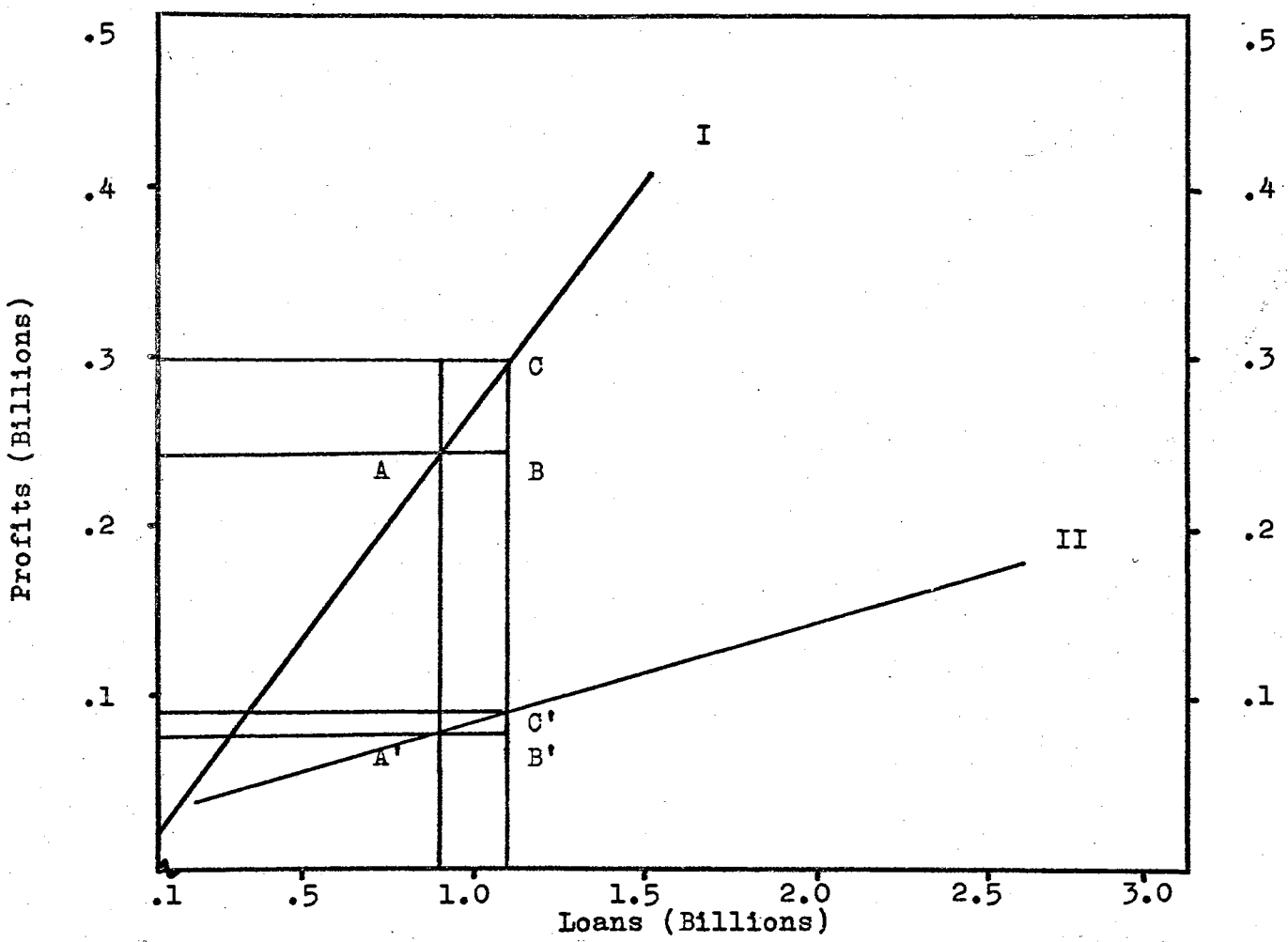
[5]The equation for the Phase I loan-profit regression curve is: $Y = 4.03 + .247X$, where X is the monthly loan level and Y is the monthly profit level. The Phase II equation is: $Y = 1.04 + .154X$.



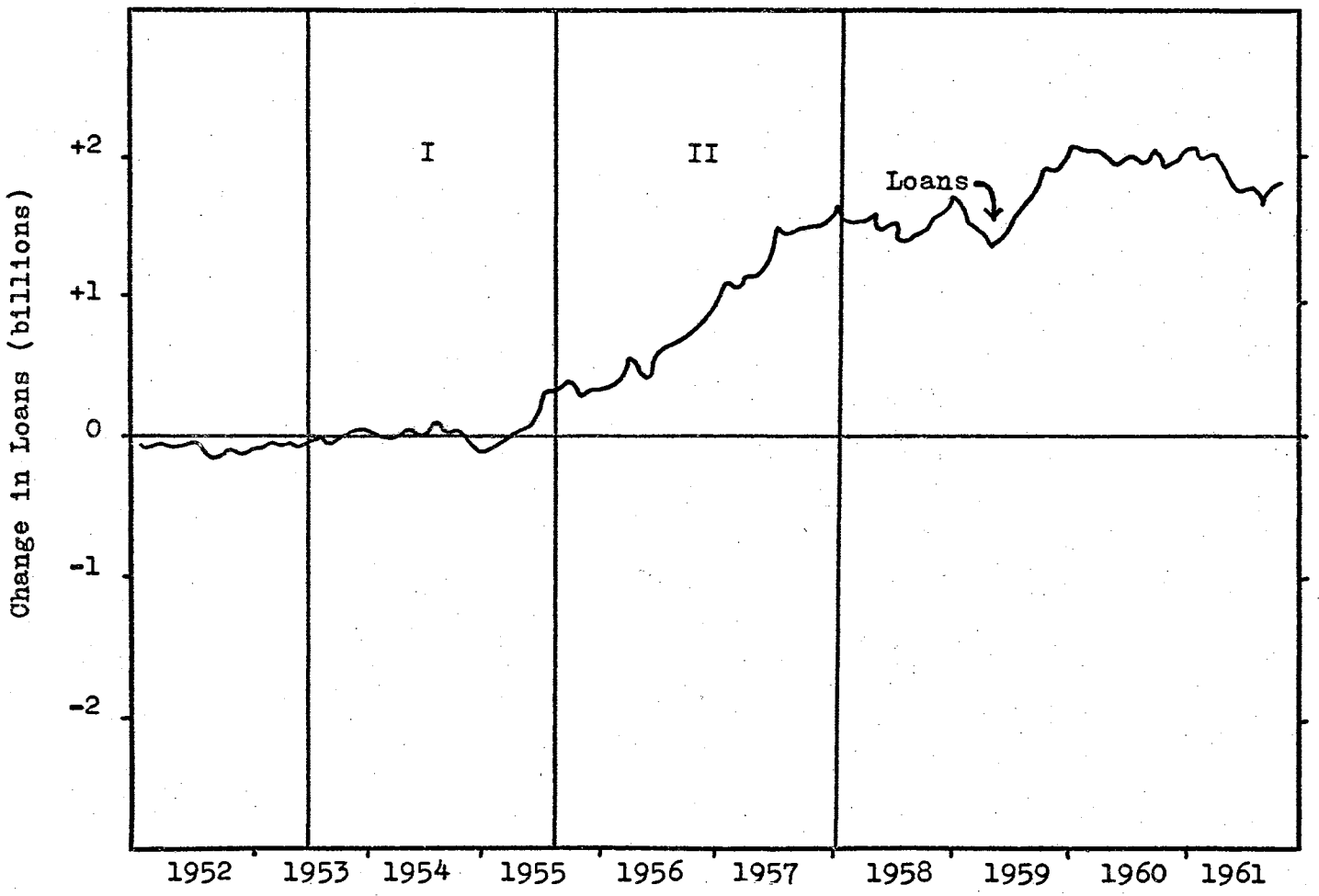
Source: Survey of Current Business

Figure 25. Industrial Output of Construction Materials



Source: Federal Reserve Bulletin

Figure 26. Relationship Between Loans and Profits of Construction Industries



Source: Federal Reserve Bulletin

Figure 27. Business Loans of Public Utilities

During Phase I little loan growth occurred, with loans bottoming-out during the last one-third of the period.

Marked cyclical variation in profits is evident, as shown by Figure 28. During Phase I profits increased from the bottom by approximately $100 millions, as shown by the moving average curve. During Phase II profits peaked at the beginning of the period and then declined.

Once again in Figure 28, prices of public transportation increased steadily throughout both periods. Gas prices showed marked seasonal variation, with some upward movement apparent. Electricity prices appear to be slowly declining, although there were indications of strength during Phase I because of greatly increased output.

In Figure 29 it can be seen that electrical output increased at an almost constant rate, indicating strength in demand, especially in view of the very small decrease in electricity prices which occurred during the Phase II period. Thus, demand for the output of this industrial complex can be considered to be strong.

From Figure 30 it can be seen that the slope of the loan-profit regression curve declined from Phase I to Phase II.[6] The marginal profit rate per dollar of borrowed funds declined from $0.484 during Phase I to $0.136

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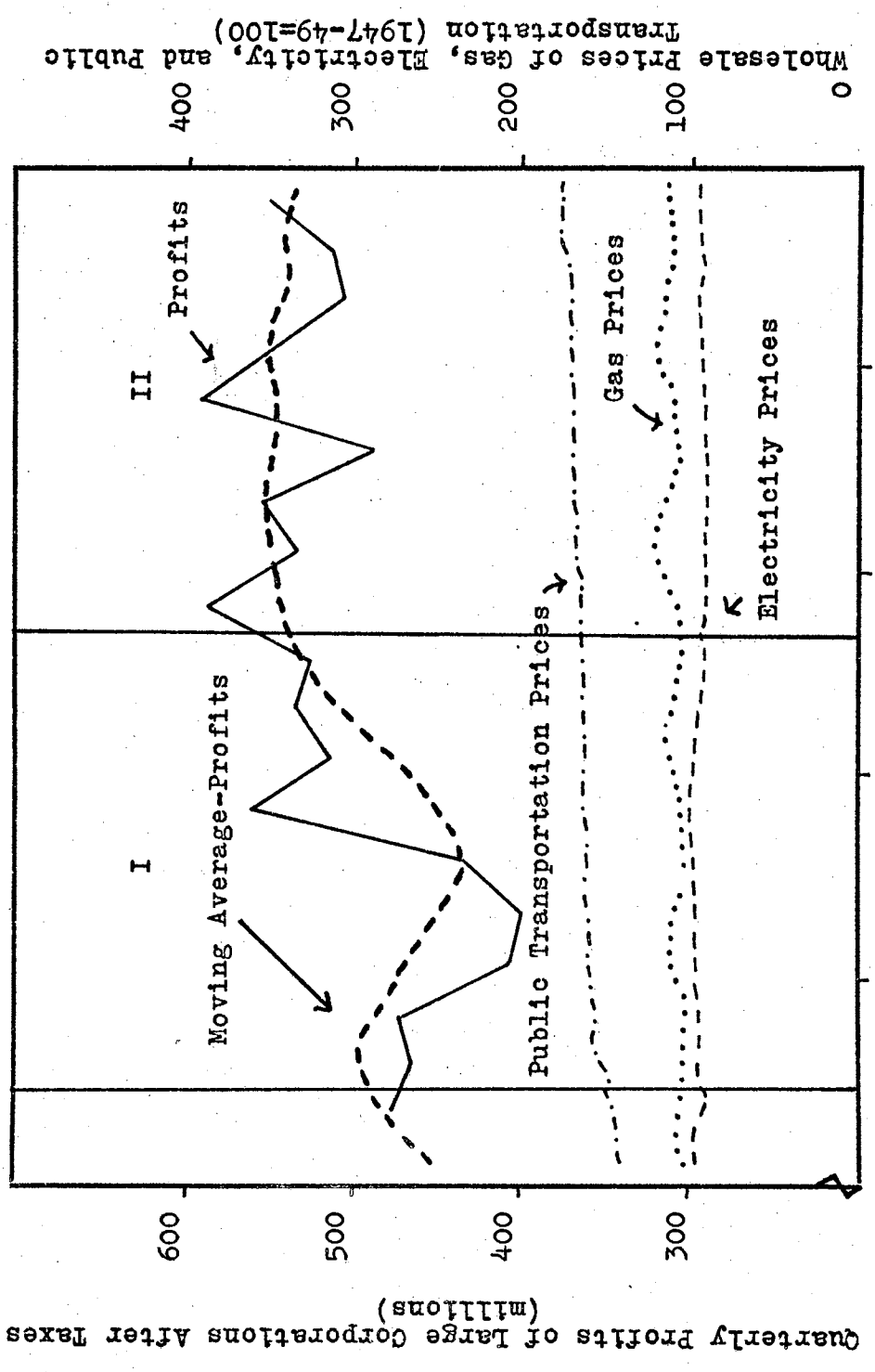
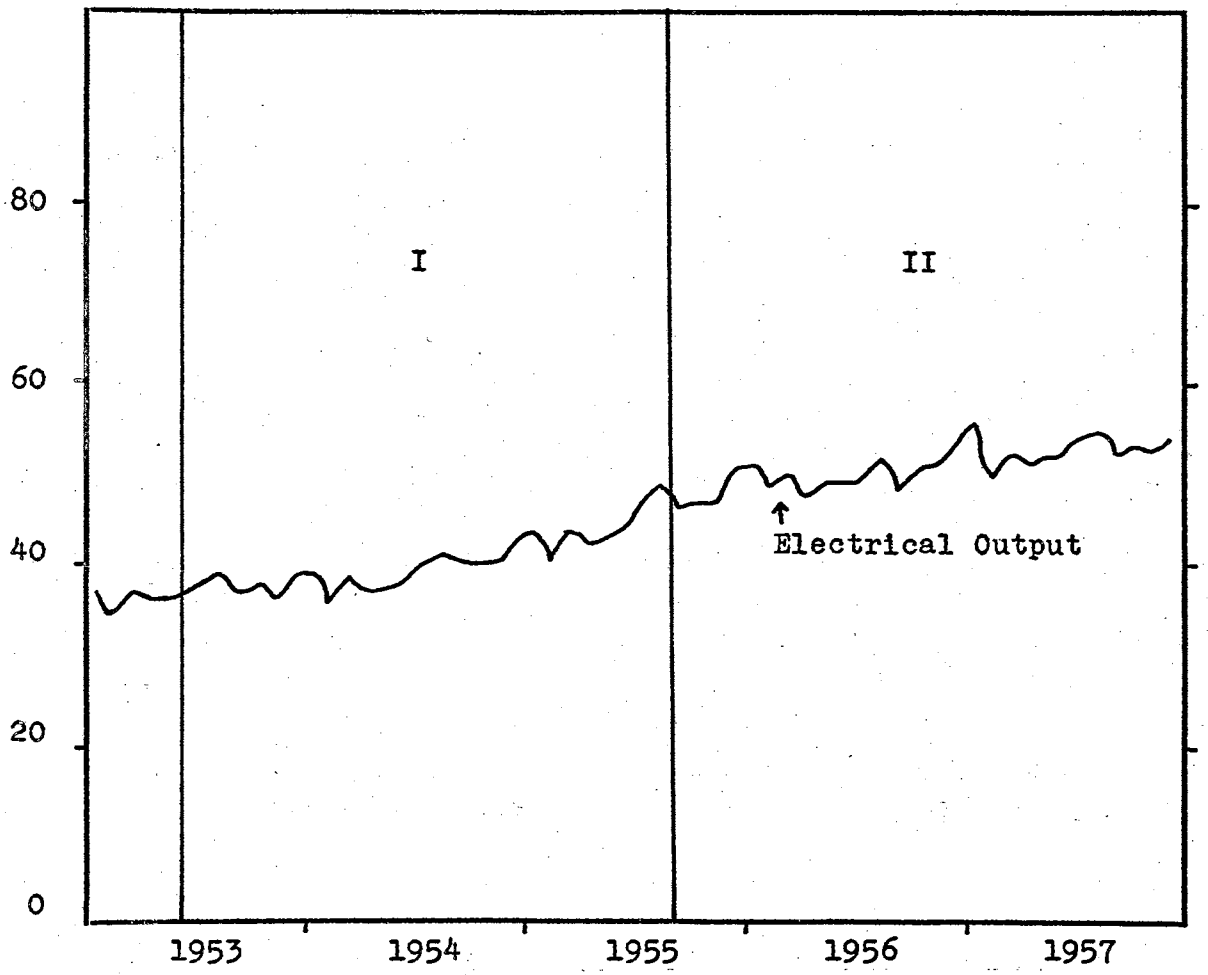
[6]The equation for the Phase I loan-profit regression curve is: $Y = 25.09 + .484X$, where X is the monthly loan level and Y is the monthly profit level. The equation for the Phase II curve is: $Y = 26.08 + .136X$.



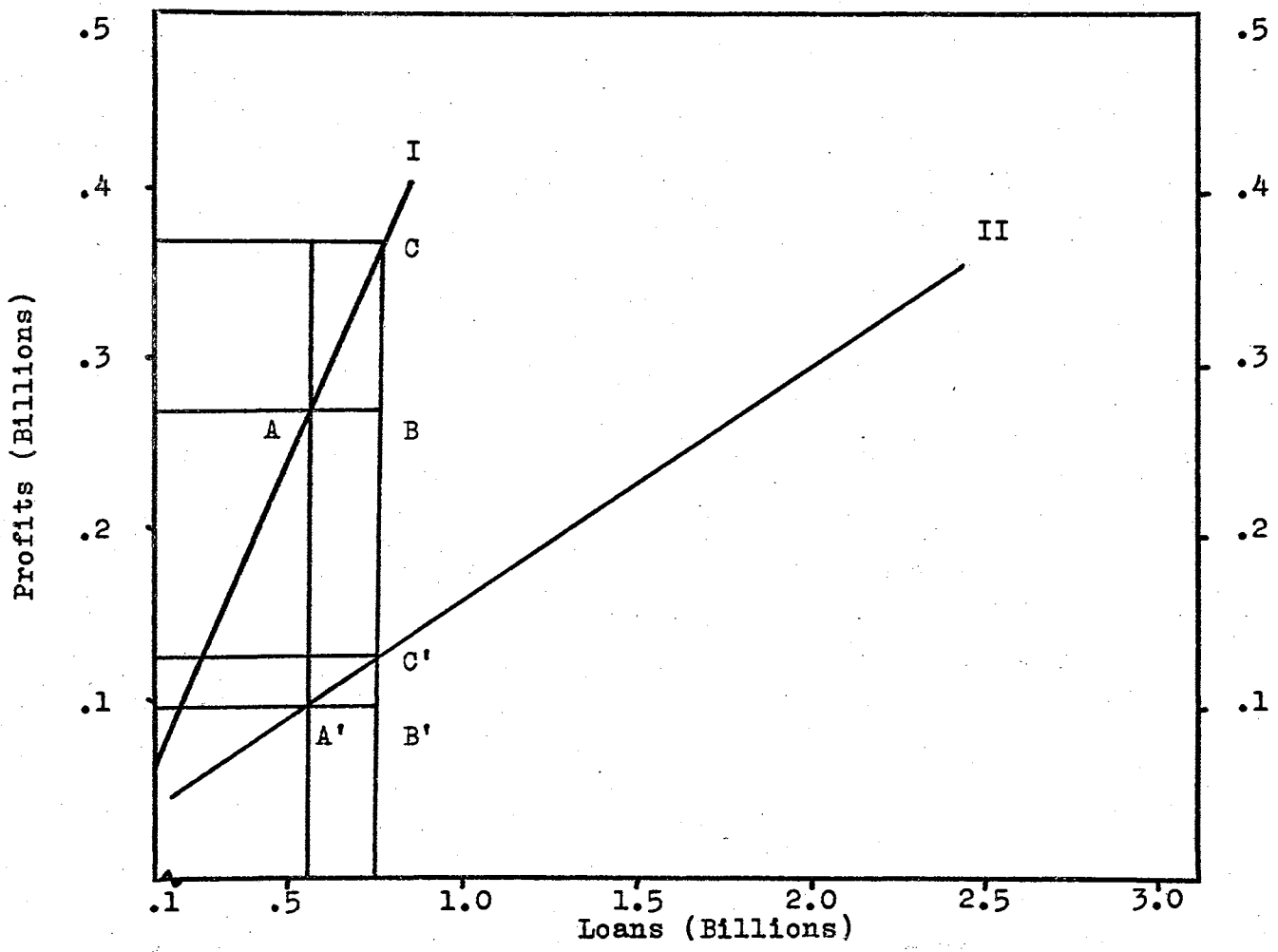
Source: Survey of Current Business

Figure 28. Profits and Prices of Public Utilities



Source: Survey of Current Business

Figure 29. Industrial Output of Electricity



Source: Federal Reserve Bulletin

Figure 30. Relationship Between Loans and Profits of Public Utilities Industries

during Phase II, a decline of 71.9 per cent.

Conclusions

Each of the selected industries experienced a decline in its loan-profit regression curve slopes as the environments shifted from monetary ease to monetary restraint. The Petroleum, Coal, and Chemical industrial complex, the Public Utilities industrial complex, and the Construction industrial complex were characterized by shifting their loan-profit regression curves downward by the greatest absolute amounts. The Petroleum, Coal, and Chemical industrial complex was characterized by the greatest Phase II regression curve slope, followed closely by the Public Utilities complex. The Construction complex experienced the greatest absolute decline in regression curve slope, which resulted in its Phase II slope being smaller than all except one industrial complex, Textiles and Related.

Table I has been constructed to show marginal profit rates, percentage shares of marginal profits, mean loan levels, and percentage shares of total loans for each industry for both Phases I and II. In addition, the anticipated percentage share of total loans for Phase II has been included to use as a base-point for the determination of possible loan discrimination.

The first column, MPR^{I}, gives the decimal marginal profit rate of each industry. That is, the amount expressed as a decimal, or in cents, that the industry is

TABLE I

MARGINAL PROFIT AND LOAN DATA FOR SIX SELECTED INDUSTRIES

Industry	MPR^{I}	MPR^{II}	PMP^{I}	PMP^{II}	$\bar{L}^{I}$	$\bar{L}^{II}$	PL^{I}	PL^{II}	Z^{ii}	$PL^{ii} - Z^{ii}$
Food and Kindred Products	.152	.110	8.2	14.0	359	676	17.6	11.2	30.0	-18.8
Textiles and Related Products	.074	.037	4.0	4.7	223	652	10.9	10.8	12.8	- 2.0
Metals and Metal Products	.132	.107	7.1	13.6	673	1,649	33.0	27.3	63.2	-35.9
Petroleum, Coal, and Chemical	.759	.240	41.1	30.6	289	1,467	14.1	24.3	10.5	+13.8
Construction and Products	.247	.154	13.4	19.6	217	447	10.7	7.4	15.7	- 8.3
Public Utilities	.484	.136	26.2	17.3	278	1,141	13.6	18.9	8.9	+10.0
Totals	1.848	.784	100.0	99.8	2,039	6,032	99.9	99.9	141.1	-41.2

capable of earning in terms of profits for a loan dollar during Phase I. This figure is the decimal coefficient of X for each industry's loan-profit curve equation. In addition, it is equal to the areas marked off on the profit axis of each regression curve to represent the change in profits resulting from a given change in loans, a dollar.

The second column, MPR^{II}, gives the same information as above for Phase II. These two columns have been summed to yield 1.848 marginal profit rate for the six selected industries for Phase I, i.e., the six industries were capable of earning $1.848 marginal profit dollars by the use of six loan dollars. For Phase II the sum of the marginal profit rates declined to .784.

The third and fourth columns give each industry's percentage share of the total marginal profit dollars for Phases I and II.

Columns five and six give the mean loan level for each of the selected industries for both phases, in millions of dollars. These figures provide the basis for calculation of the industry percentage shares of total loan funds outstanding for Phases I and II.

Column eight contains the actual percentage share of loans calculated for each industry. These figures, when compared with those in column nine, the anticipated percentage loan shares, provide the method for determination of possible loan discrimination among industries. Column ten gives the difference in the actual and anticipated

percentage share of profits for each industry. The magnitude and direction of these differences provide a measure of possible loan discrimination.

In comparing the actual Phase II loan percentage share with the anticipated percentage share two industrial complexes, Petroleum, Coal, and Chemical and Public Utilities, received an actual Phase II percentage share of total loans above the anticipated rate. These two industrial complexes also were characterized by having the two largest loan-profit curve slopes during Phase II. These two complexes, because of their larger slopes, should receive the greater share of total loan volume. This follows in that those industries having the greater marginal profit rate can best use loan dollars to generate profits and allocate society's resources, assuming, of course, no restraint of trade.

The Metals and Metal Products industrial complex has the largest difference between the actual percentage share of loans and the anticipated share of profits, indicating that it received the greatest monetary impact among the selected industries, 35.9 per cent. The next largest difference was the Food and Food Products complex, with a difference of 18.8 per cent. This was followed by Construction with a difference of 8.3 per cent and Textiles with 2.0 per cent.

Using the analytical methods selected for use in this study it appears that loan discrimination does occur among

industries as their environment shifts from that of monetary ease to monetary restraint. However, this discrimination must be defined as a product of the economic and monetary systems in that there is no proof, using regression analysis as constructed in this paper, that the discrimination resulted from an affected industry's inability to secure desired credit, or that these industries did not attempt to secure additional credit.

The central conclusion is that loan discrimination among industries does occur and is selective among these industries.

Recommendations for Further Study

As the writer developed various aspects of the study, many avenues of inquiry beyond the scope of the paper presented themselves.

It would be interesting to have a series of time studies, i.e., a series of regression curves for industries plotted for many periods of monetary ease and restraint, rather than but two.

Because of the lack of readily available loan data for Agriculture and Automotive industries, these were not included in the present study. In view of the importance of these two industries upon the economy, in terms of aggregate demand and resource allocation, some effort should be made to include them in a future study.

Another interesting avenue of inquiry is that of

using regression curve analysis for predicting optimum loan-levels for profit maximization. This would probably involve cost accounting for the industries to be studied and the computation of standard deviations, among other things, of the loan-profit regression curves.

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