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An Index of Coincident Economic Indicators for the Indian Economy

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Abstract

An index of coincident economic indicators is constructed for the Indian economy since the mid 1950s. This tracks fluctuations in aggregate economic activity and determines the phase of the business cycle the economy is in at a given point in time. It thus helps to ascertain the timing of recessions and expansions in economic activity as well as speedups and slowdowns in economic growth.

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1. INTRODUCTION

Fluctuations in aggregate economic activity, that is, phases of the business cycle, are tracked closely by policymakers and financial and economic analysts. To track the business cycle, a comprehensive measure of aggregate economic activity is utilized. Generally, the gross domestic product (GDP) is used since it represents the most aggregate measure of economic activity. It is, however, inaccurate to chart the business cycle by this one variable alone, since some aspects of the aggregate economy may not be adequately represented in the GDP. For the Indian economy, another major drawback of using the GDP is that until recently, GDP data were available only on an annual basis and with some reporting lags. Higher frequency data, that is, monthly or at least quarterly data are required to chart the business cycles. The monthly industrial production index can be used as a substitute but it is a far narrower measure of aggregate economic activity. A better alternative is to construct an index of variables using frequently available series that move contemporaneously with the business cycle, typically referred to as a coincident index.

An index of coincident economic indicators is a summary measure designed to track fluctuations in aggregate economic activity that make up the business cycle. Thus a coincident index can be used to decide the phase of the business cycle the economy is in at a given point in time. The index can therefore be used to help determine the timing of recessions and expansions as well as speedups and slowdowns in the economy.

Such a historical chronology is also necessary for designing a system for the prediction of recessions and recoveries. Specifically, the selection of leading economic indicators that anticipate recessions and expansions should be based at least in large part on their historical accuracy in predicting them. The measurement of forecasting accuracy, however, requires an explicit definition of what is to be forecast. Given the precise historical dates when recessions and expansions started, it is possible to decide how well the leading indicators predicted them.

Thus a coincident index for the Indian economy is valuable both for understanding the current state of the economy and for designing tools for the prediction of business cycles. The format of the paper is as follows. Section 2 reflects on the nature of business, growth and growth rate cycles. Section 3 describes the method for constructing the coincident index.

Section 4 outlines estimation of the coincident index for the Indian economy. The following section reports the chronology of the business cycle with reference to the major changes in the Indian economy. Section 6 discusses the growth rate chronology. The last section concludes the paper.

2. CLASSICAL BUSINESS CYCLES, GROWTH AND GROWTH RATE CYCLES

The National Bureau of Economic Research (NBER), formed in 1920 to address measurement problems in economics, pioneered research into business cycles. Due to NBER's decades of pioneering work, its basic methodology for business cycle analysis has remained a standard for examining fluctuations in business activity (Niemira and Klein, 1994, p.5). It is therefore appropriate to begin the discussion of business cycles with the characterization distilled by Wesley C. Mitchell and Arthur F. Burns (1946) from many years of research at the NBER:

"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own."

What is striking about this definition is the emphasis on the concerted nature of the upswings and downswings in different measures of economic activity. In fact, the business cycle is a consensus of cycles in many activities, which have a tendency to peak and trough around the same time (Niemira and Klein, 1994, p.4). As noted by Moore (1982):

"No single measure of aggregate economic activity is called for in the definition because several such measures appear relevant to the problem, including output, employment, income, and trade, and no single measure is either available for a long period or possesses all the desired attributes. Quarterly figures for gross national product (GNP) became available in the 1940s in the United States and even later, if at all, in other countries. Since monthly peak and trough dates are desired, quarterly figures are not sufficient in any case."

Moore further notes:

"Virtually all economic statistics are subject to error, and hence are often revised. Use of several measures necessitates an effort to determine what is the consensus among them, but it avoids some of the arbitrariness of deciding upon a single measure that perforce could be used only for a limited time with results that would be subject to revision every time the measure was revised."

Furthermore, Zarnowitz and Boschan (1975) point out that some series *"prove more useful in one set of conditions, others in a different set. To increase the chances of getting true signals and reduce those of getting false ones, it is advisable to rely on all such potentially useful (series) as a group."*

Thus two points are emphasized in the above quotes. First, a genuine business cycle is marked by three "Ps." In other words, movements in economic activity have to be *pronounced, pervasive,* and *persistent* enough to fall into the category of a recession or expansion. Second, a single measure of economic activity cannot represent aggregate economic activity. Instead, a composite index of indicators that represents current economic activity is needed to identify and measure business cycles. Such a composite index is the coincident index that is specifically designed to measure how pronounced, pervasive, and persistent the upswings and downswings in economic activity are. It represents the synchronous fluctuations in the aggregate measures of output, income, employment, and trade (sales).

A Misleading Rule-of-Thumb to Identify Recessions

It is clear from the above discussion that there is no single adequate measure of economic activity. Furthermore, since economic statistics are generally subject to error, evidence from a number of independently compiled indicators is expected to be more reliable than from any individual series. Despite the advantages of using a composite coincident index, in recent years the rigorous definition of the business cycle has increasingly been overshadowed by more simplistic shortcuts. Very often, a single adequate measure of economic activity is used to date recessions. Perhaps the most popular rule-of-thumb designates a recession as at least two successive quarters of decline in the gross domestic product (GDP). Lost in that quest for simplicity are the essential characteristics of a recession

– that it consists of a pervasive and pronounced downswing in a variety of measures of economic activity. Not surprisingly, such shortcuts can produce anomalous results. In fact, while two successive quarters of decline in GDP occur in most recessions, it is neither a necessary nor a sufficient condition for a recession.

For example, it is well known that in the mid 1970s, Japan experienced its worst recession since the second world war in the aftermath of the jump in oil prices. At the time, there were severe and prolonged declines in Japanese industrial production, employment, retail sales, and wage and salary income. Yet Japanese GDP declined only for one quarter. In the 1990s, there was an even more curious phenomenon. The two-quarter GDP decline formula would have identified four separate recessions in Japan between 1992 and 1998, some of them based on tiny declines in GDP. For instance, Japanese GDP fell by just 0.1% in the fourth quarter of 1993, and by a miniscule 0.003% in the first quarter of 1994. At the same time, industrial production rose, retail sales and income drifted slightly upward, and the level of employment stayed virtually unchanged. This was hardly a recession, but the simplistic rule-of-thumb would have identified it as one.

In the United States, the NBER officially identified a recession that lasted from January to July of 1980. For more than a decade thereafter, the data showed only one quarter of decline in GDP during that period. Only in the last couple of years have the latest revisions to GDP data produced two successive declines in GDP during that recession, belatedly vindicating the NBER's original decision. Clearly, the popular rule-of-thumb would have delayed the recognition of that recession by more than a decade!

It should now be clear that the two-quarter GDP decline rule is not a necessary or sufficient condition for a recession to occur. More to the point, such episodes are not always accompanied by the pronounced, pervasive, and persistent declines in output, income, employment, and retail and wholesale trade that mark a business cycle recession, or the complex processes that are the antecedents of a genuine recession. As a result, the symptoms that precede a real recession, as captured in the appropriate leading indicators, may not be seen ahead of such a mistakenly identified "recession". Such anomalies can lead not only to an erroneous dating of recessions, but also to difficulties in the proper selection of leading indicators of recessions and recoveries.

For the Indian economy, GDP data until recently were available only on an annual basis. Thus the two-quarter rule-of-thumb was not applicable. It may be tempting to use another variable, say, the industrial production index as a substitute. Apart from the obvious problem that industrial production is a far narrower measure of the Indian economy than a properly constructed coincident index, the use of any simplistic rule based on a single economic time series can lead to the problems already outlined.

In sum, to identify and measure business cycles accurately, the composite index of coincident indicators must capture pronounced, pervasive and persistent movements in economic activity.

Classical Cycles, Growth Cycles, and Growth Rate Cycles

The above discussion describes "classical" business cycles that measure the ups and downs of the economy with absolute levels of those variables entering the index. A second National Bureau definition of fluctuations in economic activity is termed a growth cycle. A growth cycle traces the ups and downs through deviations of the actual growth rate of the economy from its long-run trend rate of growth. In other words, a speedup (slowdown) in economic activity means growth higher (lower) than the long-run trend rate of growth.

Pronounced, pervasive and persistent economic slowdowns begin with reduced but still positive growth rates and can eventually develop into recessions. The high growth phase coincides with the business cycle recovery and the expansion mid-way while the low growth phase corresponds to expansion in the later stages leading to recession. Some slowdowns, however, continue to exhibit positive growth rates and result in renewed expansions, not recessions. As a result, all classical cycles associate with growth cycles, but not all growth cycles associate with classical cycles. Growth cycle chronologies based on trend-adjusted measures of economic activity were first developed by Mintz (1969, 1972, 1974). Burns and Mitchell noted the following about growth cycles:

"If secular trends were eliminated at the outset as fully as are seasonal variations, they would show that business cycles are a more pervasive and a more potent factor in economic life...For when the secular trend of a series rises rapidly, it may offset the influence of cyclical contractions in general business, or make the detection of this influence difficult. In

such instances [the classical business cycle method] may indicate lapses from conformity to contractions in general business, which would not appear if the secular trend were removed."

Following Mintz's work, when the OECD developed leading indicators for its member countries it decided to monitor growth cycles. Growth cycle analysis also formed the basis for the international economic indicators (IEI) project (Klein and Moore, 1985) started at the NBER in the early 1970s.

Of course, growth cycles, measured in terms of deviations from trend, necessitated the determination of the trend of the time series being analyzed. The Phase Average Trend (PAT), calculated by averaging business cycle phases, was used as the best trend measure by the OECD as well as in the IEI project, in order to measure growth cycles. However, one problem with the PAT (Boschan and Ebanks, 1978) as a benchmark for growth cycles is that it is subject to frequent and occasionally significant revisions, especially near the end of the series.

In other words, while growth cycles are not hard to identify in a historical time series, it is difficult to measure them accurately on a real-time basis (Boschan and Banerji, 1990). This is because the trend over the latest year or two is not accurately known and must be estimated, but the PAT estimates tend to be very unstable near the end (Cullity and Banerji, 1996). More generally, any measure of the most recent trend is necessarily an estimate and subject to revisions, so it is difficult to come to a precise determination of growth cycle dates, at least in real time.

This difficulty makes growth cycle analysis less than ideal as a tool for monitoring and forecasting economic cycles in real time, even though it may be useful for the purposes of historical analysis. This is one reason that by the late 1980s, Moore had started moving towards the use of *growth rate cycles* for the measurement of series which manifested few actual cyclical declines, but did show cyclical slowdowns (Layton and Moore, 1989).

Growth rate cycles are simply the cyclical upswings and downswings in the growth rate of economic activity. The growth rate used is the "six-month smoothed growth rate" concept, initiated by Moore to eliminate the need for the sort of extrapolation of the past trend

needed in growth cycle analysis. This smoothed growth rate is based on the ratio of the latest month's figure to its average over the preceding twelve months (and therefore centered about six months before the latest month). Unlike the more commonly used 12-month change, it is not very sensitive to any idiosyncratic occurrences 12 months earlier. A number of such advantages make the six-month smoothed growth rate a useful concept in cyclical analysis (Banerji, 1999). Cyclical turns in this growth rate define the growth rate cycle.

The growth rate cycle is related to Mintz's earlier work on the "step cycle" except that the former is based on the smoothed growth rate as mentioned above. Also, in concept, the growth rate cycle does not suggest that the growth rate passes through "high growth" and low growth steps, but moves, instead, from cyclical troughs to cyclical peaks and back again. At the Economic Cycle Research Institute (ECRI), headed by Moore, growth rate cycles rather than growth cycles are used as the primary tool to monitor international economies in real time. The growth rate cycle is, in effect, a second way to monitor slowdowns in contrast to downturns. Because of the difference in definition, growth rate cycles are different from growth cycles. Thus, what has emerged in recent years is the recognition that business cycles, growth cycles and growth rate cycles all need to be monitored in a complementary fashion. However, of the three, business cycles and growth rate cycles are more suitable for real-time monitoring and forecasting, while growth cycles are more suitable for historical analysis (Klein, 1998).

What makes all these kinds of cycles valid units of analysis is that they all exhibit the key hallmark of cyclical behavior, which is the cyclical co-movement in many different economic activities. It is the near-simultaneous peaks and troughs in the broad measures of output, income, employment and sales, whether in terms of levels, deviations from trend or growth rates, that characterise economic cycles.

In sum, the absolute level of a coincident index helps date turning points in the classical business cycle while the smoothed growth rate of the coincident index measures the highs and lows of the growth rate cycle, or the speedups and slowdowns in the economy. Both are suitable for tracking the economy in real time. For the Indian economy, both cycles are examined in this paper.

3. METHOD FOR CONSTRUCTING THE COINCIDENT INDEX

The coincident index measures the synchronous fluctuations in the aggregate measures of output, income, employment, and sales. It therefore includes various measures of economic activity that collectively represent the current state of the economy. Each series in the coincident index contains some information about the turning points in the business cycle. Since the series do not all show the same turning points, the index provides a collective call on the business cycle. This averaging process produces better information about cyclical turning points than any one of the individual series in the index can generate on their own. Persistent, pervasive, and pronounced movements in these economic series help date the peaks and troughs of the classical business cycle.

The construction of the index follows well-developed procedures developed by National Bureau of Economic Research researchers Geoffrey H. Moore (currently Founder and Director of Economic Cycle Research Institute, New York) and Julius Shiskin in the 1950s. The various steps of the classical approach are outlined below.

- The cyclical turning points of the coincident indicators are first determined.
- The composite coincident index is constructed using the NBER methodology.
- The cyclical turning points of the coincident index are then determined.
- The business cycle peak and trough dates are selected based on the consensus of turning point dates of coincident indicators.
- The coincident index turning points are used to resolve ties.

For growth rate cycles, the cyclical turning points of the smoothed growth rates of the coincident indicators and of the coincident index are used.

Determination of Turning Points and Dating Business and Growth Rate Cycles

The choice of turning points is made by mechanical procedures supplemented by rules of thumb and experienced judgment. The initial selection of turning points employs a computer program based on the procedures and rules developed at the National Bureau of Economic Research (see Bry and Boschan, 1971). The selection of a turning point must meet the following criteria: (1) at least five months opposite movement must occur to qualify as a turning point; (2) peaks (troughs) must be at least fifteen months apart; (3) if the data are flat

at the turning point, then the most recent period is selected as the turning point. These rules of thumb trace their roots to Burns and Mitchell (1946) and continue to be applied by the Economic Cycle Research Institute (ECRI). Finally, turning points must pass muster through the experienced judgment of the researcher. Turning points can be rejected because of special one-time events that produce spikes in the data, indicating turning points. Experienced judgment also excludes non cyclical exogenous shocks.

A specific cycle, that is, a set of turning points for each series is thus obtained. A reference cycle chronology is then determined based on the central tendency of the individual tuning points in a set of coincident economic indicators. A reference cycle based on the levels of the coincident indicators thus gives the consensus of turning points of the coincident indicators. Apart from dating the recessions, this reference cycle helps to identify leading indicators and their historical leads. The reference cycle derived from growth rates of the coincident indicators gives the highs and lows of the growth rate cycle. This dates the slowdowns and the speedups in economic activity.

Construction of the Composite Coincident Index

The construction of the index follows the traditional NBER methodology with some modifications. The basic steps involve transformation of each series, standardization of each transformed series using standardization factors, and combination of the standardized series into a raw index. The raw index is adjusted for trend and finally rebased.

First, the logarithm is computed for each component series for which such a transformation will result in the "stationarity of cyclical amplitude" (Boschan and Banerji, 1990). Amplitude stationarity requires invariance of cyclical amplitude measured over complete cycles. Where amplitude stationarity is not a concern, including for series that are growth rates or include negative quantities, the log transformation is not performed.

To prevent the more volatile components from dominating the index, the series are then divided by the standardization factor, which is the standard deviation of the detrended trend-cycle component of the series over a number of whole cycles.

Next, the standardized series are averaged with equal weights across all components in the index. The process of scaling the series to prevent more volatile series from dominating the index implicitly provides a weighting scheme in the index. The trend adjustment is then performed for this series by multiplying it by a suitable factor that scales the trend up or down to match the target trend, which is often the GDP trend over a whole number of cycles. The antilog of this series is then calculated.

The modified procedure now used at ECRI makes two notable changes to the traditional procedure (see Boschan and Banerji, 1990). First, the new method ensures that the standardization factor measures only the cyclical amplitude. The old method lumped together trend, cycle, and irregular components, so that a high-trend cyclical component would be deemphasized compared with a trendless component for no good reason. Also, the new method uses a multiplicative trend adjustment instead of the traditional additive trend adjustment, which shifts turning points in the raw index. This method ensures that the final index turning points are the same as that of the raw index. Cullity and Banerji (1996) show that the ECRI method outperforms the traditional procedure as well as the OECD method using the same set of indicators.

4. DATA AND ESTIMATION OF THE INDIAN COINCIDENT INDEX

Cyclical fluctuations in the Indian economy have been examined in some earlier studies. For instance, applying the NBER methodology, Chitre (1982) charts the growth cycles in the overall economic activity for the period 1951-75. As noted in Section 2, growth cycles are useful for historical analysis but are less suited for monitoring and forecasting economic cycles in real time. Nevertheless, Chitre's seminal work on growth cycles merits mention. Using annual data, Chitre (1982) constructs a diffusion and a composite index that comprise fifteen indicators and identifies five growth cycles during 1951-1975. He gets the same chronology of reference cycles whether the analysis is based on phases of high and low annual growth rates (step cycles) or in terms of deviations from the respective long-term trend (deviation cycles). Chitre (1991) extends the construction of the diffusion index up to 1982 using the same set of indicators. These fifteen indicators are listed below:

(1) average daily employment in factories;

(2) real net national product at factor cost;

(3) real net national product originating in non-agricultural sectors;

(4) general index of industrial production;

(5) index of industrial production - capital goods industries;

(6) real net value added in manufacturing - registered;

(7) real net value added in construction;

(8) real total gross fixed domestic capital formation, machinery and equipment;

(9) real total gross fixed domestic capital formation, construction;

(10) real total gross fixed domestic capital formation, private sector;

(11) index of wholesale prices, manufactured articles;

(12) index of security prices, variable dividend industrial securities;

(13) changes in commercial bank credit;

(14) value of imports, industrial raw materials; and

(15) value of imports, machinery and transport equipment.

Chitre (1986) employs monthly data on 94 time series covering the period January 1951 to February 1982. After considerable experimentation, he selects the following eleven economic indicators to determine the reference cycle for India's overall economic activity:

(1) index of industrial production, general index

(2) index of industrial production, consumer goods non-durables

(3) index of industrial production, capital goods

(4) index of industrial production, intermediate goods

(5) cement production

(6) electric energy generated

(7) railway traffic - total number of wagons loaded

(8) changes in bank credit

(9) cheque clearances

(10) quantum of exports

(11) quantum of imports

Nakamura (1991) uses the NNP reference cycle for annual data covering the period 1965 through 1983 to select the following coincident indicators:

(1) per capita real national income

(2) index number of agricultural production

(3) direct tax revenue

(4) fertilizer usage

(5) index number of consumer prices

(6) power generation

(7) ratio of gross domestic capital formation by private sector to GNP

(8) ratio of gross domestic capital formation by public sector to GNP

(9) ratio of gross domestic capital formation by private and public sector to GNP

Thus a wide variety of time series have been used to measure current economic activity in the Indian economy.

The fundamental difference between the variables examined in these studies and those in the present study is that here the construction of a composite coincident index is approached in a very orthodox fashion. The aim is to create a robust index that is based on an objective set of indicators and is comparable with similar indices used in other countries. The components of the composite index are those that have been tried and tested in various countries and are therefore not based on the judgment of the researcher. The index therefore strictly satisfies the classic definition of the business cycle as synchronous fluctuations in the aggregate measures of "output, employment, income and trade." Given the data problems in the Indian economy, constructing an index that conforms with this definition is not a trivial task.

Following Geoffrey Moore's convention, we examine series that measure/proxy *output, employment, income and trade*. Some variables used in previous studies such as cement production, power generation, electric energy generation, fertilizer usage, and railway traffic are ruled out since these represent a narrow measure of aggregate economic activity. Financial variables such as commercial bank credit, security prices, and cheque clearances are also not considered. In any case, some of these may be leading indicators. In the classic definition of the business cycle, "trade" refers to aggregate retail and wholesale trade, not international trade. Hence exports and imports are not explicitly included but are implicitly accounted for in the aggregate measures of output.

Needless to say that satisfying the conventional definition in the Indian context was a difficult task due to unavailability of continuous, high frequency historical data for a sufficiently long time period. The selection of the data series and procedures adopted to overcome these data limitations are described below.

The coincident index is constructed using *monthly* data from 1957 onwards. Two broad measures of *output* are used. First, the real GDP at factor cost is employed as a comprehensive measure of aggregate output. For the period 1970-71 to 1990-91, quarterly estimates of GDP reported in Das (1993) are used. For the earlier period until 1969-70, and for the later period from 1991-92 to 1995-96, we use the averages of the quarterly factors over the entire period (1970-71 to 1990-91) given in Das (1993) to interpolate the annual data to quarterly frequency. From 1996-97 onwards, quarterly estimates of GDP are published by the Central Statistical Organisation (CSO). The quarterly estimates for the entire period are seasonally adjusted using the Census X-11 procedure. To create a monthly series, simple step interpolation is used, that is, the quarterly series is repeated three times corresponding to the months of the quarter.

The second measure of output is the monthly index of industrial production, seasonally adjusted by the Census X-11 procedure. This is a much narrower measure of output and accounts for about one-fourth of GDP.

To measure *income*, wages in the factory sector obtained from the Annual Survey of Industries are used. Since wages are available on an annual basis, industrial production in consumer goods (collected from various issues of the RBI Bulletin) is used as the monthly reference series to interpolate to monthly frequency. The interpolation procedure is as follows. First, the monthly reference series is converted to an annual series. For the annualized reference series and the annual wage series, the average absolute symmetric percent changes are calculated using the formula:

$$average\{\,|\,[200(X_{it}-X_{it-1})/(X_{it}+X_{it-1})]\,|\,\}$$

The ratio of the two averages is then taken as a measure of the annual relative volatility.

Second, the ratio of the monthly reference series to its annual average for that year is calculated to obtain a monthly series of factors that show the variation of the reference series around its own average in the course of the year. This ratio is then multiplied by the relative volatility of the two series calculated in the first step to estimate a set of factors adjusted to the volatility of the annual wage series.

Third, the annual wage series is expanded into a monthly series in the form of a simple step interpolation, by repeating the annual number twelve times. This series is then multiplied by the corresponding "adjusted factor" for that month calculated in the second step. This gives the interpolated monthly wage series. The monthly nominal wage series is then deflated using the consumer price index for general industrial workers. The real monthly wage series is then seasonally adjusted.

To measure *employment*, total monthly employment in the private and public sectors, seasonally adjusted is used. This is collected from various issues of the *Monthly Abstract of Statistics* but is later abandoned since it does not show cycles. For *unemployment*, the series on monthly registered unemployed gleaned from various issues of the Monthly Abstract of Statistics, seasonally adjusted using the Census X-11 procedure is included. Generally, for the construction of the composite coincident index, the unemployment rate is preferred. This measure of unemployment is unfortunately not available for the Indian economy.

To measure *trade*, a proxy for *aggregate retail and wholesale trade* is required. Since data on sales are not available, the industrial production for consumer goods at constant prices (from RBI Bulletin) and seasonally adjusted is used as a proxy. Note that this is a production series, not a sales series though there should not be a major difference at business cycle frequencies.

In sum, the coincident index is estimated using *monthly, seasonally adjusted data* for the period *January 1957 to June 1999* and comprises the following five time series:

Output Series:

- GDP at factor cost and constant prices interpolated to generate a monthly series
- general index of monthly industrial production

Income Series:

- wages to workers in factory sector, interpolated to generate a monthly series using the industrial production of consumer goods as the monthly reference series

Employment/Unemployment Series:

- monthly registered unemployed

Trade Series:

- industrial production of consumer goods

5. CHRONOLOGY OF BUSINESS CYCLES IN THE INDIAN ECONOMY SINCE 1957

Chart 1 shows the composite coincident index of the above five variables. The shaded regions represent the periods from peak to trough, that is, the duration of recessions. Plots of the individual components are shown in Chart 2 along with the periods of recession. The dates of troughs and peaks (based on the consensus of turning points in the components and the composite index) are given in Table 1. It is clear from Table 1 that expansions have generally been longer than contractions. Indian business cycles have averaged over six years in length, with recessions averaging just under a year and expansions averaging just over five years. This finding is consistent with evidence for the post-war US economy that shows relatively longer expansions and shorter contractions (see Diebold and Ruderbusch, 1992; Vilasuso, 1996).

Six recessions are identified as follows:

- November 1964 to November 1965
- April 1966 to April 1967
- June 1972 to May 1973
- April 1979 to March 1980

- March 1991 to September 1991
- May 1996 to February 1997

Detailed information on the duration and severity of the recessions is outlined in Tables 2 to 4. These tables also show the clustering of turning points of the indicators as well as the coincident index that form the basis for the determination of the turning points of the business cycle. The tables clearly demonstrate the three Ps of a recession, i.e., movements in economic activity are persistent, pervasive, and pronounced. In all the recessions it is noteworthy that unemployment has been most adversely affected with the increase ranging from 14.5 to 54 percent.

Recessions in the 1960s

The period from the end of 1964 through the middle of 1967 witnessed two recessions with an interval of only four months. Each of the two recessions lasted for 12 months (from peak to trough) – the first from *November 1964 to November 1965* and the second *from April 1966 to April 1967.*

While our business cycle analysis yields the above dates for the recessions, we delve deeper into the possible causes. These recessions were due to several factors. In the first half of the 1960s, India was involved in two wars – with China in 1962 and with Pakistan in 1965. Consequently, defense expenditures rose sharply increasing the consolidated government fiscal deficit. This period was also severely hit by two successive monsoon failures of 1965 and 1966. The magnitude of the adverse effects of these droughts was large due to the neglect of the agricultural sector in favour of industry in the second Five Year Plan (1956-61). Further, not much was done to improve the agricultural sector's performance in the third Five Year Plan (1961-66). As a result of this neglect, the agricultural sector remained heavily dependent on weather. Foodgrain production in 1965-66 and 1967-68 fell to a level that was lower than that of 1960-61 and per capita production also fell considerably. (Joshi and Little, 1996). The shortage of food was further aggravated by the United States suspending the PL-480 agreement of aid in 1965 as a result of the war with Pakistan. Foodgrain production picked up later in the calendar year 1967 due to the impact of the "green revolution."

There was also a mild industrial deceleration due to a reduction in demand from the agricultural sector and shortages of agricultural raw materials and imported inputs. Restrictive fiscal policies adopted during this period accentuated the deceleration. The worst hit sector was of capital goods where production fell by 17% over the two year period 1966-67 and 1967-68 and rose gradually after that (Joshi and Little, 1996). As pointed out by Ahluwalia (1985), "The mid-sixties witnessed the emergence of a number of latent strains as well as a few new factors which were to change the course of industrialisation in the following period." Shetty (1978) attributes the deceleration to a "structural retrogression."

The balance of payments situation deteriorated considerably in 1965-66 and 1966-67. Exports of traditional goods also deteriorated and the dollar value of the exports fell in 1966-67 and in 1967-68 despite the devaluation in 1966 because of the droughts (Joshi and Little, 1996)). The balance of payments situation improved after 1966-67 largely due to the fall on food imports after the agricultural recovery and the decrease in capital goods imports.

Thus the two recessions in the 1960s can be explained by the two wars, a drop in agricultural output, industrial deceleration, restrictive fiscal policies, the balance of payments crisis and high inflation.

Recession from June 1972 to May 1973

According to our analysis, the next recession occurred in the early 1970s from *June 1972 to May 1973*. Several factors initiated the recession in 1972-73. In early 1971 the agitation in the then-East Pakistan resulted in a huge flow of refugees into India creating an enormous economic burden. Indo-Pakistani relations deteriorated during 1971 culminating in a war in December 1971. The preparation and the conduct of this war resulted in a sharp increase in defense expenditure over and above the expenditure incurred to support the refugees.

The agricultural sector was badly hit during 1972-73. Both the summer and winter rains failed resulting in an 8 percent drop in foodgrain and agricultural production (Joshi and Little, 1996). At the same time, foreign aid declined even more sharply with the relations between India and the United States cooling further before the war of 1971 and American aid virtually stopped in 1972-73. Thus at a time when the government was tackling the high

expenditures due to drought and war, and also felt the need to increase capital investment to make up for the stagnation in the late 1960s, support in terms of foreign aid fell substantially (Joshi and Little, 1996). This increased the dependence of the government on borrowing from the Reserve Bank fuelling inflationary pressures.

During this period, the management of food supplies was also not handled properly. Even though agricultural production fell in 1972-73, food imports were delayed. Further, the government bought less than had been authorized so that food availability fell by more than was necessary. Finally, due to the delay in purchases, India paid very high prices on the world wheat market. The government nationalized wheat trade in the spring of 1993 in an attempt to eliminate middlemen but this worsened the situation and the scheme was abandoned.

The oil price shock increased oil prices in September 1973. Although this shock affected the economy adversely, the impact was not severe enough to trigger a recession.

Recession from April 1979 to March 1980

During this period the economy suffered from both internal and external shocks. The drought in 1979 was very severe resulting in a drop in agricultural production by over 15 percent (Joshi and Little, 1996). The economy also suffered the consequences of the global oil price rise. At the same time, domestic oil supplies were also disrupted by the agitation in Assam, which supplied one-third of India's oil production. All these factors caused power shortages that further led to shortages of coal and transport facilities. The effects of the drought combined with the shortages of key inputs led to an industrial recession.

After this short recession (11 months), the economy grew rapidly in the 1980s. GDP growth increased from about 3.6 percent per annum from the mid sixties through the seventies to around 5.5 percent in the eighties. This expansion lasted 132 months from March 1980 to March 1991 (the longest in the period under study) as shown in Table 1. The economic reforms undertaken from mid eighties onwards contributed to this expansion. These measures included industrial deregulation, financial liberalisation, import deregulation, export incentives, exchange rate depreciation, and tax reforms. While there was a drought in 1987, it was not severe and the agricultural sector recovered soon after. Further, fiscal policy was expansionary, the manufacturing sector continued to grow and exports also increased. At the

same time it was clear that the underlying macroeconomic fundamentals were not strong enough to sustain the expansion. Fiscal and current account deficits were high and the burden of domestic and foreign debt was heavy and unsustainable. Since the macroeconomic fundamentals were weak, the Iraqi invasion of Kuwait in August 1990 and the Gulf War were enough to trigger a full-scale crisis.

Recession from March 1991 to September 1991

In early 1991, the Indian economy was in the throes of a macroeconomic crisis. India's credit rating had been downgraded sharply and foreign lending was also cut-off. Inflation, fiscal and current account deficits, domestic and foreign borrowing were all high. There was a steep fall in foreign exchange reserves to a level of two weeks imports. In this scenario, structural reforms were initiated by the new government that took office at the end of June 1991. The immediate objectives of the reforms were to decrease inflation, reduce the fiscal deficit, improve the balance of payments position, and, overall, to stabilize the economy. Steps undertaken included fiscal contraction, a credit squeeze, and a devaluation of the rupee. The immediate impact of these measures on the economy was contractionary.

The coincident index analysis suggests that the peak in the business cycle occurred in March 1991 but the recession lasted only six months.

Recession from May 1996 to February 1997

The recovery/expansion that started in late 1991 continued until the middle of 1996 when the economy once again slipped into a recession. The liberalization and reforms that followed the external crisis of 1991 were initially rewarded with an improvement in the almost all economic indicators – GDP growth rate, exports, investment, and foreign exchange reserves rose rapidly. By 1995, however, the reform process itself had lost its momentum. Furthermore, the elections in 1996 produced a short-lived coalition government that was not able to focus on key economic issues. Industrial production, industrial investment, and consumer demand fell and the economy faced infrastructure bottlenecks. This recession lasted from May 1996 to February 1997.

6. CHRONOLOGY OF GROWTH RATE CYCLES

The growth rate cycle chronology is reported in Table 2. Chart 3 shows the growth rate cycles and Chart 4 gives the growth rates of the individual components with the growth rate chronology. In all, 13 growth cycles are identified from January 1957 onwards compared to 6 classical business cycle recessions. The duration of the slowdowns is generally higher with the average duration measuring about two years while the average duration of the business cycle recession is less than one year. The growth cycles corresponding to the business cycles identified earlier are given below:

Business Cycles	*Corresponding Growth Rate Cycles*
• November 1964 to November 1965	November 1963 to November 1965
• April 1966 to April 1967	April 1966 to March 1967
• June 1972 to May 1973	February 1969 to February 1974
• April 1979 to March 1980	February 1976 to December 1979
• March 1991 to September 1991	March 1990 to September 1991
• May 1996 to February 1997	September 1994 to February 1997

Note that except for the April 1966 recession, the growth rate cycle peaks lead their comparable business cycle peaks highlighting the distinction between a slowdown and a full-fledged recession. This distinction is not marked for the troughs. The average duration of growth rate cycles is less than three years with the average downturn lasting two years and the average upturn lasting a little less than a year.

7. CONCLUSIONS

An analysis of business cycles since the mid fifties shows that the Indian economy exhibits the characteristic synchronous upswings and downswings in a variety of economic activities. It also exhibits the synchronous upswings and downswings in the growth rates of a variety of economic activities that characterize the growth rate cycle.

In duration, Indian business cycles have averaged over six years in length, with recessions averaging just under a year and expansions averaging just over five years in length.

Indian growth rate cycles have averaged less than three years in length, with the average downturn lasting two years and the average upturn lasting a little less than a year.

This paper lays a strong foundation for future research. Using the coincident index developed here and the chronologies reported as benchmarks, leading indicators for the Indian economy can now be evaluated and a leading index developed.

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Table 1

Business Cycle Chronology for India

Dates of Peaks and Troughs		Duration (in months)	
Trough	**Peak**	**Contraction (peak to trough)**	**Expansion (trough to peak)**
	November 1964		
November 1965	April 1966	12	5
April 1967	June 1972	12	62
May 1973	April 1979	11	71
March 1980	March 1991	11	132
September 1991	May 1996	6	56
February 1997		9	
Average (months)		10.2	65.2
Median (months)		11.0	62.0
Standard Deviation (months)		2.3	45.3

Table 2

Recessions in the 1960s

Business Cycle	Peak	Trough	Duration	% drop	Peak	Trough	Duration	% drop
	Nov-64	***Nov-65***	12		***Apr-66***	***Apr-67***	12	
GDP (Output)	I/65	II/66	15	-5.6	NC	NC	NC	NC
Industrial Production (Output)	Jun-65	Jan-66	7	-8.0	May-66	Feb-67	9	-5.6
Unemployment	***Nov-64***	***Nov-65***	12	-23.6	Jan-66	Aug-66	7	-14.5
Wages (Income)	NA	NA	NA	NA	May-66	Feb-67	9	-12.4
IIP-Consumer Goods (Sales)	NA	NA	NA	NA	***Apr-66***	***Apr-67***	12	-17.1
Coincident Index	***Nov-64***	***Jan-66***	14	-4.6	***Apr-66***	***Mar-67***	11	-6.1

Notes for Tables 2-4:

NC stands for no cycle, i.e., no discernible drop during the recession.

NA stands for data not available.

Bold, italicized dates represent recognized cyclical turning points. Other dates represent unrecognized cyclical turning points, i.e., local highs and lows in the vicinity of the recession.

Table 3

Recessions in the 1970s

Business Cycle	Peak	Trough	Duration	% drop	Peak	Trough	Duration	% drop
	Jun-72	*May-73*	11		*Apr-79*	*Mar-80*	11	
GDP (Output)	IV/71	III/72	9	-5.4	*I/79*	*IV/79*	9	**-10.4**
Industrial Production (Output)	Oct-72	Feb-73	4	-4.5	*Mar-79*	*Dec-79*	9	**-8.4**
Unemployment	*Feb-67*	*May-73*	**69**	**-54.1**	*Dec-79*	*Dec-83*	**48**	**-32.6**
Wages (Income)	*May-72*	*Feb-75*	**33**	**-21.3**	*May-79*	*Mar-80*	**10**	**-11.8**
IIP Consumer Goods (Sales)	*Aug-72*	*Oct-73*	**10**	**-11.2**	*May-78*	*Apr-80*	**23**	**-21.0**
Coincident Index	*Jun-72*	*Feb-73*	7	**-4.6**	*Apr-79*	*Mar-80*	**11**	**-6.8**

Table 4

Recessions in the 1990s

	Peak	Trough	Duration	% drop	Peak	Trough	Duration	% drop
Business Cycle	*Mar-91*	*Sep-91*	9		*May-96*	*Feb-97*	9	
GDP (Output)	I/91	III/91	6	-5.2	III/96	IV/96	3	-7.8
Industrial Production (Output)	Mar-91	Aug-91	5	-12.4	May-96	Nov-96	6	-4.5
Unemployment	*Sep-90*	*Sep-91*	**12**	**-30.1**	*Jul-95*	*Apr-97*	**21**	**-50.0**
Wages (Income)	*Feb-90*	*Dec-91*	**22**	**-28.6**	*Feb-96*	*Feb-97*	**12**	**-30.8**
IIP Consumer Goods (Sales)	*Apr-91*	*Sep-91*	**5**	**-6.8**	*May-96*	*Nov-96*	**6**	**-14.3**
Coincident Index	*Mar-91*	*Sep-91*	**6**	**-8.5**	*Aug-96*	*Feb-97*	**6**	**-7.2**

Table 5

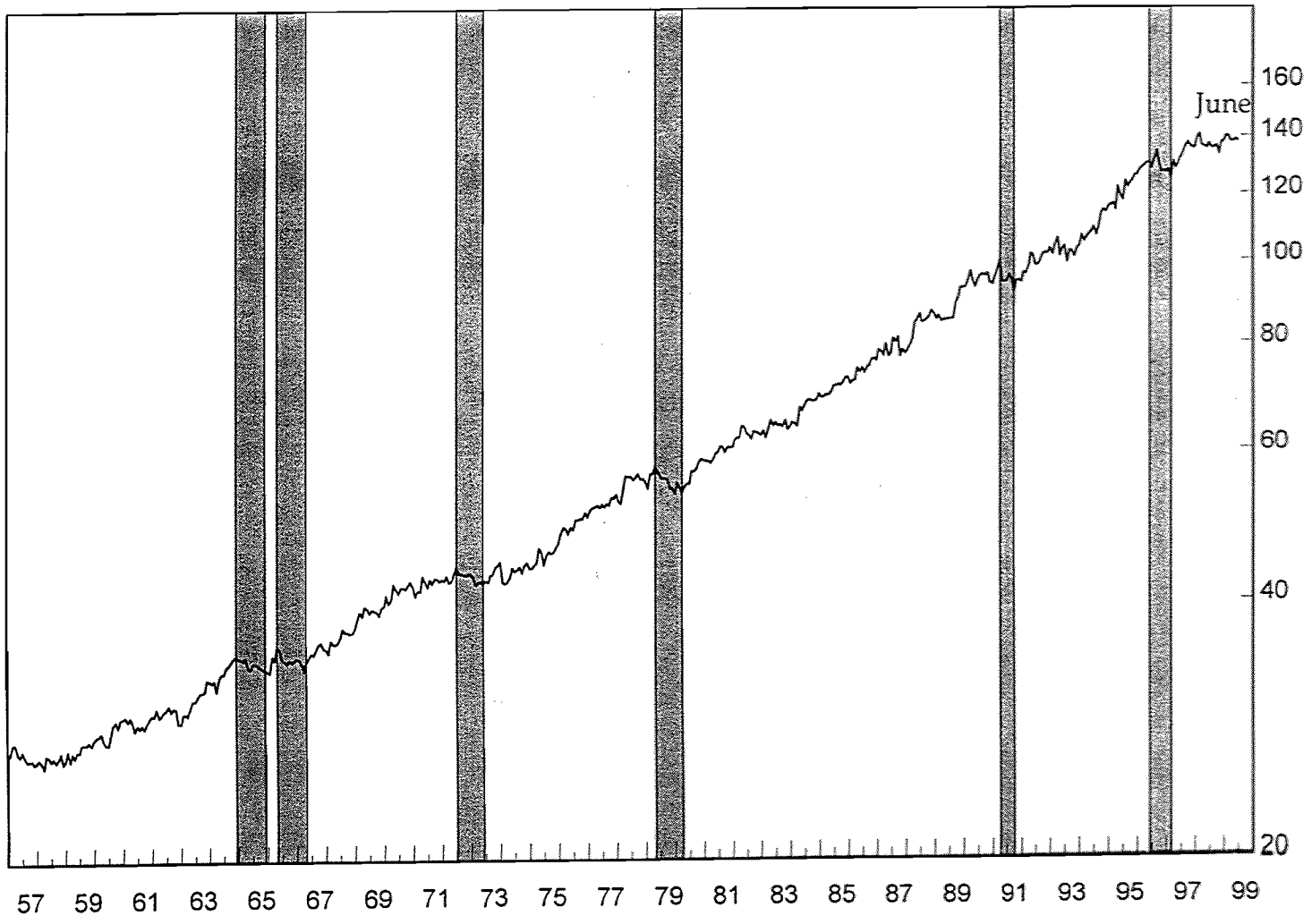
Growth Rate Cycle Chronology for India

Table 5

Growth Rate Cycle Chronology for India

Dates of Peaks and Troughs		Duration (in months)	
Trough	**Peak**	**Contraction (peak to trough)**	**Expansion (trough to peak)**
	May 1959		
May 1961	February 1962	24	9
November 1962	November 1963	9	12
November 1965	April 1966	24	5
March 1967	February 1969	11	23
February 1974	February 1976	60	24
December 1979	November 1980	46	11
November 1981	April 1982	12	5
November 1983	August 1984	19	9
October 1987	June 1988	38	8
March 1989	March 1990	9	12
September 1991	April 1992	18	7
October 1993	September 1994	18	11
February 1997		29	
Average (months)		24.4	11.3
Median (months)		19.0	10.0
Standard Deviation (months)		15.4	6.2

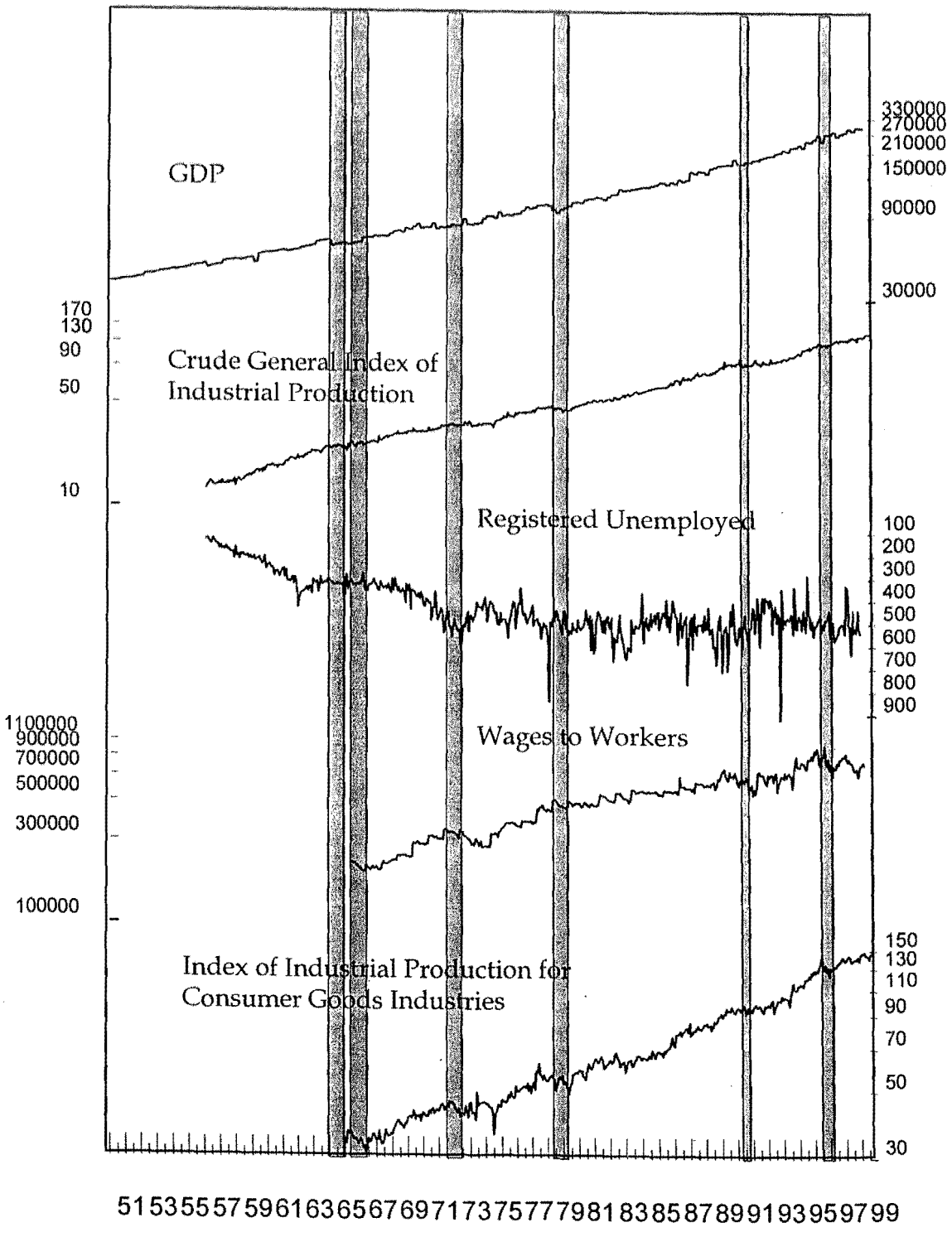
Indian Coincident Index (1992=100)



Shaded areas represent Indian business cycle recessions.

Chart 1

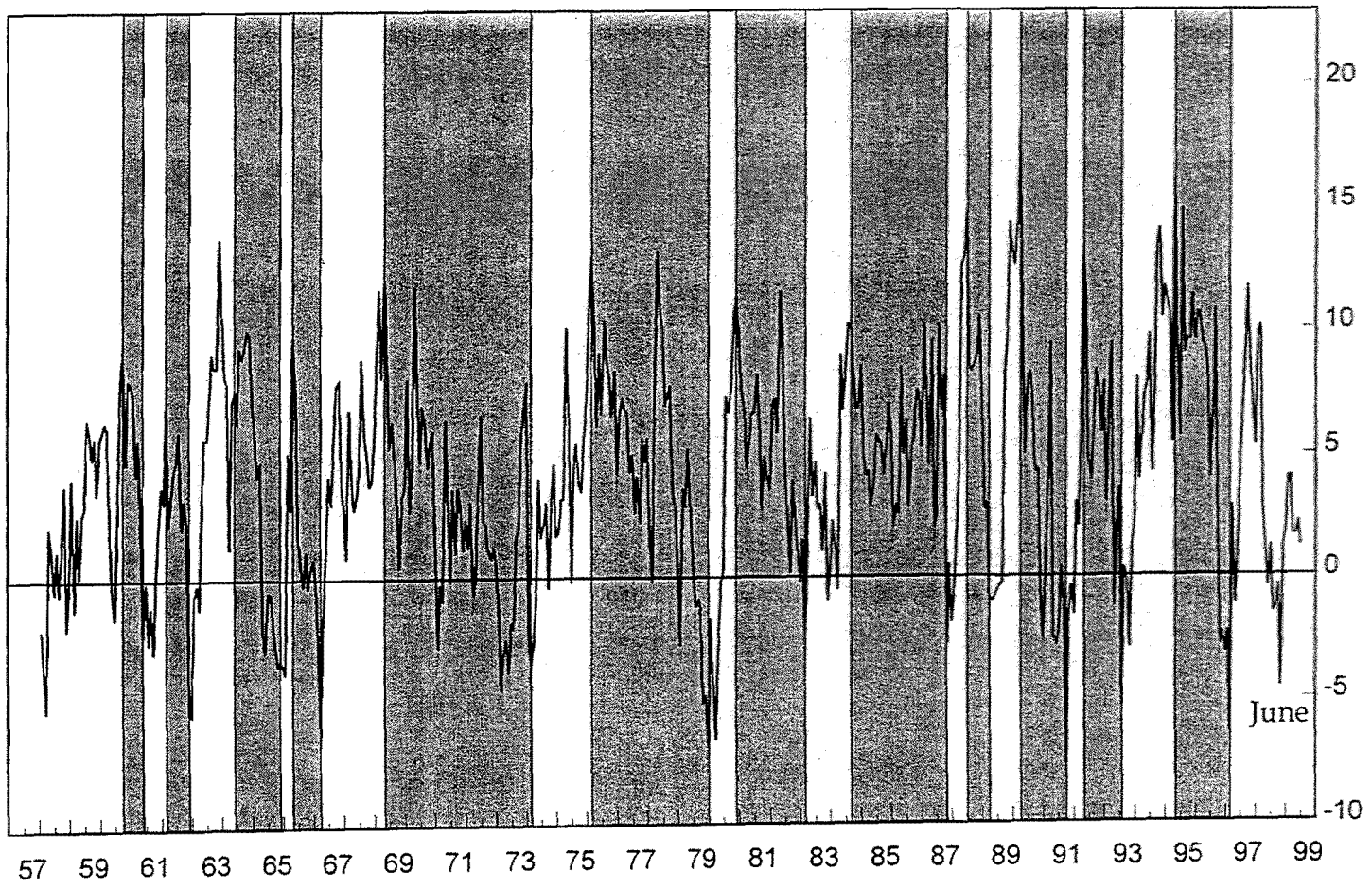
Components of Indian Coincident Index



Shaded areas represent Indian business cycle recessions.

Chart 2

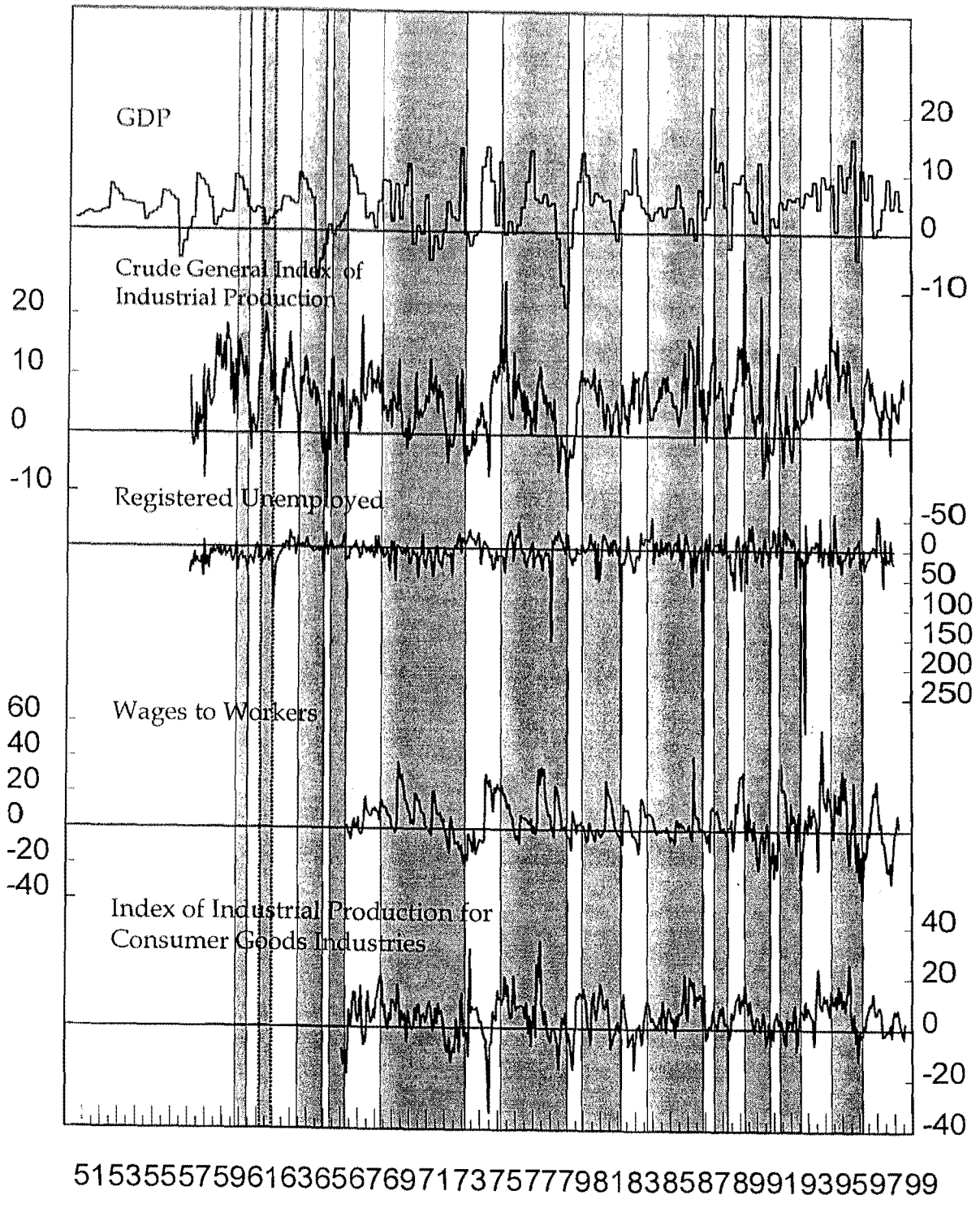
Indian Coincident Index, Growth Rate (%)



Shaded areas represent Indian growth rate cycle downturns.

Chart 3

Components of Indian Coincident Index, Growth Rate (%)



Shaded areas represent Indian growth rate cycle downturns.

Chart 4

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