OECD Statistics Working Papers 2006/01

Composite Leading Indicators for Major OECD Non-Member Economies: Brazil, China, India, Indonesia, Russian Federation, South Africa

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https://dx.doi.org/10.1787/834716666802

OECD

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development **25-Jan-2006**

English - Or. English

STATISTICS DIRECTORATE

STD/DOC(2006)1
Unclassified

COMPOSITE LEADING INDICATORS FOR MAJOR OECD NON-MEMBER ECONOMIES:
BRAZIL
CHINA
INDIA
INDONESIA
RUSSIAN FEDERATION
SOUTH AFRICA

OECD Statistics Working Paper

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Centre for Co-operation with Non-Members

December 2005

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JT00200206

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ABSTRACT

The OECD developed a System of Composite Leading indicators for its Member countries in the early 1980's based on the "growth cycle" approach. Today the OECD compiles composite leading indicators (CLIs) for 23 of its 30 Member countries and it is envisaged to expand country coverage to include all Member countries and the major six OECD non-member economies (NMEs) monitored by the organization in the OECD System of Composite Leading Indicators.

The importance of the six major NMEs was considered the first priority and a workshop with participants from the six major NMEs was held at the OECD in Paris in April 2005 to discuss an initial OECD selection of potential leading indicators for the six major NMEs and national suggestions for alternative and/or additional potential leading indicators for calculation of country specific composite leading indicators. The outcomes of this meeting and follow-up activities undertaken by the OECD in co-operation with the participating national agencies are reflected in the results presented in this final version of the document.

The OECD indicator system uses univariate analysis to estimate trend and cycles individually for each component series and then a composite indicator is obtained by aggregation of the resulting de-trended components. Today, statistical techniques based on alternative univariate methods and multivariate analysis are increasingly used in cyclical analysis and some of these techniques are used in this study to supplement the current OECD approach in the selection of leading components and the construction of composite indicators.

RÉSUMÉ

L'OCDE a développé un système d'indicateurs composites avancés pour ses pays membres au début des années 80 basé sur les "cycles de croissance". Aujourd'hui, l'OCDE calcule les indicateurs composites avancés pour 23 des 30 pays membres et envisage d'étendre la couverture du système des indicateurs composites avancés à tous les pays membres ainsi qu'aux six principales économies non membres suivies par l'Organisation.

L'importance des six principales économies non membres est considérée comme prioritaire et un séminaire regroupant ces six principales économies non membres fut organisé au siège de l'OCDE à Paris en avril 2005 afin de discuter d'une première sélection par l'OCDE d'indicateurs avancés potentiels pour les six principales économies non membres et discuter des suggestions des pays pour des indicateurs avancés potentiels alternatifs et/ou supplémentaires pour le calcul des indicateurs composites avancés spécifiques aux pays. Les résultats de cette réunion et les futures activités entreprises par l'OCDE en collaboration avec les agences nationales participantes sont décrits dans la version finale de ce document.

Le système des indicateurs composites avancés de l'OCDE utilise une analyse univariée afin d'estimer la tendance et les cycles individuellement pour chaque série composante et ensuite un indicateur composite est obtenu par aggrégation des composantes sans tendance. Aujourd'hui, les techniques statistiques basées sur d'autres méthodes d'analyse univariée ainsi que multivariée sont de plus en plus utilisées en analyse cyclique et certaines de ces techniques sont utilisées dans l'étude afin de compléter l'approche courante de l'OCDE dans la sélection des composantes avancées et dans la construction des indicateurs composites.

FOREWORD

The OECD developed a System of Composite Leading indicators for its Member countries in the early 1980s based on the "growth cycle" approach. Today the OECD compiles composite leading indicators (CLIs) for 23 of its 30 Member countries and it is envisaged to expand country coverage to include all Member countries and the major six OECD non-member economies (NMEs) monitored by the organization in the OECD System of Composite Leading Indicators.

The importance of the six major NMEs was considered the first priority and a workshop with participants from the six major NMEs was held at the OECD in Paris in April 2005 to discuss an initial OECD selection of potential leading indicators for the six major NMEs and national suggestions for alternative and/or additional potential leading indicators for calculation of country specific composite leading indicators. The outcomes of this meeting and follow-up activities undertaken by the OECD in co-operation with the participating national agencies are reflected in the results presented in this final version of the document.

The development of the CLIs for the NMEs was carried out by Ronny Nilsson and Olivier Brunet of the Short-term Economic Statistics Division, in the OECD Statistics Directorate. For the development of the final CLIs, the OECD Statistics Directorate would like to thank the following country experts for their support and interest in the subject: Salomao Quadros da Silva (Getulio Vargas Foundation, Rio de Janeiro), Shi Faqi (National Bureau of Statistics, Beijing), Yongjun Zhang (State Information Centre, Beijing), A. B. Chakraborty (Reserve Bank of India, Mumbai), Slamet Sutomo (BPS statistics Indonesia, Jakarta), Iaan Venter (South African Reserve Bank, Pretoria).

This document has been prepared within the framework of the programme of work of the Centre for Co-operation with Non-Members and is published on the responsibility of the Secretary-General.

Statistics Directorate
OECD
Paris

December 2005

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1. INTRODUCTION

The construction of composite leading indicators for Brazil, China, India, Indonesia, Russian Federation and South Africa is the focus of this paper. Earlier studies on China, Indonesia and Russia in this field have been conducted by the OECD's Statistics Directorate in co-operation with the National Bureau of Statistics of the People's Republic of China, the Bank of Indonesia and the Centre for Economic Analysis of the Russian Federation.

Business cycle analysis and in particular construction of composite leading indicators are areas in which transition and emerging economies have had little experience to date, but is one which is likely to become increasingly important as they move to market economies. A major constraint for the construction of composite indicators in transition and emerging economies is data availability. The cyclical indicator approach requires high frequency data and consistent time series for a reasonably long period of time. In addition, most of the indicators identified as leading indicators in developed market economies are usually not available on a monthly or quarterly basis in many developing countries or they are only available for a short period of time.

Several developing countries in Asia have improved their national statistical systems after the 1997 Asian financial crises and a similar improvement process started in Russia during the transition period in the early and mid-1990s. Many economic and financial indicators, which were not available before the crises or only available with a yearly frequency, are now available on a monthly or quarterly basis. Such indicators include as well indicators derived from recently implemented or harmonized business tendency surveys in Russia, China, India and Indonesia supported by technical assistance work by the OECD in co-operation with the European Commission and Eurostat for transition countries in Eastern Europe and Russia over the period 1991-1998 and in co-operation with the Asian Development Bank (ADB) and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) for developing countries in Asia including China, India and Indonesia over the period 1999-2003. These surveys are conducted on a monthly or quarterly basis and include indicators such as business confidence, production, employment and price expectations, stock and order situation.

The OECD indicator system uses univariate analysis to estimate trend and cycles individually for each component series and then a composite indicator is obtained by aggregation of the resulting de-trended components. Today, statistical techniques based on alternative univariate methods and multivariate analysis are increasingly used in cyclical analysis and some of these techniques are used in this study to supplement the current OECD approach in the selection of leading components and the construction of composite indicators.

The main characteristics of the constructed CLIs for the major six OECD non-member countries considered here and the economic indicators included as component series in the country specific CLIs are presented in Section 1, which also includes some conclusions for future research and development. Growth cycles and reference series are covered in Section 2. Selection and evaluation of indicators are presented in the next two sections where both classical NBER analysis and modern time series analysis such as spectral and dynamic factor analysis are used in the selection and evaluation process. The construction of composite leading indicators and the characteristics of the CLIs and their components are presented in Section 5. The basic methodology employed is outlined in the final section.

2. SUMMARY AND CONCLUSIONS

This paper explores the possibility of constructing composite leading indicators (CLIs) for assessing and forecasting cyclical fluctuations in economic activity in Brazil, China, India, Indonesia, Russia and South Africa. From the set of about 20-30 analysed cyclical indicators for each country, the best leading indicators were selected in each country on the basis of the empirical results. A set of about 10 to 15 indicators was used to construct alternative CLIs for each country which were evaluated against industrial production as reference indicator for the growth cycle in each respective country. Charts 1-6 show the cyclical developments of the best performing CLIs and the reference indicator for each respective country.

The pre-selected cyclical indictors were evaluated for their cyclical performance against industrial production as the reference series in each country with a set of statistical methods including both classical descriptive and univariat methods based on the NBER approach and cross spectral analysis and multivariate methods such as dynamic factor models. A screening procedure based on the practical criteria (frequency) and seven cyclical criteria according to the above methods were used to select a reduced set of cyclical indicators with the best cyclical characteristics. Indicators were included in the final set of analysed indicators if they were accepted on more than 4 of the 8 criteria used.

The results of this evaluation showed that very few indicators scored well on all the 7 cyclical criteria. In particular, few indicators showed coherence and were not classified as leading indicators according to the cross spectral analysis. The two measures of cyclical classification used from dynamic factor analysis, i.e. cross-correlation between common components and cyclical timing classification in general showed consistent results and classified more series as leading indicators than the cross spectral analysis. On the other hand, classical measures such as cross-correlation and turning point behaviour (median lag) showed the most consistent results, and more indicators were classified as leading indicators in comparison with both the cross spectral and dynamic factor results.

A starting point for the selection of potential leading indicators in any country is to investigate the national economic structure and international linkages. This will give information on key sectors and factors to take into account when searching for potential leading indicators in a country. The component series included in the individual country CLIs for the six OECD non-member countries considered here support this approach by showing a relatively high proportion of components related to international linkages such as exports/imports, terms of trade, exchange rates and world price of crude oil. The component series selected for Brazil, China, India, Indonesia, Russia and South Africa are presented in Table 1.

In addition to the above criteria, potential indicators were selected from as many as possible of the subject areas set out in Table 2 to obtain a good representation of overall economic activity. However, as noted above, the proportions of the component series from the foreign trade domain is much higher than the share noted across OECD Member countries. Business tendency and consumer surveys and monetary and financial series are the two other subject areas with high representation of component series, as in OECD countries. However, in Russia the share of components from business tendency and consumer survey indicators is much higher than in OECD countries. In the case of India and Indonesia the share of components related to monetary and financial area is extremely high with 50 and 60 per cent of the component series respectively compared to about 26 per cent across OECD countries.

The selection of potential indicators in the six NMEs is of course very much related to data availability, which partly explains the high representation of indicators from the foreign trade domain and financial area after the 1997 financial crises in Asia. For these countries there is a lack of suitable real indicators, with the exception of derived indicators from recently implemented business tendency surveys in most of the countries.

Table 1: Leading indicators for major OECD non-member economies

Component	Subject Area	Frequency	Starting date	Smoothness MCD/ QCD (1)	Timeliness latest data available at *t*
BRAZIL					
Export volume	External	Monthly	1981	1	t+2
Industrial production, semi- and non-durable goods	Real	Monthly	1975	2	t+2
Spong iron production	Real	Monthly	1979	5	t+2
Sales of motor cars for domestic market	Real	Monthly	1981	1	t+2
Share Price index, FGV 100E	Financial	Monthly	1993	1	t+2
Terms of trade	External	Monthly	1979	3	t+2
Finished goods stocks, inverted	Tendency surveys	Quarterly	1979	1Q	t+4
Order books	Tendency surveys	Quarterly	1978	1Q	t+4
CHINA					
Broad money supply	Financial	Monthly	1990	3	t+2
Cargo handled at ports	External	Monthly	1983	6	t+2
Chemical fertilizer	Real	Monthly	1983	3	t+2
Enterprise deposits	Financial	Monthly	1978	2	t+2
Imports from Asia	External	Monthly	1993	5	t+2
Non-ferrous metals production	Real	Monthly	1983	6	t+2
INDIA					
Business Confidence	Tendency surveys	Quarterly	1997	1Q	t+4
Imports	External	Monthly	1995	4	t+2
Exchange rate, USD, inverted	External	Monthly	1995	2	t+2
Money supply M1	Financial	Monthly	1995	4	t+2
Deposit interest rate, inverted	Financial	Monthly	1997	2	t+2
Share Price Index, BSE Dollex	Financial	Monthly	1991	2	t+2
IIP Basic Goods	Real	Monthly	1995	5	t+2
IIP Intermediate Goods	Real	Monthly	1995	6	t+2
INDONESIA					
Exchange rate USD	External	Monthly	1990	2	t+2
Exports	External	Monthly	1990	4	t+2
Imports	External	Monthly	1990	2	t+2
Call money rate	Financial	Monthly	1990	4	t+2
Share price index, JSX Composite	Financial	Monthly	1990	3	t+2
RUSSIA					
Business confidence, industry	Tendency surveys	Monthly	1998	1	t+2
Selling prices, future tendency, industry	Tendency surveys	Monthly	1996	1	t+2
Business situation, construction	Tendency surveys	Quarterly	1994	1Q	t+4
Stock level, retail trade	Tendency surveys	Quarterly	1997	1Q	t+4
Crude oil price, world	External	Monthly	1980	2	t+2
Balance of payments, current	External	Quarterly	1994	1Q	t+8
Net trade	External	Monthly	1994	3	t+2
SOUTH AFRICA					
Building plans	Real	Monthly	1990	1Q	t+2
Business confidence, manufacturing	Tendency surveys	Quarterly	1990	1Q	t+4
Interest rate spread	Financial	Monthly	1990	1Q	t+2
Motor cars sales	Real	Monthly	1990	1Q	t+2
Order inflow, manufacturing	Tendency surveys	Quarterly	1991	4	t+4
Share price index, total	Financial	Monthly	1990	6	t+2

(1) MCD (Months for Cyclical Dominance) is defined as the shortest span of months for which the I/C ratio is less than unity. I and C are the average month-to-month changes without regard to sign of the irregular and trend cycle component of the series, respectively. Although I remains approximately constant as the span of months increases, C should increase. Therefore, the I/C ratio, itself a measure of smoothness, should decline and eventually become less than unity.
In practice, there are some series for which the I/C ratio at first declines as the span of months increases, and then starts to increase again without ever having dropped as low as 1. Hence, there is a convention that the maximum value of MCD should be six. For quarterly series there is an analogous measure, Quarters for Cyclical Dominance (QCD) which has a maximum value conventionally defined as 2.

Table 2: Leading indicators in OECD Member countries and the major non-member economies by subject area

Indicators by subject area	Number of countries/indicators							
	OECD Member countries		Major non-member economies					
	Number	Per cent	Brazil	China	India	Indonesia	Russia	South Africa
Production, stocks and orders	12	7.7	2	2	2			
Construction, sales, trade and transport	17	10.9	1					2
Labour force	3	1.9						
Prices, costs and profits	12	7.7					1	
Monetary and financial	41	26.3	1	2	3	2		2
Foreign trade	8	5.1	2	2	2	3	2	
Economic activity in foreign countries	4	2.6						
Business and consumer surveys	59	37.8	2		1		4	2
Total/Average	156 / 6.8	100	8	6	8	5	7	6

2.1 Characteristics of leading indicators

As noted above, a major problem with the CLIs constructed for the six OECD non-member economies is the short time period, for which potential leading indicators are available, and in some cases the absence of a monthly reference series with consistent data for a reasonably long period. Further major problems are the reliance on an excessive number of quarterly indicators and the timeliness of the data.

The **timeliness** of the latest data available for the component series for the CLIs is summarised in Table 1. The timeliness criteria used refers to the ability of the component indicator to meet the publication deadline for the OECD's Main Economic Indicators publication. CLI data for a given month "t" is published at the beginning of month "t+2". This implies that component series available at this date would fulfill the timeliness criteria. This is a particular problem for series with a quarterly frequency, such as the quarterly series on balance of payments in Russia.

The **frequency** of the tendency survey series included as components in the CLIs for all countries is quarterly with exception of two series for Russia. This means that the delay for timely data is two months (indicated as t+4 in Table 1). This is a particular problem for the CLI constructed for Russia which includes four tendency survey components out of a total of seven components.

Smoothness is another important characteristic for the selection of leading indicators. The months/quarters for cyclical dominance MCD/QCD values (see definition in footnote (1) to Table 1) give an idea of the smoothness of the series. Indicators with small MCD values are preferred in order to minimize the length of the moving average when performing smoothing. Monthly component series with MCD values of 5 or 6 are very irregular and will imply revisions to the series when data next becomes available. For the CLIs constructed here, such series are related to real sector variables (production series) in Brazil, China and India, to external trade in China and a financial variable (share price index) in South Africa.

2.2 Characteristics of composite leading indicators (CLIs)

The characteristics of the constructed CLIs with the best cyclical properties in each country are presented in Table 3. These results are compared with the historical performance of the CLIs for the United

States, Japan and Germany over the last 40 years. The results show acceptable cyclical properties for all the six OECD non-member economies . However, it is worth noting that the results for India, Indonesia and Russia are based on data for very short time periods, 9 to 14 years, which include only 2 to 3 cycles. This means that the turning point measures given are not significant in a statistical sense for these three countries.

Cyclical Characteristics

The statistical criteria used to evaluate both individual components and CLIs in relation to the reference series (industrial production) include general fit measured by cross-correlation and behavior at turning points as measured by median or mean lead/lag, standard deviation around the median, smoothness (the months for cyclical dominance MCD value gives an idea of the smoothness of the CLI) and extra and/or missing cycles.

To evaluate the length of the lead, the **median lead at turning points** is preferred to the mean, since the number of turning points is extremely small and the mean lead would be strongly affected by extreme values. The median lead at all turning points is in the range 3-7 months for all countries except India where a very short lead of 1 month is recorded.

Compared to the cyclical properties of the CLIs for the above three major OECD countries the constructed CLIs for the six OECD non-member economies show the following general cyclical characteristics:

- correlation coefficient at the same rather high level as in OECD countries, but this may be explained by the short time period and small number of cycles;
- lead at trough rather short for the CLI in Brazil;
- lead at peak rather short for the CLI in India;
- variability of lead at all turning points measured by the standard deviation is higher in all countries except India and Russia;
- good smoothness of the CLI is ensured by an MCD value of 1 for all countries

The **number of missing and extra cycles** of the CLI in relation to the cycles in the reference series gives very important information about the quality of the CLI. If there are too many extra cycles, the risk that the CLI gives false signals becomes significant. Conversely, if the CLI failed in predicting several cycles in the past it may not always be very reliable in anticipating changes in economic activity.

The CLI for **Brazil** missed one cycle in the early 1980s and picked up one extra mini cycle in the mid-1980s and registered one cycle in the early 1990s not picked up in the industrial production index because of a very irregular development registered in output over this period. Industrial production registered seven cycles over the period 1979 to 2004 for which the CLI is calculated. This is about the same track record as the OECD CLI for the United Kingdom which registered three extra cycles over the same number of cycles in industrial production (see Chart 1).

In **China**, the CLI has predicted all turning points well in advance and tracked the cyclical amplitudes very well over the short period since 1983 over which it is calculated. However, one cycle is not picked up over the six cycles registered in industrial output (see Chart 2).

Table 3: Main characteristics of composite leading indicators

Country	Starting date	Extra (x), missing (m) cycles/ total number of cycles (1)		Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
All series		x, m	total										
Brazil	1979	1m 1x	7	1	5	5	5	4	1	4	6.5	4	0.64
China	1983	1m	6	1	5	6	6	3	4	4	6.5	6	0.70
India	1995	0	2	1	1	2	1	1	2	1	0.8	3	0.89
Indonesia	1993	1m	3	1	7	3	5	7	3	7	9.3	3	0.68
Russia	1994	1x	2	1	7	7	7	7	7	7	4.5	7	0.72
South Africa	1975	0	6	1	8	9	9	4	6	5	10.3	5	0.73
United States	1955	1m	13	1	8	5	7	7	4	6	3.6	5	0.77
Japan	1959	1x	11	1	9	5	7	9	5	8	5.4	6	0.84
Germany	1961	1x	11	1	6	2	4	7	2	3	4.3	6	0.72

(1) Excluding extra cycles which have been considered as minor
(2) Cross-correlation for the lead at which the highest correlation occurs

The CLI for **India** shows a median lead of only one month at all turning points over the two cycles registered since 1995 in industrial production. However, the correlation with the reference cycle is very high with a peak-correlation coefficient of 0.89 at a lead of three months. No extra or missing cycles are recorded over the investigated period (see Chart 3).

Indonesia registered three growth cycles in industrial production over the period 1993-2004 of which the first cycle over the period 1994-1996 was missed by the CLI (see Chart 4).

In **Russia**, the CLI has predicted matching turning points with a median lead of seven months at all turning points and tracked the cyclical amplitudes of industrial production very well over the short period since 1994 over which it is calculated. The CLI indicated, however, one extra cycle over the period 1995-96 not registered in industrial production (see Chart 5).

The CLI for **South Africa** shows a median lead of five months at all turning points and a rather high cyclical correspondence with industrial production over the period since 1975. No extra or missing cycles are recorded over the six cycles registered in industrial production (see Chart 6).

The above results are encouraging, but as stressed earlier, these results are based on evaluations over a very short time period with only two or three growth cycles registered in India, Indonesia and Russia. Future research and development would be needed to monitor the quality of the constructed CLIs and to look for improvements in the areas outlined below.

It is very important to have a broad range of indicators reflecting the cyclical development from different parts of the economy when analysing fluctuations in aggregate economic activity. In the selection of potential cyclical indicators for the investigated countries, the indicators included in the OECD system of leading indicators were used as the reference frame.

Most OECD countries use indicators from several subject areas to compile CLIs. However, as noted above, in the six OECD non-member economies considered here, most of the leading indicators selected come from few subject areas (see Table 2). In the case of India and Indonesia the share of components related to monetary and financial area is over 50 per cent of the selected indicators and in Russia the share of components coming from business and consumer surveys is also over 50 per cent. On the other hand, no labour force indicators are used in any of the countries and no indicators in Indonesia and Russia come from the production, stocks and orders, construction, sales and transport subject areas In order to have more broadly based and possibly more reliable CLIs in the considered countries it would be necessary to investigate alternative indicators from other subject areas as well.

A subject area of special interest to all of the countries considered, in particular, in Indonesia and Russia, would be the production, stocks and orders production areas. Real indicators from this domain would be suitable candidates for potential leading indicators. However, such indicators are covered by qualitative indicators derived from business tendency surveys. The problem here is that the surveys are conducted on a quarterly frequency in all of the countries and both timeliness and associated revisions pose problems for the calculation of monthly CLIs. Implementation of monthly business tendency surveys would be a cost efficient way to obtain timely leading indicators reflecting the production cycle.

The results also indicate that industrial production may not be the best reference series for the aggregate economic cycle in certain countries and alternative reference series should be investigated. In addition, other series related to monetary and financial conditions, labour market conditions, foreign trade, and activity in foreign countries etc. should be analysed and new potential leading indicators may be found.

Finally, problems relating to changing cyclical behaviour, statistical problems and data availability will mean that the selected potential leading indicators used in this study will have to be monitored regularly to see if the cyclical characteristics remain stable in the future.

COMPOSITE LEADING INDICATOR AND INDUSTRIAL PRODUCTION
Percentage deviation from trend, seasonally adjusted

Chart 1: BRAZIL

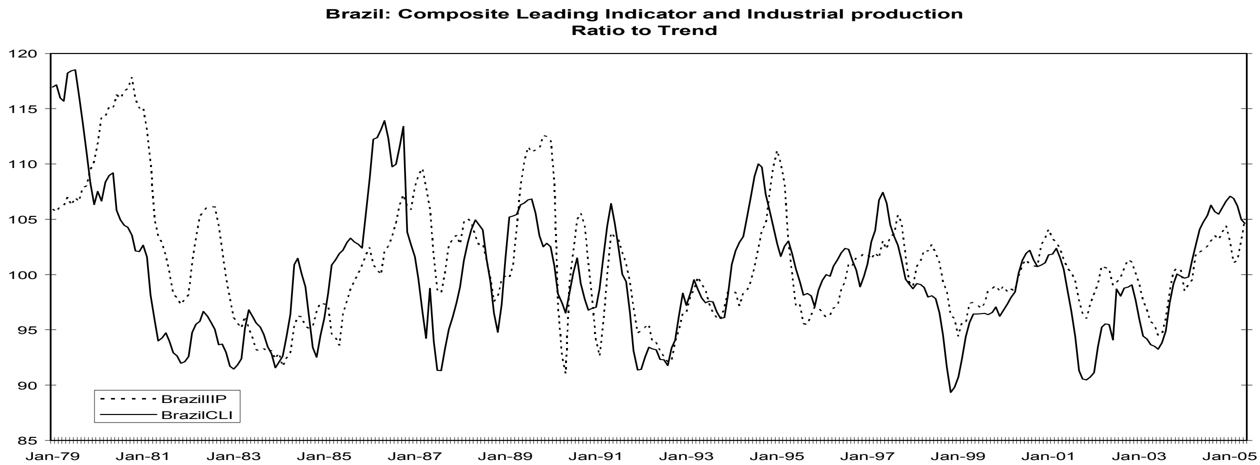


Chart 2: CHINA

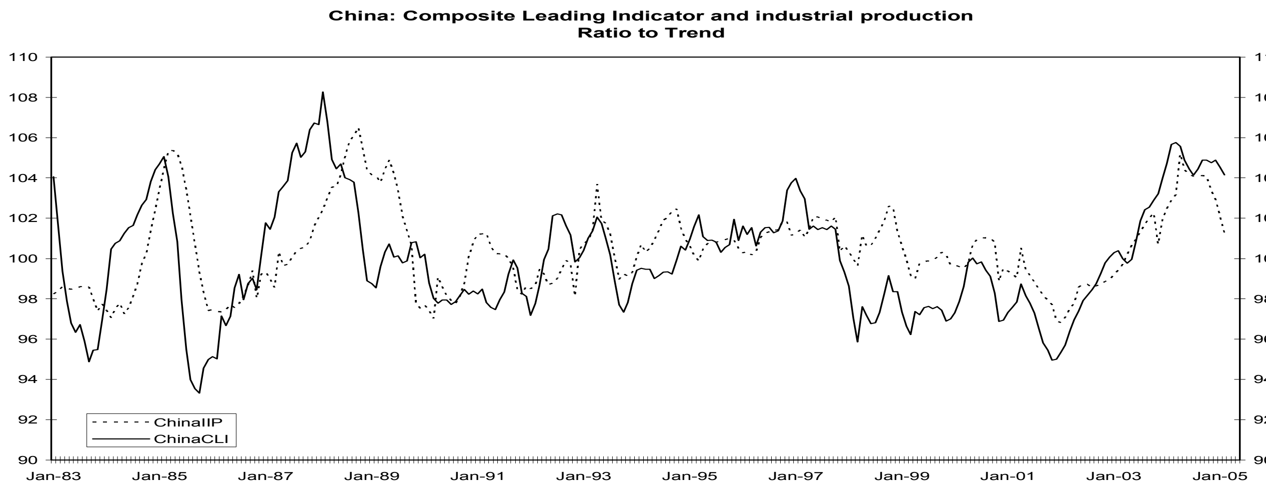
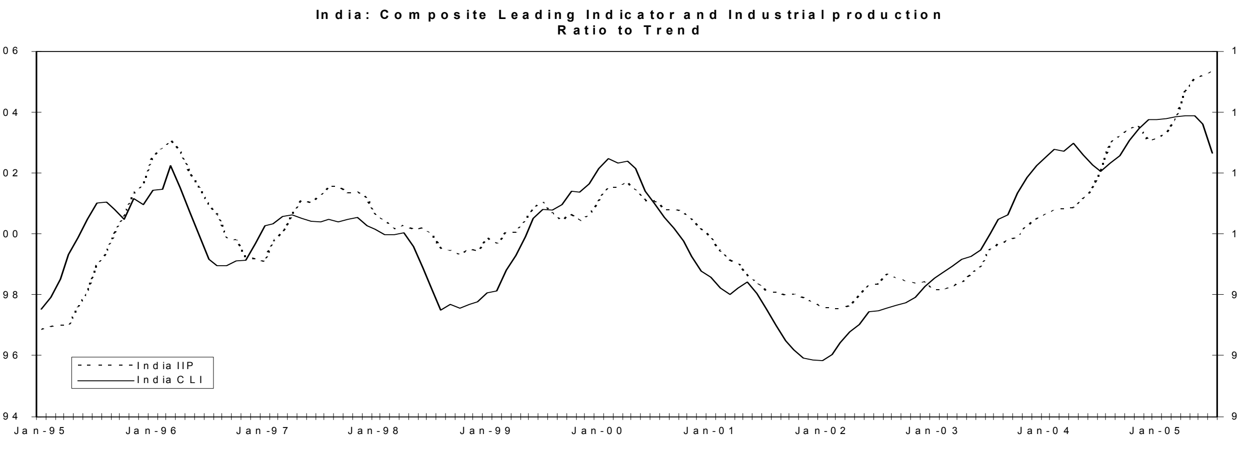


Chart 3: INDIA



COMPOSITE LEADING INDICATOR AND INDUSTRIAL PRODUCTION

Percentage deviation from trend, seasonally adjusted

Chart 4: INDONESIA

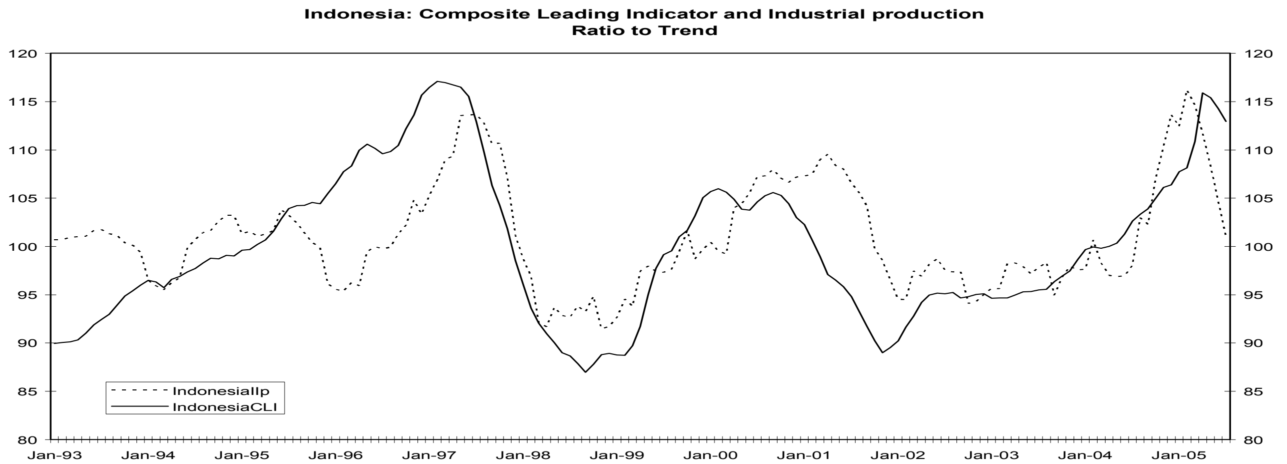


Chart 5: RUSSIA

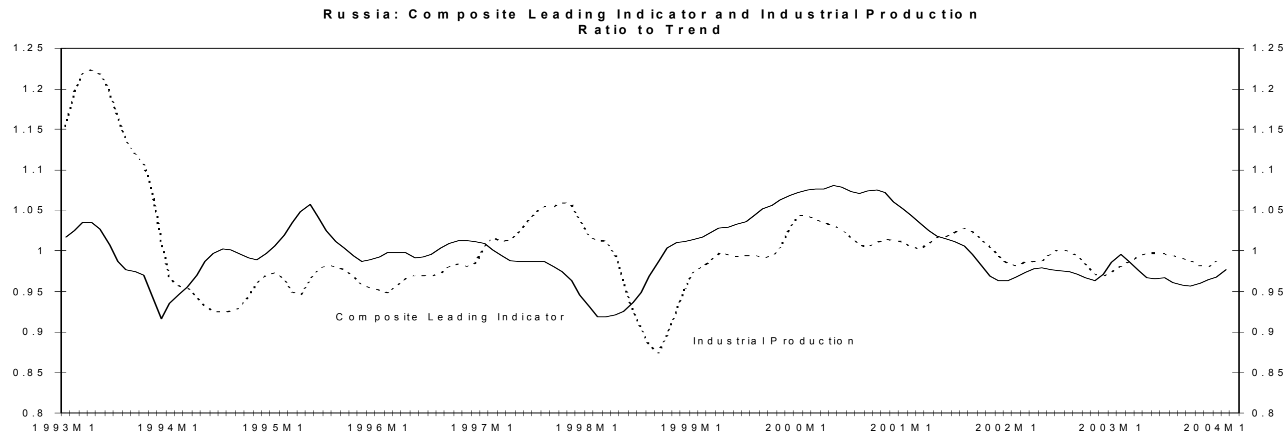
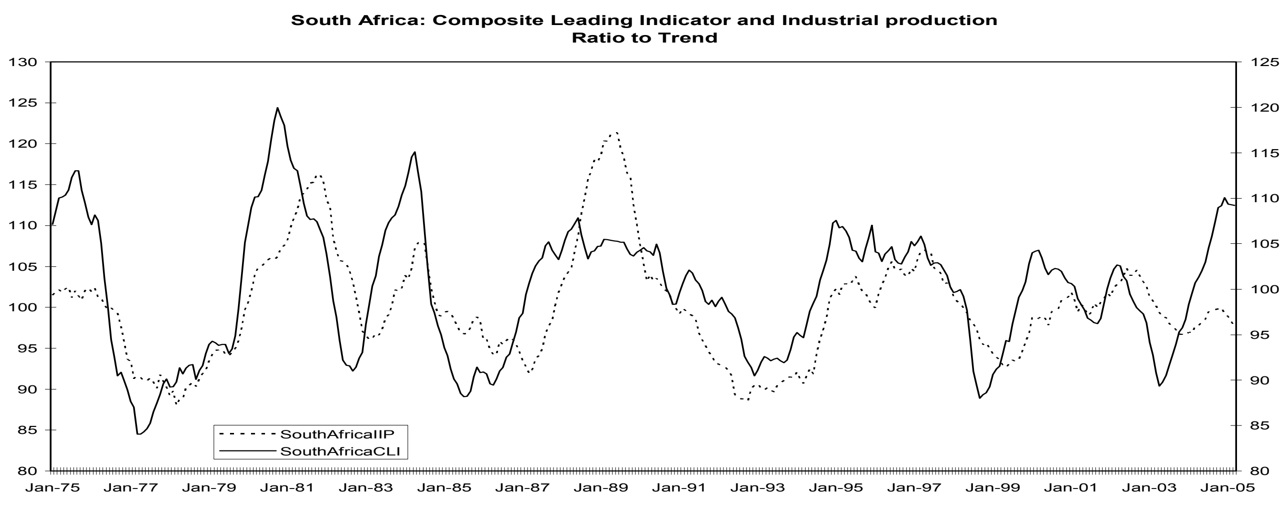


Chart 6: SOUTH AFRICA



3. REFERENCE SERIES AND GROWTH CYCLES

3.1 Reference series

The characteristics of the reference series selected for the six OECD non-member economies are set out in Table 4. The coverage of the monthly industrial production series refers to total industry excluding construction in three of the countries (China, India and Russia) and to manufacturing in Indonesia and South Africa. The industrial production series for Brazil covers mining and manufacturing. All industrial production series except the one for China are volume indices supplied by national sources. In China, a series on gross industrial output calculated from production data in value terms was available up to 1999. This series was replaced in early 1994 by a series on value added in industry in current prices. The two series are linked and recalculated by the National Bureau of Statistics in China to values in comparable prices and this series is used as the reference series for China.

Consistent time series data are only available for a long period for Brazil, China and South Africa where the data go back to 1978 and 1975. In the case of Indonesia, consistent data are available back to 1990 while time series are only available back to the mid-1990s for India and Russia. All series are used in seasonally adjusted form and the adjustment is performed by the OECD for all countries using X12-ARIMA or TRAMO-SEATS seasonal adjustment programs. Timeliness is a major problem in all countries where the latest data are available three months after the reference month.

Table 4: Reference series (Industrial production)

Country	Coverage	Type of series	Frequency	Starting date	Seasonal adjustment	Timeliness latest data available at *t*
Brazil	Mining and manufacturing	Volume index	Monthly	1978	Adjusted	t+3
China	Industry excluding construction	Values in comparable prices	Monthly	1978	Adjusted	t+3
India	Industry excluding construction	Volume index	Monthly	1995	Adjusted	t+3
Indonesia	Manufacturing	Volume index	Monthly	1990	Adjusted	t+3
Russia	Industry excluding construction	Volume index	Monthly	1993	Adjusted	t+3
South Africa	Manufacturing	Volume index	Monthly	1975	Adjusted	t+3

3.2 Growth cycles in Industrial production and GDP

Cyclical indicator systems are constructed around a "reference series" or "reference chronology". The reference series is the economic variable whose cyclical movements it is intended to predict. This makes it possible to establish the timing classification of economic series as leading, coincident or lagging with respect to some pre-determined benchmark.

The OECD uses a single economic variable as the reference series around which the indicator systems are built. Ideally, Gross Domestic Product (GDP) would be used as the reference series, but for many countries there is often a substantial time lag in the publication of GDP estimates and in any case they are usually available only on an annual or quarterly basis.

Indices of industrial production however are available on a monthly basis for most countries and industrial production constitutes the more cyclical part of the aggregate economy. In addition, the cyclical profiles of industrial production and GDP have been found to be closely related, so that cyclical indicators identified against industrial production serve well as indicators for the GDP cycle. In the OECD system, the index of total industrial production is used as the main reference series.

The cycles in GDP and industrial production for the United States, the Euro-zone and Japan are presented in Charts 7-9 to illustrate the close cyclical relationships between the two series among OECD countries. Longer time series on both GDP and industrial production are available for Brazil, Indonesia and South Africa and the cycles in the two series are compared in Charts 10-12 to determine whether similar cyclical relationships exist in developing countries as well.

The cycles presented in Charts 7 to 12 refer to “growth cycles” which are measured as deviations from the long-term trend. A contraction phase signals a decline in the rate of growth but not necessarily an absolute decline. This is distinct from “classical” business cycles, which are defined as a succession of periods of absolute growth and decline. The trend method used by the OECD system is the “phase-average-trend” method.

Having identified the reference series the next step is to identify its past cyclical behaviour. The “reference chronology”, i.e. the historical cyclical pattern consists of the dates of the turning points in the reference series. The turning point dates for industrial production and GDP for the United States, the Euro-zone and Japan are set out in Table 5 and turning point dates for the same series for Brazil, Indonesia and South Africa are presented in Table 6. The method of determining cyclical turning points used here is established by the National Bureau of Economic Research (NBER) in the United States, in which the selection of a turning point must meet the following criteria:

- the phase duration (from peak to trough or trough to peak) must be at least 5 months;
- the cycle duration (from either peak to peak or trough to trough) must be at least 15 months;
- in the case of a flat turning point zone or a double peak or trough in the turning point zone, the most recent value is selected as the turning point;
- extreme values are ignored if their effect is brief and fully reversed.

The above rules for determining turning points in a single series or a composite index series for establishing a reference chronology have been formalised and incorporated in a computerised routine (Bry and Boschan). The turning point dates shown in Table 5 and Table 6 have been identified by this routine which is part of the phase-average-trend computer program.

The results shown in Table 5 confirm the close relationships between GDP and industrial production in OECD countries and zones and that in most cases turning points in industrial production are located in the same quarter as corresponding turning points in GDP.

The relationship between industrial production and GDP for Brazil, Indonesia and South Africa are presented in Table 6. The results for Brazil show the same close relationship between GDP and industrial production as in OECD countries. This may partly be explained by the fact that data by sectors for Brazil show a relative low share of agriculture as a percentage of GDP compared to the other developing countries with a share of 6 per cent respectively in 2003 (see Table 7). In addition, Brazil also registers the highest share of the service sector compared to the other developing countries, being about the same level as in OECD countries. In the case of Indonesia, the share of agriculture as a percentage of GDP is about 17 per cent in 2003 compared to a little over 2 per cent in OECD countries and the share of services is about 40 per cent compared to 70 per cent in OECD countries. This may be one explanation for the difference in the relationship between GDP and industrial production registered for Indonesia with a two quarter lead of

GDP over industrial production and with more pronounced cyclical amplitudes in GDP. However, the short time period, with only one cycle identified in the GDP series for Indonesia, makes the trend estimation difficult and influences the cyclical amplitudes and the dating of cyclical turning points. This may be a more realistic explanation for the difference in the relationship between GDP and industrial production in the case of Indonesia.

CYCLES IN GDP AND INDUSTRIAL PRODUCTION
Percentage deviation from trend, seasonally adjusted

Chart 7: UNITED STATES

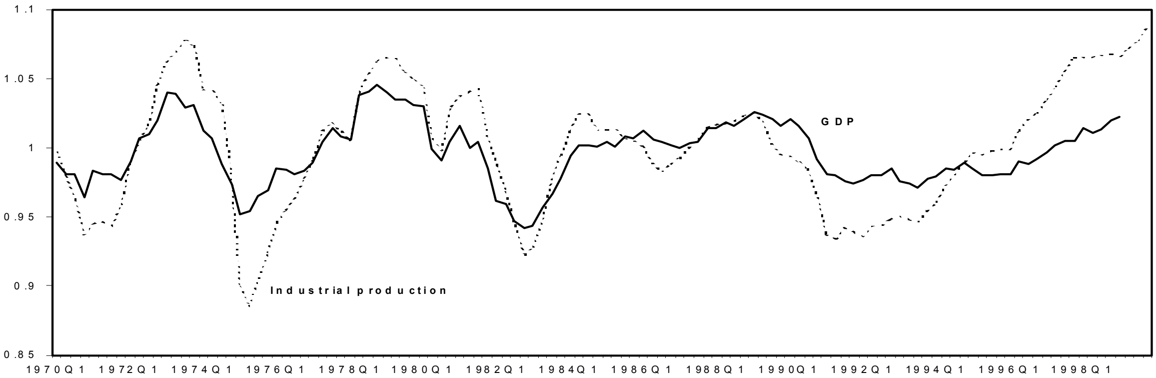


Chart 8: EURO-ZONE

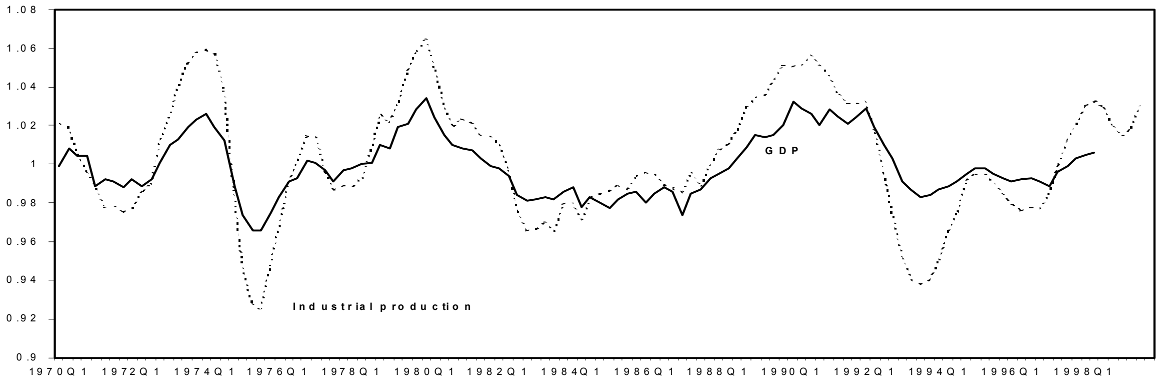


Chart 9: JAPAN

Table 5: Cyclical turning points in GDP and Industrial production in selected OECD countries and zones, 1970-2000

United States			Euro-zone			Japan		
Turning point dates			Turning point dates			Turning point dates		
GDP	Industrial production (IP)	IP Lead (-) Lag (+)	GDP	Industrial production (IP)	IP Lead (-) Lag (+)	GDP	Industrial production (IP)	IP Lead (-) Lag (+)
Peak/ Trough	Peak/ Trough	Quarters	Peak/ Trough	Peak/ Trough	Quarters	Peak/ Trough	Peak/ Trough	Quarters
4/70	11/70	0	4/71	1/72	-3	4/71	12/71	0
1/73	10/73	+3	1/73	9/73	+2	1/73	1/74	+4
1/75	3/75	0	3/75	7/75	0	1/75	3/75	0
			4/76	1/77	+1	4/75	1/77	+5
			3/77	2/78	+2	3/77	10/77	+1
4/78	5/79	+2	1/80	1/80	0	1/80	2/80	0
3/80	7/80	0					5/81	
3/81	7/81	0					10/81	
4/82	12/82	0	2/84	11/82	-5	1/83	12/82	-1
2/84	6/84	0				4/85	10/84	-4
1/87	9/86	-2				2/87	5/87	0
2/89	1/89	-1	3/90	8/90	0	1/91	10/90	-1
4/91	3/91	-3	3/93	6/93	-1	3/95	2/94	-4
						2/97	5/97	0
Median		0			0			0
Mean		-0.1			-0.4			0.1

Table 6: Cyclical turning points in GDP and Industrial production in selected developing countries

Brazil			Indonesia			South Africa		
Turning point dates			Turning point dates			Turning point dates		
GDP	Industrial production (IP)	IP Lead (-) Lag (+)	GDP	Industrial production (IP)	IP Lead (-) Lag (+)	GDP	Industrial production (IP)	IP Lead (-) Lag (+)
Peak/ Trough	Peak/ Trough	Quarters	Peak/ Trough	Peak/ Trough	Quarters	Peak/ Trough	Peak/ Trough	Quarters
						Q3/74	10/75	0
						Q4/77	03/78	3
						Q3/81	12/81	1
						Q2/83	01/83	-1
						Q1/84	06/84	1
						Q4/86	05/87	2
Q3/91	12/89	-7				Q4/88	04/89	4
Q3/92	08/92	0	Q2/93	03/94	3	Q4/92	04/93	2
Q4/94	12/94	0		04/95		Q2/94	05/95	4
Q1/96	05/95	-3		02/96		Q2/95	11/95	2
Q3/97	10/97	1	Q2/97	03/97	-1	Q2/97	04/97	0
Q1/99	12/98	-1	Q1/98	05/98	1	Q4/98	03/99	2
Q1/01	12/00	-1		02/01		Q3/00		
Q4/01	10/01	0		12/01		Q4/01		
Q4/02	11/02	0	Q3/03	05/04	3	Q2/02	04/02	0
Q2/03	06/03	0				Q3/03	12/03	1
Median		0			2			1.5
Mean		-1.0			1.5			1.5

Table 7: Shares of major sectors in GDP and Trade in goods as a percentage of GDP

Country	Agriculture		Industry Total		Industry Manufacturing		Services	
	1990	2003	1990	2003	1990	2003	1990	2003
Brazil*	8.0	6.0	39.0	21.0	25.0	13.0	53.0	73.0
China	27.0	14.6	41.6	52.3	33.0	35.0	31.3	33.1
India	31.3	22.4	27.6	26.5	17.1	15.7	41.1	51.1
Indonesia	19.4	16.6	39.1	43.6	20.7	24.7	41.5	39.9
Russia	17.0	5.0	48.0	34.0	na	na	35.0	61.0
South Africa**	5.0	4.0	40.0	31.0	24.0	19.0	55.0	65.0
OECD Area***	3.1	2.4	31.5	27.9	21.6	19.2	65.3	69.8

*Data refer to 1990 and 2002, **Data for Manufacturing refer to 1990 and 2002, *** Data refer to 1990 and 2000

Sources: Asian Development Bank, World Bank, OECD Historical Statistics

CYCLES IN GDP AND INDUSTRIAL PRODUCTION
Percentage deviation from trend, seasonally adjusted

Chart 10: BRAZIL

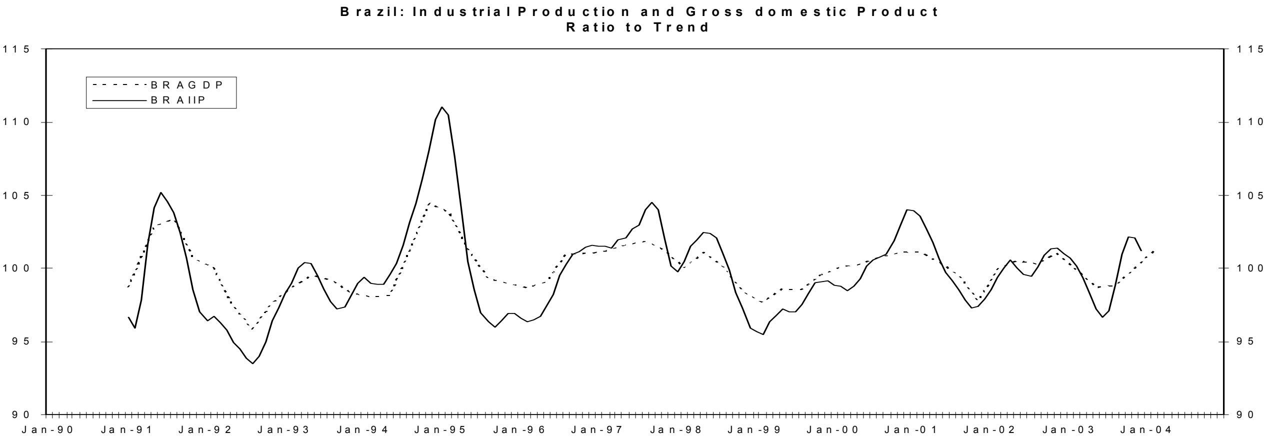


Chart 11: INDONESIA

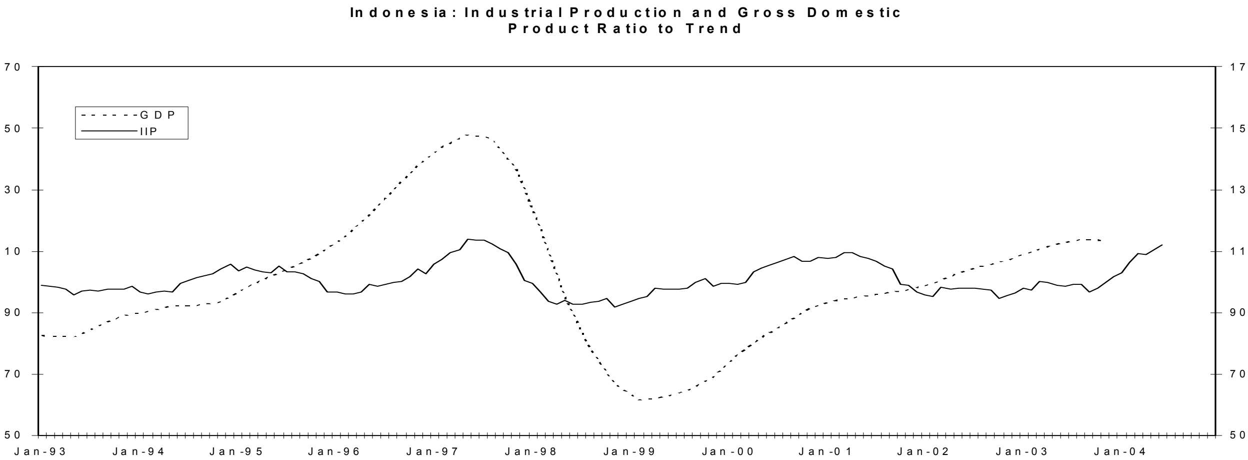
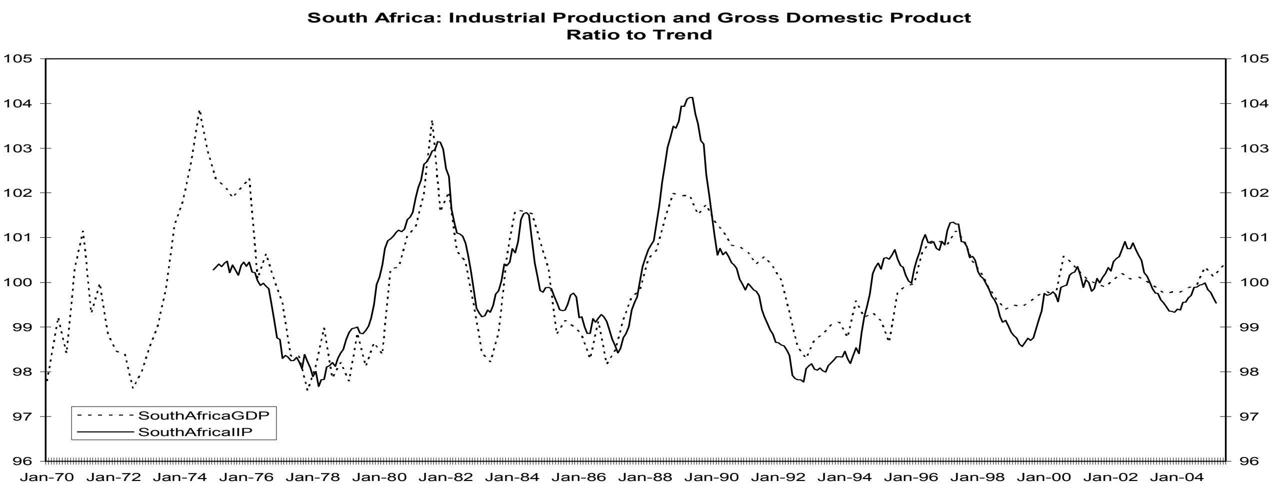


Chart 12: SOUTH AFRICA



3.3 Characteristics of growth cycles in Industrial production

The characteristics of growth cycles in industrial production for the individual countries are set out in Tables 8-13. The tables list the dates of the reference chronologies of peaks and troughs which define the beginning and end of contraction and expansion phases and cycles and give the duration of the phases and cycles in months. The tables include as well a measure of the strength of the cyclical amplitudes with the amplitude of the expansion phase (+) or the contraction phase (-) given as a percentage of trend. The amplitude measure is calculated as a percentage above trend at peak plus percentage below trend at trough taking account of the effect of irregular variation and extreme values.

Brazil

Over the period 1978 - 2004, industrial production registered seven growth cycles measured from peak to peak. The length of the cycle is not very stable with duration of as short as 17 months for the first cycle and as long as 55 and 60 months for the second and fourth cycles respectively. The average duration of the cycle is 37.3 months with an average duration of the expansion phase of 21.3 months and an average duration of the contraction phase of 16 months.

The amplitudes of the cyclical phases show very strong and rather stable cyclical movements over the whole period up to the last expansion starting in October 2001. The average amplitude of the expansion phase is 15.5 per cent and of the average amplitude of the contraction phases is – 17.2 per cent (see Chart 13 and Table 8).

The last cycle spanning close to two years from December 2000 to November 2002 was about a year shorter than average. The strength of the last expansion period was much weaker than average with an increase above trend of only 5.4 per cent.

Chart 13: BRAZIL **Growth cycles in Industrial production**

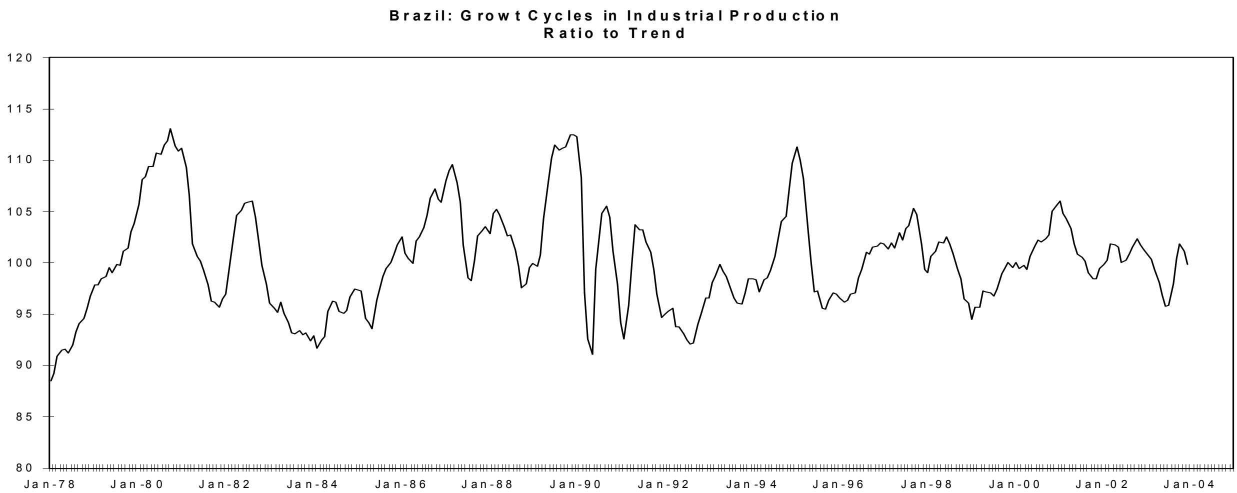


Table 8: Brazil - Characteristics of growth cycles in Industrial production, 1978-2004

Phase / cycle	Turning points (dates)			Duration (months)		Amplitude (phase)
	Peak	Trough	Peak	Phase	Cycle	% of trend
Contraction	2/1981	12/1981		10		-20.4
Expansion		12/1981	7/1982	7		12.1
Cycle No 1	2/1981		7/1982		17	
Contraction	7/1982	3/1984		20		-16.6
Expansion		3/1984	2/1987	35		23.1
Cycle No 2	7/1982		2/1987		55	
Contraction	2/1987	11/1988		21		-17.0
Expansion		11/1988	12/1989	13		18.3
Cycle No 3	2/1987		12/1989		34	
Contraction	12/1989	8/1992		32		-22.8
Expansion		8/1992	12/1994	28		21.4
Cycle No 4	12/1989		12/1994		60	
Contraction	12/1994	5/1995		5		-18.6
Expansion		5/1995	10/1997	29		12.5
Cycle No 5	12/1994		10/1997		34	
Contraction	10/1997	12/1998		14		-13.6
Expansion		12/1998	12/2000	24		15.3
Cycle No 6	10/1997		12/2000		38	
Contraction	12/2000	10/2001		10		-11.3
Expansion		10/2001	11/2002	13		5.4
Cycle No 7	12/2000		11/2002		23	
Average:						
Contraction				16.0		-17.2
Expansion				21.3		15.5
Cycle					37.3	

China

The characteristics of growth cycles as measured by gross industrial output over the period 1978 to 1994 and by industrial value added over the period 1995-2004 are presented in Table 9. The linked industrial output series in value terms is recalculated to constant prices of 1995.

Over the period 1978-2004, industrial output registered eight growth cycles measured from trough to trough. The length of the cycle is not very stable with duration as short as 25 and 19 months for the first and second cycles respectively and as long as 54 and 49 months for the fourth and seventh cycles respectively. The average duration of the cycle is 35 months with an average duration of the expansion phase of 21 months and an average duration of the contraction phase of 13 months.

The amplitudes of the cyclical phases show rather strong cyclical movements over the period up to 1990. The strength of the amplitudes show a tendency to decrease over time during this period: the expansion phase 1979-1980 registers an increase above trend of about 16 per cent and the contraction phase 1988-1990 registers a fall below trend of about 10 per cent.

The three cycles registered over the period 1990 to 2004 show much weaker cyclical amplitudes over both contraction and expansion phases compared to the period before 1990. The average amplitudes of both the expansion and contraction phases over the whole period 1978-2004 are about +/- 9 per cent compared to about +/- 6 per cent over the last three cycles (see Chart 14 and Table 9).

Chart 14: CHINA **Growth cycles in Industrial production**

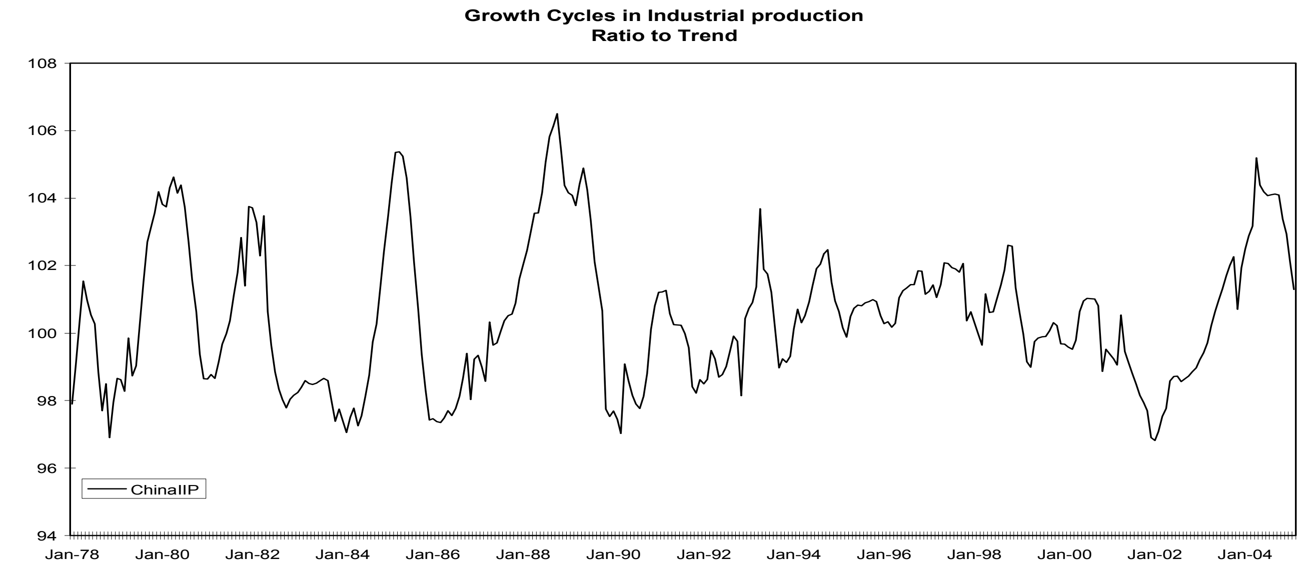


Table 9: China - Characteristics of growth cycles in Industrial production, 1978-2004

Phase / cycle	Turning points (dates)			Duration (months)		Amplitude (phase)
	Trough	Peak	Trough	Phase	Cycle	% of trend
Expansion	1/1979	2/1980		13		16.2
Slowdown		2/1980	2/1981	12		-9.6
Cycle No 1	1/1979		2/1981		25	
Expansion	2/1981	2/1982		12		15.6
Slowdown		2/1982	9/1982	7		-15.4
Cycle No 2	2/1981		9/1982		19	
Expansion	9/1982	4/1985		31		8.9
Slowdown		4/1985	2/1986	10		-10.2
Cycle No 3	9/1982		2/1986		41	
Expansion	2/1986	9/1988		31		11.2
Slowdown		9/1988	8/1990	23		-10.4
Cycle No 4	2/1986		8/1990		54	
Expansion	8/1990	1/1991		5		6.6
Slowdown		1/1991	12/1991	11		-10.2
Cycle No 5	8/1990		12/1991		16	
Expansion	12/1991	10/1994		34		8.9
Slowdown		10/1994	1/1995	3		-4.8
Cycle No 6	12/1991		1/1995		37	
Expansion	1/1995	5/1997		28		4.9
Slowdown		5/1997	2/1999	21		-6.3
Cycle No 7	1/1995		2/1999		49	
Expansion	2/1999	7/2000		17		5.5
Slowdown		7/2000	2/2002	19		-7.1
Cycle No 8	2/1999		2/2002		36	
Average:						
Expansion				21.4		9.7
Slowdown				13.3		-9.3
Cycle					34.7	

India

Industrial production registered seven growth cycles measured from trough to trough over the period 1978 - 2004. The length of the cycle is not very stable with duration as short as 23 months for the third and sixth cycles respectively and as long as 60 months for the fourth cycle. The average duration of the cycle is 38 months with an average duration of the expansion phase of 20 months and an average duration of the contraction phase of 18 months.

The amplitudes of the cyclical phases show very different cyclical movements over the entire period investigated. The expansion phase 1983-1984 registers an increase above trend of about 7 per cent and the contraction phase 1984-1986 registers a fall below trend of about 5 per cent. In contrast, the expansion phase 1988-1990 shows an increase above trend of over 22 per cent while the contraction phase 1990-1993 shows a fall below trend of 24 per cent (see Chart 15 and Table 10).

The strength of the cyclical phases over the last two growth cycles spanning the period 1996-2004 were much weaker than average with an increase or fall above or below trend of only about +/- 5 per cent compared to an average of about +/- 10 per cent for the whole period 1978-2004.

Chart 15: INDIA **Growth cycles in Industrial production**

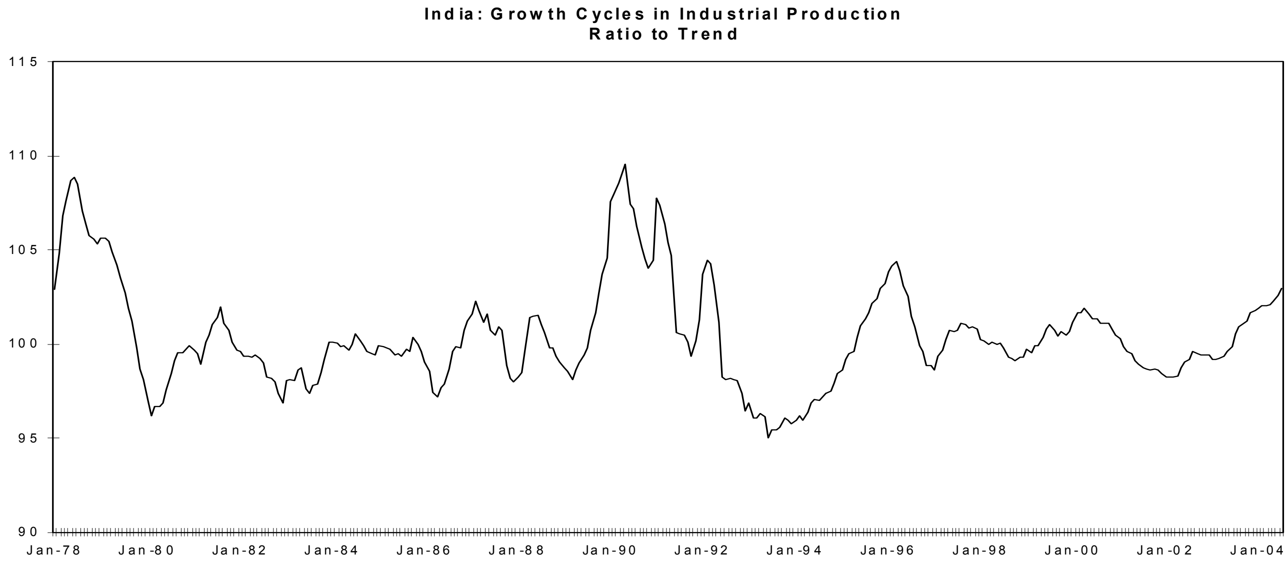


Table 10: India - Characteristics of growth cycles in Industrial production, 1978-2004

Phase / cycle	Turning points (dates)			Duration (months)		Amplitude (phase)
	Trough	Peak	Trough	Phase	Cycle	% of trend
Expansion	12/1979	6/1981		18		10.9
Contraction		6/1981	1/1983	19		-10.5
Cycle No 1	12/1979		1/1983		37	
Expansion	1/1983	2/1984		13		7.0
Contraction		2/1984	2/1986	24		-5.4
Cycle No 2	1/1983		2/1986		37	
Expansion	2/1986	7/1987		17		9.0
Contraction		7/1987	1/1988	6		-10.1
Cycle No 3	2/1986		1/1988		23	
Expansion	1/1988	3/1990		26		21.8
Contraction		3/1990	1/1993	34		-24.0
Cycle No 4	1/1988		1/1993		60	
Expansion	1/1993	2/1996		37		11.2
Contraction		2/1996	11/1996	9		-7.8
Cycle No 5	1/1993		11/1996		46	
Expansion	11/1996	10/1997		11		5.3
Contraction		10/1997	10/1998	12		-5.2
Cycle No 6	11/1996		10/1998		23	
Expansion	10/1998	3/2000		17		5.4
Contraction		3/2000	2/2002	23		-4.8
Cycle No 7	10/1998		2/2002		40	
Average:						
Expansion				19.9		10.1
Contraction				18.1		-9.7
Cycle					38.0	

Indonesia

Industrial production registered three growth cycles measured from trough to trough over the period 1993 - 2004. The length of the cycle is rather stable over the first two cycles with a duration of 23 and 27 months respectively but almost double in length (47 months) for the third cycle. The average duration of the cycle is 31 months with an average duration of the expansion phase of 20 months and an average duration in the contraction phase of 11 months.

The amplitudes of the cyclical phases show very strong cyclical movements with an average increase above trend of 26 per cent over expansion phases and an average fall below trend of about 27 per cent over contraction phases. The Asian financial crisis which hit Indonesia in 1997 did not effect the contraction phase over the period 1997-1998 to any great extent with a fall below trend of 27 per cent which corresponds to the average over the last three contractions. (see Chart 16 and Table 11).

Chart 16: I INDONESIA Growth cycles in Industrial production

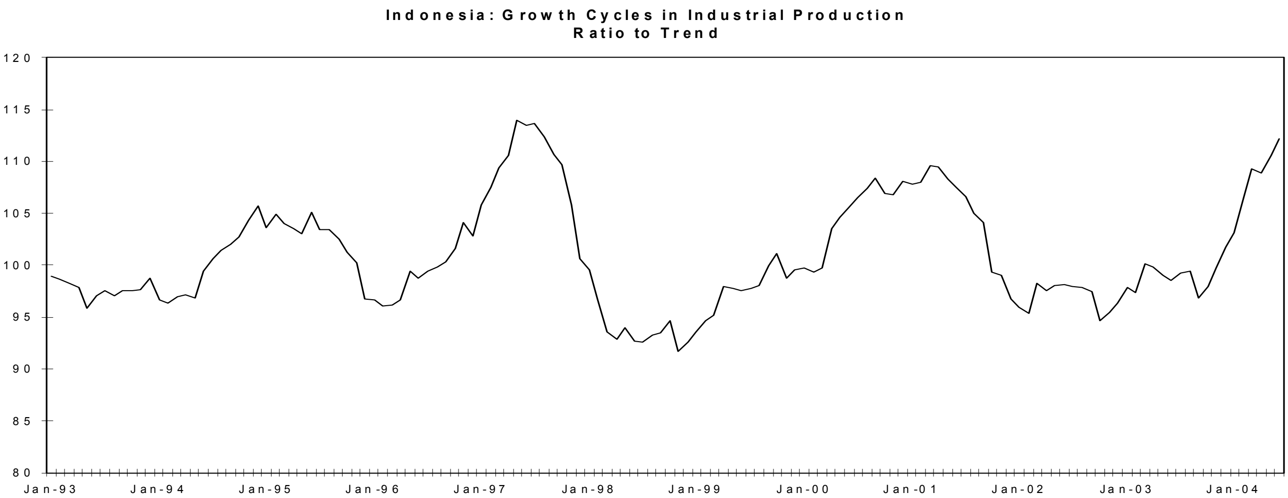


Table 11: Indonesia - Characteristics of growth cycles in Industrial production, 1990- 2004

Phase / cycle	Turning points (dates)			Duration (months)		Amplitude (phase)
	Trough	Peak	Trough	Phase	Cycle	% of trend
Expansion	3/1994	4/1995		13		22.4
Contraction		4/1995	2/1996	10		-25.8
Cycle No 1	3/1994		2/1996		23	
Expansion	2/1996	3/1997		13		33.5
Contraction		3/1997	5/1998	14		-26.7
Cycle No 2	2/1996		5/1998		27	
Expansion	5/1998	2/2001		33		23.0
Contraction		2/2001	12/2001	10		-30.1
Cycle No 3	5/1998		12/2001		43	
Average:						
Expansion				19.7		26.3
Contraction				11.3		-27.5
Cycle					31.0	

Russian Federation

Industrial production registered two growth cycles measured from trough to trough over the period 1993 - 2004. The length of the cycle is very stable over the two cycles with duration of around 50 months for each cycle. The average duration of the expansion phase is 28 months and the average duration of the contraction phase is 22 months.

The amplitudes of the cyclical phases show rather strong cyclical movements over the contraction period 1997-1998 where a decrease below trend of about 20 per cent is registered and with an increase above trend of 19 per cent in the following expansion period 1998-2000. The average amplitudes of contraction and expansion phases is about +/- 15 per cent (see Chart 17 and Table 12).

Chart 17: RUSSIA Growth cycles in Industrial production

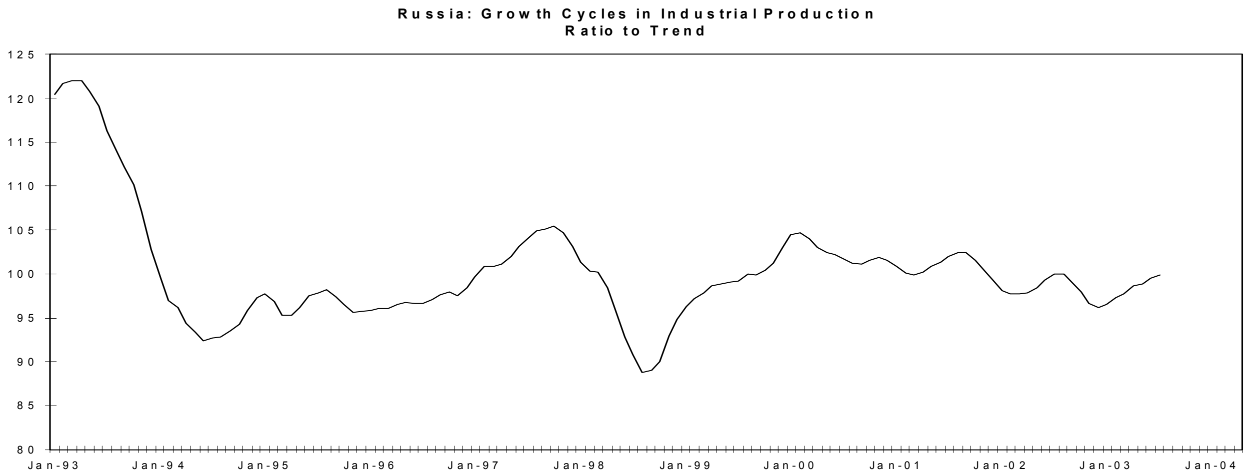


Table 12: Russia - Characteristics of growth cycles in Industrial production, 1993-2004

Phase / cycle	Turning points (dates)			Duration (months)		Amplitude (phase)
	Trough	Peak	Trough	Phase	Cycle	% of trend
Expansion	7/1994	11/1997		40		14.1
Contraction		11/1997	9/1998	10		-19.5
Cycle No 1	7/1994		9/1998		50	
Expansion	9/1998	2/2000		17		18.9
Contraction		2/2000	12/2002	34		-9.8
Cycle No 2	9/1998		12/2002		51	
Average:						
Expansion				28.5		16.5
Contraction				22.0		-14.6
Cycle					50.5	

South Africa

Industrial production registered six growth cycles measured from peak to peak over the period 1975 - 2004. The length of the cycle is rather long and not very stable over the six cycles with a duration of 74 and 73 months for the first and fourth cycles respectively and as short as 23 months for the fifth cycle. The average duration of the cycle is 53 months with an average duration of the expansion phase of 27 months and an average duration of the contraction phase of 26 months.

The amplitudes of the cyclical phases show very strong cyclical movements over the period up to 1995. The expansion phase 1978-1981 registers an increase above trend of about 38 per cent and the contraction phase 1989-1993 registers a fall below trend of about 38 per cent as well.

The two cycles registered over the period 1995 to 2004 show much weaker cyclical amplitudes over both contraction and expansion phases compared to the period before 1995. The average amplitudes of both the expansion and contraction phases over the whole period 1978-2004 are about +/- 23 per cent compared to about +/- 15 per cent over the last two cycles (see Chart 18 and Table 13).

Chart 18: SOUTH AFRICA Growth cycles in Industrial production

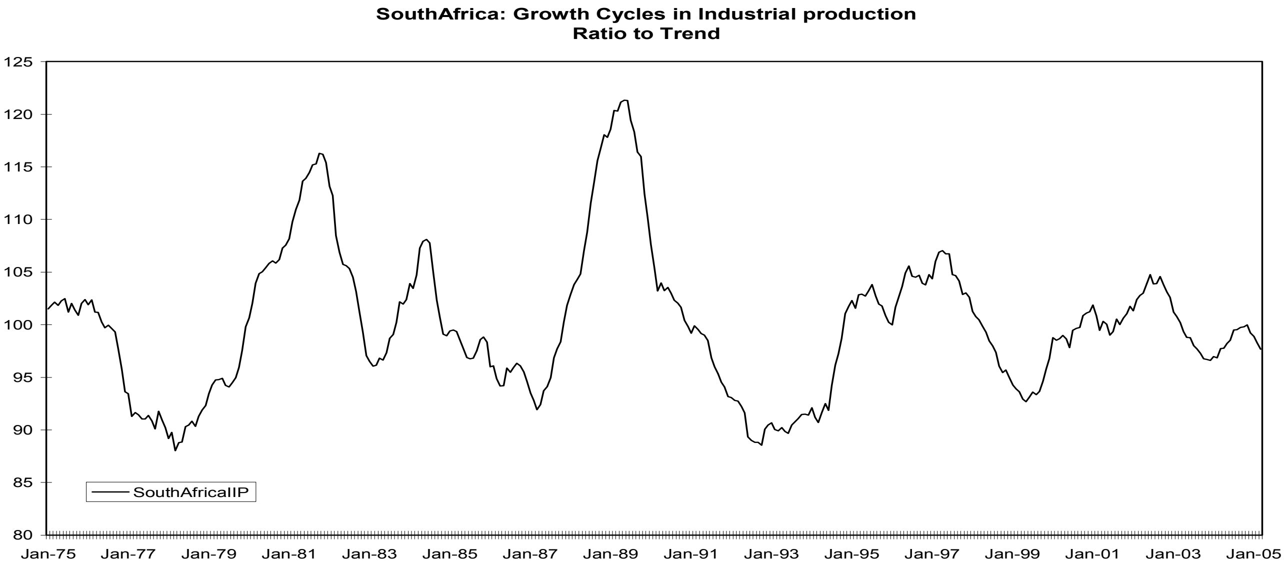


Table 13: South Africa - Characteristics of growth cycles in Industrial production, 1975-2004

Phase / cycle	Turning points (dates)			Duration (months)		Amplitude (phase)
	Peak	Trough	Peak	Phase	Cycle	% of trend
Slowdown	10/1975	3/1978		29		-21.2
Expansion		3/1978	12/1981	45		37.5
Cycle No 1	10/1975		12/1981		74	
Slowdown	12/1981	1/1983		13		-27.3
Expansion		1/1983	6/1984	17		16.8
Cycle No 2	12/1981		6/1984		30	
Slowdown	6/1984	5/1987		35		-21.4
Expansion		5/1987	4/1989	23		34.9
Cycle No 3	6/1984		4/1989		58	
Slowdown	4/1989	4/1993		48		-38.4
Expansion		4/1993	5/1995	25		21.4
Cycle No 4	4/1989		5/1995		73	
Slowdown	5/1995	11/1995		6		-9.7
Expansion		11/1995	4/1997	17		14.8
Cycle No 5	5/1995		4/1997		23	
Slowdown	4/1997	3/1999		23		-22.1
Expansion		3/1999	4/2002	37		15.9
Cycle No 6	4/1997		4/2002		60	
Average:						
Slowdown				25.7		-23.3
Expansion				27.3		23.5
Cycle					53.0	

4. SELECTION OF INDICATORS

4.1 Data sources and pre-selection of indicators

The OECD's Main Economic Indicators (MEI) database is used as the main source for the selection of potential cyclical indicators for a country. The database covers macroeconomic indicators for the following major subject areas: (1) industrial production, (2) selected commodity output variables (crude steel, crude petroleum etc.), (3) business and consumer tendency survey series, (4) selected manufacturing variables (deliveries, stocks, new orders etc.), (5) construction, (6) domestic trade, (7) labour market series, (8) consumer and producer prices, (9) money aggregates, (10) interest rates, (11) financial variables, (12) exchange rates, (13) international trade and (14) balance of payments data.

The coverage of potential cyclical indicators for the major OECD non-member economies included in the MEI database is however not broad enough to obtain a reasonable number of leading indicators for each country in order to calculate a composite indicator. National data sources as well as international databanks have supplemented the MEI database as sources for the selection of potential cyclical indicators.

A pre-selection of potential indicators was conducted on the basis of the following criteria:

Relevance

- economic significance -- there has to be an economic reason for the observed leading relationship before the series can be accepted as an indicator;
- breadth of coverage -- series with a wide coverage, in terms of the representation of the economic activity concerned, are preferred to narrowly-defined series;

Practical considerations

- frequency of publication -- monthly series are preferred to quarterly series;
- absence of excessive revisions;
- timeliness of publication and easy accessibility for data collection and updating;
- availability of a long time series of the data with no breaks.

In addition to above criteria, potential indicators were selected from as many as possible of the subject areas outlined above in this Section to obtain a good representation of overall economic activity. In the final selection, an attempt was made to obtain a fair balance of indicators from the different subject areas in order to avoid overweighting a particular economic sector. Applying the above criteria, between 40 and 60 monthly and quarterly indicators from all subject areas were selected for each country.

5. EVALUATION OF INDICATORS

The pre-selected candidate indicators series were evaluated for their cyclical performance with a set of statistical methods including both classical descriptive and univariat methods based on the NBER approach and multivariate methods such as dynamic factor models.

5.1 Turning point analysis

The performance of cyclical indicators can be evaluated a number of ways. One is to examine the behaviour of the indicators in relation to the cyclical turning points of the reference series, i.e. peak-and-trough analysis. Forecasting turning points is one of the main objectives of the cyclical indicator technique as predicting the timing of cyclical turning points is one of the least reliable activities in economic forecasting.

For peak-and-trough analysis, statistics are assembled on each series' behaviour at cyclical turning points. This includes: the mean or median leads, the mean deviation from the median and the number of extra or missing cycles when compared to the reference series. Generally, these figures are not statistically significant in the usual sense due to the limited number of turning points available over the period investigated and because most series contain irregular movements and double or multiple peaks and troughs. The median, rather than the mean, is usually used in this kind of analysis because of the relatively small number of observations. However, peak-and-trough analysis involves a substantial amount of judgement which may alter the measures significantly.

5.2 Cross-correlation

Cross-correlation analysis is used to complement the peak-and-trough analysis concerning the average lead of the indicator, and to give information about the extent to which the cyclical profiles of indicator and reference series resemble each other. This is important if the cyclical indicators are to give information about the likely rate and amplitude of movements in the reference series. Thus, it is also useful to examine the "general fit" of the indicators in relation to the reference series at all stages of the cycle.

In testing the general fit, cross-correlation between lagged smoothed cyclical indicators and reference series is used. The number of months lag at which the correlation has the highest value is a guide to the average lead of the indicator over the reference series and the correlation coefficient shows the extent to which the cyclical profiles of composite indicators resemble each other. There are limitations to this method however. First, it is a measure only of the linear relationship between variables, and second, the presence of extreme values can affect the estimate of the cross-correlation coefficient.

The average lead of the cyclical indicator, as measured by the lag at which the closest correlation occurs, should not be too different from the median lag at all turning points if the composite indicator is to give reliable information both about approaching turning points as well as the evolution of the reference series.

5.3 Coherence and mean delay

Cross spectral analysis decomposes a time series into a series of frequencies representing fixed-length cycles and is used here to assess the strength of the wavelength relationship between the indicator and the reference series. To determine the lead or lag of the indicator against the reference series, two statistics are used: coherence and mean delay. Coherence measures the proportion of variance explained by the indicator at a given frequency of the reference series. Mean delay measures the time difference between the indicator and the reference series.

For business cycle analysis, the periodicity range of 1.5 to 8 years is of primary interest, so high coherence within this period is evidence that the indicator contains information related to the cyclical behaviour of the reference series. The coherence measure can take values between 0 and 1. Mean delay is measured in radians but is converted into a time-oriented measure to give the timing difference between the indicator and the reference series. However, the leads and lags measured by the mean delay in cross spectral analysis will rarely provide direct estimates of the time domain relationships except under specific assumptions. This means that care should be exercised in interpreting these statistics and that cross-spectral analysis should be used to verify and supplement other cyclical measures.

5.4 Dynamic factor analysis

Factor models are used to extract the common information from a set of variables or indicators which is then used for the construction of a composite indicator. The common component of each indicator is estimated by eliminating the idiosyncratic noise or short-term irregularities affecting each indicator. In dynamic factor models, the cyclical timing classification of the indicators with respect to the reference series is a by-product of the decomposition procedure. The following measures are used for identification and selection of indicators to be considered for further analysis and included in different types of composite indicators.

The ratio of the common component variance over the indicators variance is used to analyse the degree of co-movement or commonality among the indicators. A high ratio (close to 1) means strong commonality while indicators that are almost independent will have a low ratio. Indicators with a ratio below 0.3 are considered as almost idiosyncratic and would not qualify as good cyclical indicators.

The cross-correlation between the common component of each indicator and the common component of the reference series is used to identify indicators with good cyclical properties and to classify indicators as leading, coincident and lagging in relation to the reference series. High correlations at positive (negative) lags indicate a leading (lagging) behaviour of the indicator with respect to the reference series. Indicators with the highest correlation at zero lag are classified as coincident with respect to the reference series.

An alternative cyclical timing classification of the indicators is based on the common parts with respect to that of the reference series and is performed by calculating the mean delays from the first row of the common components spectral density matrix. The automatic classification is based on the following rules: if mean delay is between -1 and 1, then the indicator is classified as coincident and if mean delay is higher than 1 (-1), then the indicator is leading (lagging) by more than one period.

5.5 Evaluation results for pre-selected indicators

In order to reduce the number of indicators a selection is performed on the results of a screening procedure based on the one practical consideration and seven criteria related to the cyclical performance of the indicators according to the statistical methods outlined above. Indicators are included in the final set of analysed indicators if they are accepted on more than four of the following eight criteria:

1. Frequency:	monthly indicators are accepted
2. Coherence	indicators with values above 0.30 are accepted
3. Mean delay:	indicators classified as leading and coincident are accepted
4. Cross-correlation:	indicators with a correlation coefficient (r max) above 0.50 and at peak-correlation leads (t max) above 2 periods are accepted

5.	Turning point analysis:	indicators with a median leads above 2 periods at cyclical turning points are accepted
6.	Common component variance:	indicators with ratio values above 0.30 of common component variance over indicator variance are accepted
7.	Common component cross	correlation: indicators with a correlation coefficient above 0.50 and peak-correlation at positive (leading behaviour) or zero lags are accepted
8.	Cyclical classification:	indicators classified as coincident or leading are accepted

The evaluation results are presented in Annex 1 for the 20-30 indicators analysed for each country and the best leading indicators were selected in each country on the basis of the empirical results. A final set of 10-15 leading indicators was used to construct alternative CLIs for each country. The cyclical characteristics of the final set of leading indicators for each country are presented in Section 6.1 below.

The results of the screening process of the cyclical characteristics of the analysed indicators show the difficulty in identifying and classifying individual indicators by timing as leading, coincident or lagging against a reference series representing overall economic activity. In this exercise industrial production is used as the reference series. The different methods do not always give the same cyclical timing classification. This is illustrated in Tables, 14 and 15 where one criterion from each method is used to classify the indicators by timing. The different measures used for the classification are mean delay (cross spectral analysis) median lead at turning points (NBER analysis) and cross correlation between common components (dynamic factor analysis).

The cyclical timing classification of the 148 indicators evaluated by country is set out in Table 14. The two measures used from spectral analysis and dynamic factor analysis classify 78 and 61 per cent of the indicators respectively as coincident indicators across all countries. On the other hand, 59 per cent of the indicators are classified as leading indicators according to the NBER measure (median lead at all turning points). This underscores the difficulty in obtaining a consistent timing classification of the indicators from the different methods.

The timing classification across individual countries is even more inconsistent according to the different measures. For China and South Africa, 88 and 77 per cent of the indicators respectively are classified as coincident indicators according to the mean delay and 100 and 88 percent of the indicators respectively for the two countries are classified as coincident indicators with the measure used from the dynamic factor analysis. However, over 65 per cent of the indicators in Brazil, Russia and South Africa are classified as leading indicators according to the median lead at all turning points.

The classification of the indicators by subject areas is set out in Table 15, which uses a breakdown by subject in four categories:

- tendency surveys (business and consumer surveys);
- real indicators (production, stocks, order, construction, sales, transport, labour and prices);
- external indicators (foreign trade and activity in foreign countries);
- financial indicators (monetary and financial).

The results by subject show that tendency surveys are classified as good leading indicators by all measures; 72 per cent according to the median lead measure and over 50 per cent according to the mean delay and dynamic factor measure respectively. On the other hand, only 13 per cent of the real indicators are classified as leading by the mean delay and dynamic factor analysis measure. External and financial indicators are classified as leading in about 25 per cent of the cases according to the mean delay while the dynamic factor measure classify 27 and 14 per cent of the indicators as leading for the same subjects.

Table 14: Cyclical behaviour of evaluated indicators by country

Country	Number of indicators tested	Cross Spectral Analysis (1)			NBER Analysis (2)			Dynamic Factor Analysis (3)		
		Leading %	Coincident %	Lagging %	Leading %	Coincident %	Lagging %	Leading %	Coincident %	Lagging %
Brazil	21	42.8	52.4	4.8	66.7	9.5	23.8	23.8	76.8	0.0
China	26	7.7	88.5	2.8	50.0	38.5	11.5	0.0	100.0	0.0
India	30	10.0	43.3	46.7	43.3	50.0	6.7	10.0	76.7	13.3
Indonesia	23	17.4	52.2	30.4	56.5	26.1	17.4	30.4	56.5	13.1
Russia	22	50.0	50.0	0.0	72.7	27.3	0.0	27.3	63.6	9.1
South Africa	26	11.5	77.0	11.5	69.2	23.1	7.7	7.7	88.5	3.8
Total	148	21.6	60.8	17.6	58.8	30.4	10.8	15.5	77.7	6.8

(1) Mean delay
(2) Median lead/lag at turning points
(3) Cross correlation between common components

Table 15: Cyclical behaviour of evaluated indicators by subject area

Subject Area	Number of indicators tested	Cross Spectral Analysis (1)			NBER Analysis (2)			Dynamic Factor Analysis (3)		
		Leading %	Coincident %	Lagging %	Leading %	Coincident %	Lagging %	Leading %	Coincident %	Lagging %
Tendency Surveys	50	26.0	68.0	6.0	72.0	22.0	6.0	10.0	84.0	6.0
Real	37	13.5	59.5	27.0	54.0	32.4	13.5	13.5	81.1	5.4
External	33	24.2	54.6	21.2	57.6	30.3	12.1	27.3	66.7	6.0
Financial	28	25.0	57.1	17.9	57.1	28.6	14.3	14.3	78.6	7.1

(1) Mean delay
(2) Median lead/lag at turning points
(3) Cross correlation between common components

6. COMPOSITE LEADING INDICATORS

The final set of analysed indicators which scored best on the evaluation criteria were used as potential component series for the construction of alternative composite leading indicators for each country. For the final selection of CLI components a more thorough analysis was conducted where each indicators' **behaviour at cyclical peaks and troughs** were evaluated. The measures used in this analysis focused on:

- median lead;
- standard deviation at turning points; and
- the number of extra and missing cycles when compared to the reference series.

In addition to the above turning point analysis of the indicators (see Tables 16-21), special attention was also given to practical issues such as frequency and timeliness. These issues are very important for the calculation of the CLI on a regular monthly basis. Smoothness is a further important issue for the final selection of CLI components. Irregular series with a high MCD/QCD value have to be smoothed and this will imply revisions to the series when new data becomes available.

The **timeliness** of the latest data available for the component series and the CLIs is set out in Tables 16-21 for each country. The timeliness criteria used here refers to the ability of the component indicator to meet the publication deadline for the Main Economic Indicators publication. CLI data for a given month "t" is published at the beginning of month "t+2" This implies that component series available at this date would fulfill the timeliness criteria. This is a particular problem for series with a quarterly frequency, but also for some of the monthly component series.

The **frequency** of the tendency survey series included as components in the CLIs for most countries is quarterly. This means that the delay for timely data is two months (indicated as t+4 in Table 1). This is in particular a problem for the construction of CLIs in countries where tendency survey series are among the best leading indicators.

Smoothness is another important characteristic for the selection of leading indicators. The months/quarters for cyclical dominance MCD/QCD value (range of 1-6 for monthly data and 1-2 for quarterly data) gives an idea of the smoothness of the series. Indicators with small MCD values are preferred in order to minimize the length of the moving average when performing smoothing. Monthly component series with MCD values of 5 or 6 are very irregular and will imply revisions to the series when new data becomes available (see Tables 16-21).

The component series in a detrended form (see Section 7 for detrending methods) are aggregated into one single composite indicator. A number of steps are involved in combining individual indicators to obtain the composite indicator. These entail:

- **Periodicity**. Composite leading indicators (CLI) are calculated with a monthly periodicity. It is therefore necessary to convert quarterly component series to a monthly series. This is done using linear interpolation.
- **Smoothing**. In order to reduce the irregularity of the final composite leading indicator (CLI), component series are smoothed according to the Month for Cyclical Dominance (MCD) value.

- **Normalisation.** All component series are normalised in order to express the cyclical movements in a comparable form (for multiplicative or additive model when estimating the trend) and to homogenise their cyclical amplitude.

- **Weighting**. For each country, component series have an equal weight when aggregated into the composite leading indicator (CLI).

6.1 Characteristics of components and composite leading indicators

6.1.1 Brazil

Components

The best performing CLI for Brazil at present contains eight leading indicators including two quarterly indicators from the business tendency survey carried out by the Fondation Vargas in Rio de Janeiro, available since 1978. The quarterly frequency of the survey series is a problem for the timeliness of the CLI which means that two of the components will not be updated every month which in turn will result in revisions to the CLI once a quarter. On the other hand, these business tendency survey series show very stable but short leads at cyclical turning points although they produce some extra cycles due to their sensitive cyclical nature. This is illustrated in Chart 19 which shows the survey series on finished goods stocks in inverted form and industrial production.

Three leading indicators show extremely long but unstable leads and rather weak correlation with the reference series: spong iron production, production of semi- non-durable goods and export volume. However, all of these indicators are available on a monthly basis with a good timeliness which means that they are indispensable for the calculation of a timely CLI (see Table 16).

Composite Leading Indicator

The record of the CLI at predicting turning points and reproducing amplitudes of cycles has been rather good over the period since 1979, over which it is calculated. The average lead is three to four months according to the median and mean measures respectively which are calculated over the seven cycles registered over the period 1979-2004.

The CLI missed one cycle in the early 1980s and picked up one extra mini cycle in the mid-1980s and registered one cycle in the early 1990s not picked up in the industrial production index because of a very irregular development registered in output over this period. Industrial production registered seven cycles over the period 1979 to 2004 for which the CLI is calculated. (see Chart 1).

Chart 19: BRAZIL Finished goods, stocks and Industrial production

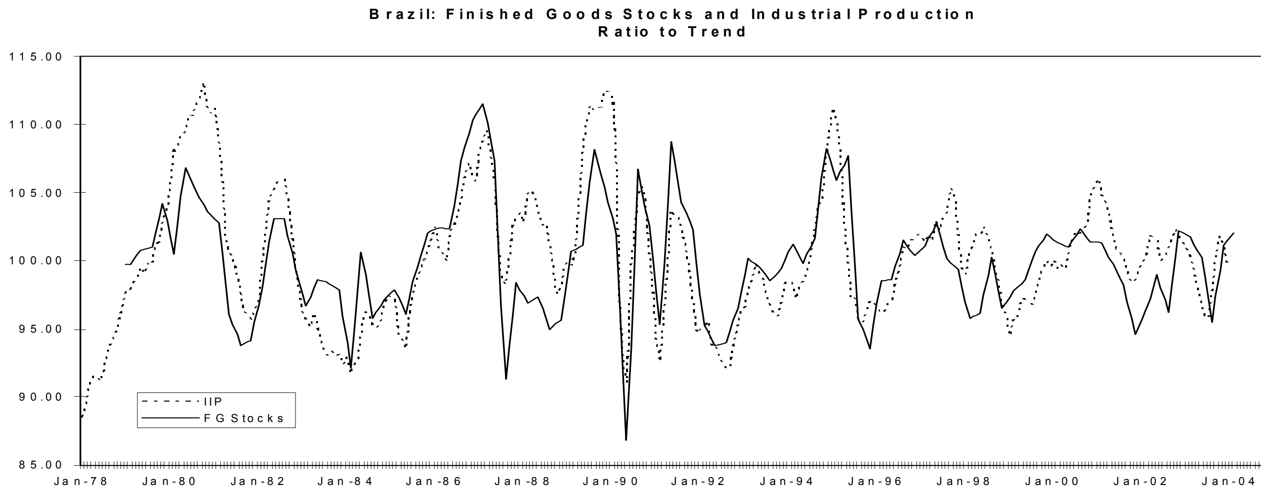


Table 16: Brazil - Characteristics of composite leading indicator and components

Indicator	Starting date	Timeliness Latest Data available at t	Extra (x), Missing (m) cycles	Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
Composite leading indicator New	1979	t+2	1m, 1x	1	5	5	5	4	1	4	6.5	4	0.64
Export volume	1981	t+2	½ m	1	14	8	11	13	7	10	10.6	12	0.33
IIPSemiNonDur	1975	t+2	0	2	12	12	12	8	7	8	16.6	0	0.70
IronSpong	1979	t+2	½ m	5	11	4	8	13	0	7	9.0	17	0.55
SalesMotor CarsDom	1981	t+2	1 m	1	6	9	8	9	4	5	10.7	7	0.30
SharePriceFG V100E	1993	t+2	½ m	1	4	-1	1	3	4	4	9.4	4	0.57
Terms of Trade	1979	t+2	½ m, 2x	3	5	0	3	5	-3	2	9.2	12	0.37
Finished goods stocks, inverted	1979	t+4	2x	1Q	3	4	3	3	3	3	5.1	0	0.71
Order books	1978	t+4	1m, 2x	1Q	10	6	8	10	3	4	10.5	7	0.42

6.1.2 China

Components

It has proved exceptionally difficult to find suitable cyclical indicators for China, though a few of the six indicators selected as leading indicators have a significant lead. However, the cyclical characteristics of certain indicators are not consistent across the different measures: an indicator which shows a long lead according to turning point measures such as median lead, show a much short lead according to the peak-correlation lead measure. The opposite relationship is noted for indicators, which show a short lead according to the median lead. All components are monthly which makes it possible to calculate a timely CLI.

One indicator closely linked to industrial output fails to track the aggregate cycle very well. The series on non-ferrous metals production misses one of the six cycles registered in output over the investigated period (see Table 17). The importance of foreign trade as a driving force of economic development in China is represented by an indicator on imports from Asia with very good leading properties as illustrated in Chart 20.

Composite Leading Indicator

The CLI predicted all turning points well in advance and tracked the cyclical amplitudes very well over the short period since 1983 over which it is calculated. The mean and median leads at all turning points are 6 and 4 months respectively and the general fit with the reference series is rather good with a correlation coefficient of 0.70. However, one cycle is not picked up over the six cycles registered in industrial output (see Chart 2).

Chart 20: CHINA **Imports from Asia and Industrial production**

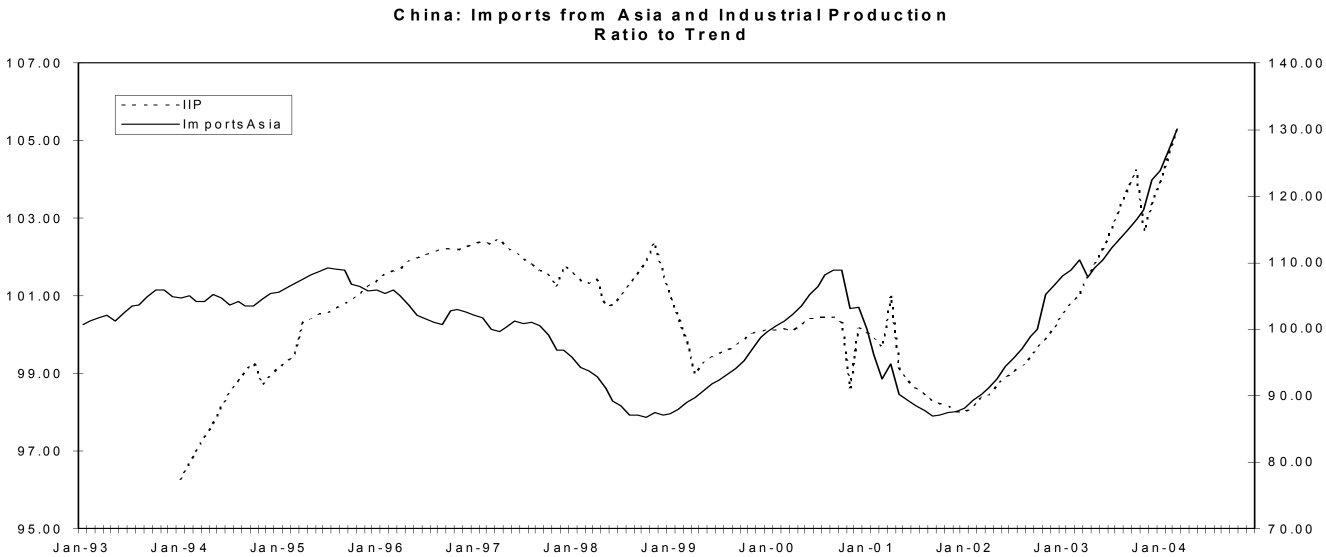


Table 17: China - Characteristics of composite leading indicator and components

Indicator	Starting date	Timeliness Latest Data available at t	Extra (x), Missing (m) cycles	Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
Composite leading indicator	1983	t+2	1 m	1	5	6	6	3	4	4	6.5	6	0.70
Broad money supply	1990	t+2	0	3	11	6	8	10	8	8	6.7	2	0.56
Cargo handled at ports	1983	t+2	1 ½ x	6	13	7	10	15	9	10	6.6	0	0.45
Chemical fertilizer	1983	t+2	½ x	3	15	13	14	14	16	15	7.5	9	0.27
Enterprise deposits	1978	t+2	0	2	1	0	0	1	-1	1	5.5	3	0.42
Imports from Asia	1993	t+2	0	5	8	5	6	0	5	3	10.2	7	0.50
Non-ferrous metals production	1983	t+2	1 x, 1m	6	4	7	6	5	5	5	7.9	6	0.29

6.1.3 India

Components

Eight leading indicators are used to calculate the best performing CLI for India, of which three are financial and monetary indicators and one is an indicator from the business tendency survey conducted by the National Council of Applied Economic Research. The survey series is, however, only available since 1997 which is also the case for the deposit interest rate series. Two leading indicators monitor external relations and two refer to the real sector. All series are monthly except the quarterly business tendency survey indicator, which makes it possible to calculate a timely CLI.

Most leading indicators show very short leads, only the three series on imports, deposit interest rate and share prices register some longer leads according to the median with leads in the range of 3-7 months. The deposit interest rate series in inverted form show a median lead of 7 months at turning points and 14 months according to the peak-correlation lead with a good fit against the reference series with a correlation coefficient of 0.83. The cyclical profile of the deposit interest rate series against industrial production is presented in Chart 21.

Composite Leading Indicator

The CLI shows a median lead of only 1 month at all turning points over the two cycles registered since 1995 in industrial production. However, the correlation with the reference cycle is very high with a peak-correlation coefficient of 0.89 at a lead of 3 months. No extra or missing cycles are recorded over the investigated period (see Chart 3).

Chart 21: INDIA **Deposit interest rate and Industrial production**

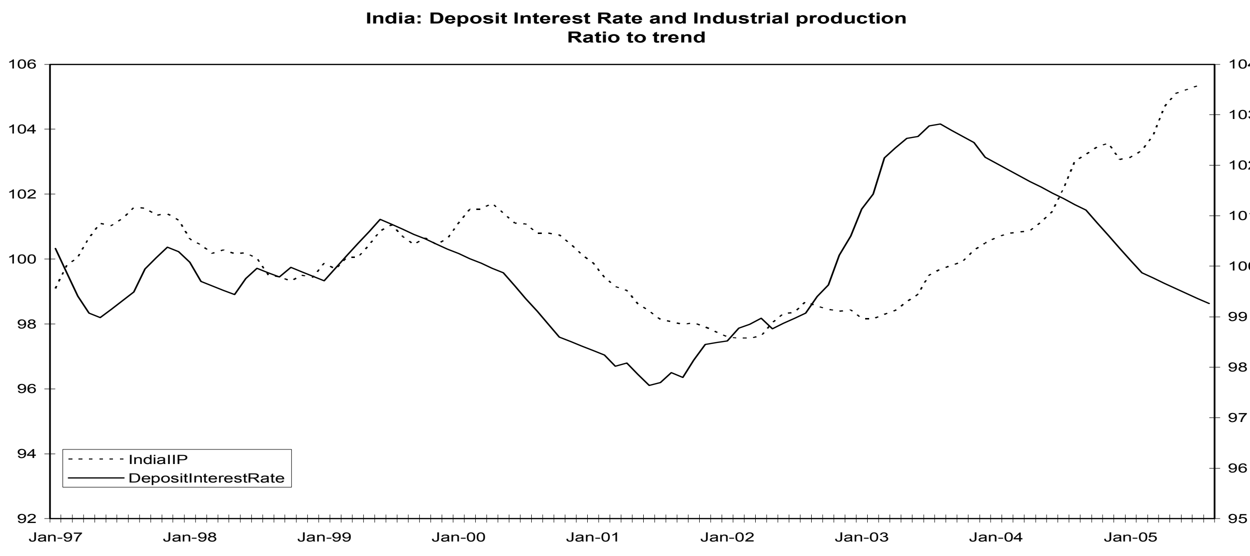


Table 18: India - Characteristics of composite leading indicator and components

Indicator	Starting date	Timeliness Latest Data available at t	Extra (x), Missing (m) cycles	Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
Composite leading indicator	1995	t+2	0	1	1	2	1	1	2	1	0.8	3	0.89
Business Confidence	1997	t+4	0	1Q	-2	3	1	-2	3	2	2.6	1	0.68
Imports	1995	t+2	1m	4	5	1	3	5	1	4	4.8	3	0.38
Exchange rate, USD, inverted	1995	t+2	0	1	2	3	3	0	2	1	4.7	8	0.77
Money supply M1	1995	t+2	1m	4	5	-3	1	5	-3	1	7.1	5	0.56
Deposit interest rate, inverted	1997	t+2	0	4	5	7	6	5	7	7	5.0	14	0.83
Share Price Index BSE Dollex	1991	t+2	0	2	8	-1	4	3	2	3	10.9	0	0.75
IIP Basic Goods	1995	t+2	0	5	-1	4	2	0	5	1	3.9	0	0.77
IIP Intermediate Goods	1995	t+2	1m	6	3	-2	1	3	-2	1	3.7	0	0.86

6.1.4 Indonesia

Components

Three of the five leading indicators used to calculate the CLI for Indonesia are external indicators: imports, exports and USD exchange rate. The other two leading indicators are financial series and refer to call money rate and the Jakarta composite share price index. All indicators are available on a monthly basis which makes it possible to calculate a timely CLI.

The two financial indicators show leads in the range of 6-11 months at all turning points according to the median measure with very long leads in the range of 13-14 months at peaks. The USD exchange rate series register about the same good leading performance at turning points as the two financial series. The cyclical profile of the share price index against industrial production is illustrated in Chart 22 which shows the good track record of this indicator with no missing or extra turning points.

Composite Leading Indicator

Indonesia registered three growth cycles in industrial production over the period 1993-2004 for which consistent monthly industrial production data are available. The CLI evaluated over the period since 1993 shows a median lead of 3 months at all turning points and a rather good correlation with industrial production with a correlation coefficient of 0.68.

The CLI failed to indicate clearly the first cycle over the period 1994-1996, which was only picked-up as a period of unchanged or slightly slowing growth but no real decrease in the rate of growth (see Chart 4).

Chart 22: INDONESIA **Share price index and Industrial production**

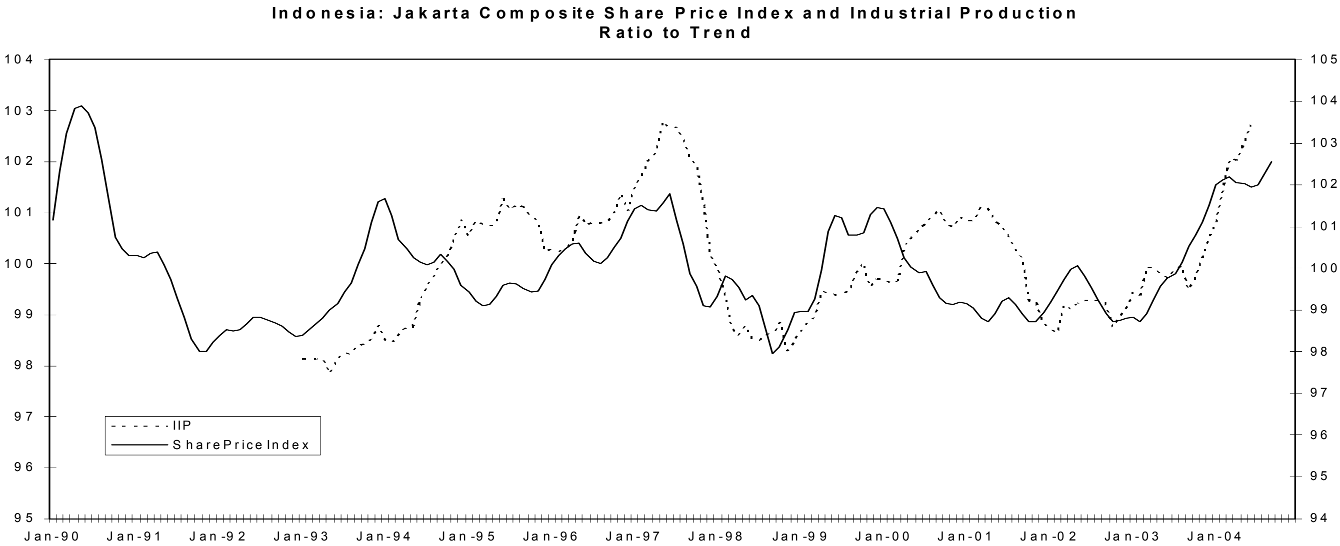


Table 19: Indonesia - Characteristics of composite leading indicator and components

Indicator	Starting date	Timeliness Latest Data available at t	Extra (x), Missing (m) cycles	Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
Composite leading indicator	1993	t+2	1m	1	7	3	5	7	3	7	9.3	3	0.68
Exchange rate, USD, inverted	1993	t+2	1m	2	8	7	8	11	7	11	10.1	3	0.47
Exports	1993	t+2	1m	4	5	1	3	5	2	4	8.7	1	0.69
Imports	1993	t+2	1m	2	3	1	2	3	1	3	9.8	1	0.61
Call money rate, inverted	1993	t+2	0	4	11	5	8	13	10	11	8.6	7	0.61
Share price index, JSX Composite	1993	t+2	0	3	10	2	6	14	2	6	9.5	10	0.53

6.1.5 Russian Federation

Components

Four of the seven leading indicators used to calculate the CLI for Russia are business tendency survey indicators conducted by the Centre for Economic Analysis of the Russian Federation. Two survey indicators refer to the industrial sector, business confidence and future selling prices, one indicator refers to business situation in the construction sector and one refers to the stock level in the retail trade sector. The three other indicators refer to external relations: net trade, balance of payments and world price on crude oil. The quarterly frequency of two of the business tendency survey indicators and in particular the balance of payments series which show very bad timeliness (t+8) is a problem for the calculation of a monthly CLI.

The business tendency survey series on stock levels in retail trade shows a very long median lead of 11 months at all turning points over the short period since 1997 for which data is available. The two series on net trade and balance of payments also show rather long median leads of 6 and 7 months respectively. However, they both missed one cycle and indicated one extra cycle over the period 1995-96. The series on world crude oil price shows a stable median lead of 4 months at all turning points and a good track record with no extra cycles or missing cycles (see Chart 23).

Composite Leading Indicator

The CLI has predicted matching turning points with a median lead of 7 months at all turning points and tracked the cyclical amplitudes of industrial production very well over the short period since 1994 over which it is calculated. The CLI indicated, however, one extra cycle over the period 1995-96 not registered in industrial production (see Chart 5).

Chart 23: RUSSIA **World crude oil price and Industrial production**

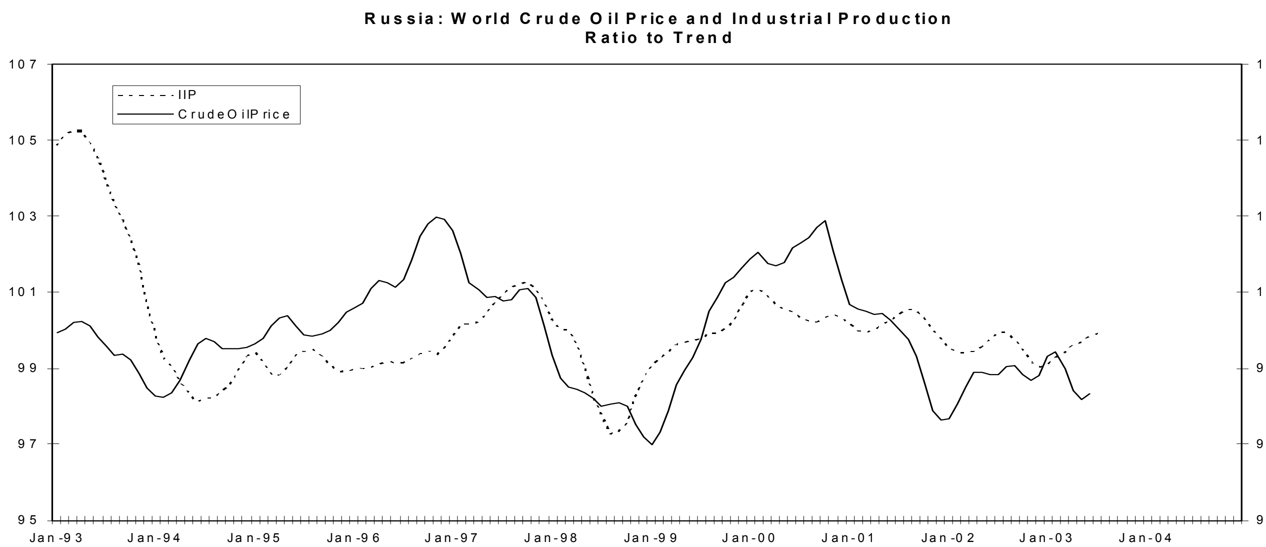


Table 20: Russia - Characteristics of composite leading indicator and components

Indicator	Starting date	Timeliness Latest Data available at t	Extra (x), Missing (m) cycles	Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
Composite leading indicator	1994	t+2	1x	1	7.5	7.0	7.3	7.5	7.0	7.0	4.5	7	0.72
Business confidence	1998	t+2	0	1	7	2	3	7	2	2	3.2	4	0.79
Selling prices, FT	1996	t+2	½ m	1	10	2	6	10	2	6	5.7	12	0.60
Business situation, construction	1994	t+4	½ m, 1x	1Q	3	0	2	3	0	2	1.9	3	0.58
Stock level, retail trade	1997	t+4	½ m	1Q	15	7	11	15	7	11	5.7	13	0.66
Crude oil price, world	1980	t+2	1m	2	3	4	4	3	4	4	8.9	6	0.40
Balance of payments, current	1994	t+8	1m, 1x	1Q	6	7	6	6	7	7	6.0	9	0.77
Net trade	1994	t+2	1m, 1x	3	8	6	7	8	6	6	5.6	7	0.68

6.1.6 South Africa

Components

The CLI constructed for South Africa contains six leading indicators including two quarterly indicators from the business tendency survey conducted by the Bureau for Economic Research at the University of Stellenbosch. The quarterly frequency of the survey series is a problem for the timeliness of the CLI, but they show very stable although rather short leads at cyclical turning points and a good track record with only one extra turning point registered over the period back to 1970 or 1975. This is illustrated in Chart 24 for the survey series on business confidence in manufacturing and the reference series, i.e. industrial production.

Two indicators show rather long leads at cyclical turning points: interest rate spread and share price index. However, the share price indicator shows two extra cycles in relation to the reference series. All leading indicators with exception of the two survey indicators are available on a monthly basis with good timeliness which means that they are indispensable for the calculation of a timely CLI

Composite Leading Indicator

The CLI for South Africa shows a median lead of 5 months at all turning points and a rather high cyclical correspondence with industrial production over the period since 1975. No extra or missing turning points are recorded over the six cycles registered in industrial production (see Chart 6).

Chart 24: SOUTH AFRICA Business confidence in manufacturing and Industrial production

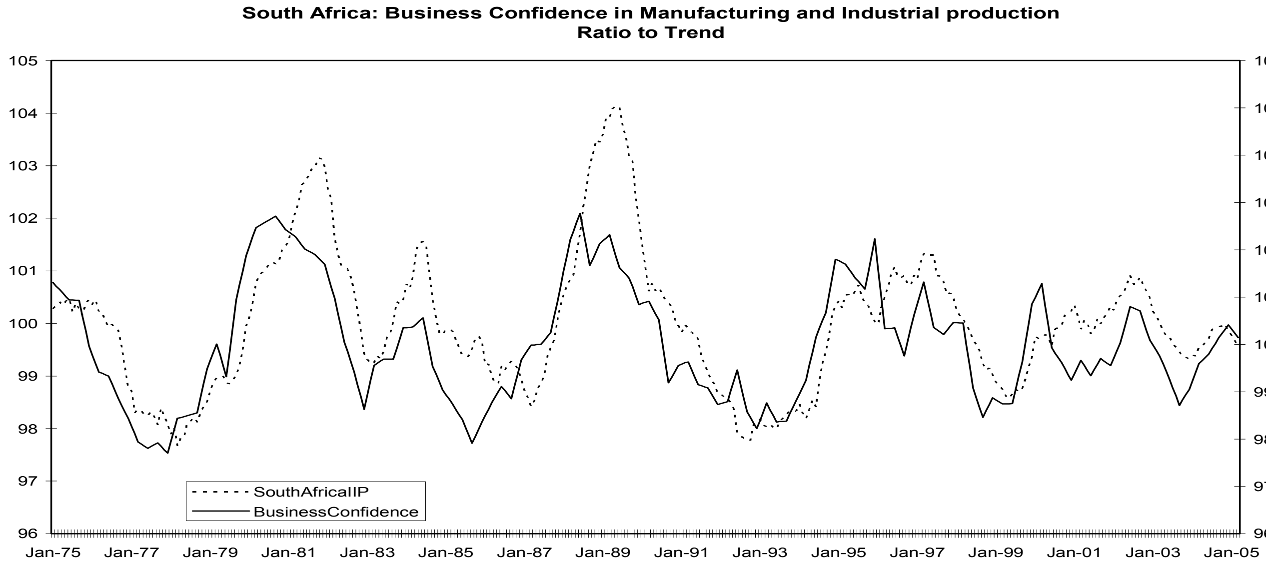


Table 21: South Africa - Characteristics of composite leading indicator and components

Indicator	Starting date	Timeliness Latest Data available at t	Extra (x), Missing (m) cycles	Smoothness MCD/ QCD	Mean lead (+) at turning points (TP)			Median lead (+) at turning points (TP)			Standard deviation	Cross correlation (2)	
					Peak	Trough	All TP	Peak	Trough	All TP		Lead (+)	Coef.
Composite leading indicator	1975	t+2	0	1	8	9	9	4	6	5	10.3	5	0.73
Building plans	1975	t+2	1 x, 2 m	6	10	7	8	11	3	8	10.6	-1	0.43
Confidence, mfg	1975	t+4	1 x	1Q	5	4	4	3	3	3	7.6	6	0.86
Interest rate spread	1996	t+2	0	2	31	9	16	31	9	10	13.1	12	0.48
Motor cars sales	1975	t+2	2 x	5	6	9	8	1	9	7	7.6	2	0.56
Order inflow, mfg	1970	t+4	1 x	1Q	7	8	5	4	4	5	9.2	8	0.62
Share prices, total	1978	t+2	2 x	2	12	10	11	14	7	9	7.7	11	0.40

* Inverted

7. BASIC METHODOLOGY

7.1 Data transformation

The OECD cyclical indicator system uses the "growth cycle" or "deviation-from-trend" approach. This is necessary because essential cyclical similarities between series may be obscured by different long-term trends. Trend estimation is therefore a crucial step in detecting cyclical movements and identifying turning points. Two different methods are used in this study for extracting growth cycles and identifying cyclical turning points: the Phase-Average Trend (PAT) method and the Hodrick-Prescott (HP) method. The two de-trending methods are described below in Sections 7.2 and 7.3.

The modified version of the PAT method adopted by the OECD is used as the basic de-trending method if data requirements are fulfilled. The advantage of this method compared to the HP method is that it may be run with input turning points which allow calibration of the PAT trend. This is also an important aspect when analysing cycles across countries, synchronisation of cycles between reference series such as industrial production and GDP and synchronisation of cycles across leading indicators within a country.

A constraint with the PAT method is the length of time period needed to run the program, i.e. 99 observations or just over eight years of data. In addition, a minimum of four turning points are required for the calculation of the PAT trend. On the other hand, an advantage with the HP method is the fact that it poses no restriction on the length of time series and is used on time series with less than eight years of data. This property is also used for identification of potential turning points at the very near end of the series, last six months where the Bry-Boschan routine does not identify turning points.

7.2 The PAT Method

The basic method of trend estimation adopted by the OECD is a modified version of the phase-average trend (PAT) method developed by the United States NBER. This method has been designed specifically to separate the long-term trends from medium-term cycles, with the latter defined according to the criteria programmed in the Bry-Boschan computer routine for selection of cyclical turning points.

The PAT of a series is estimated by first dividing the series into phases. These are defined as the number of months between successive turning points. The means of the observations in each phase are then calculated and these phase-averages are used to compute a three-term moving average. The values obtained from the moving average are assigned to the mid-point of the three-phase period, known as a "triplet", to which they refer. The trend is then obtained by computing the slope between the mid-points of successive triplets. The trend is extrapolated from the last available triplet to the end of the series by a least-squares log-linear regression starting from the mid-point of the last triplet.

The growth cycle program based on the PAT method is designed to:

- select turning points (peaks and troughs) in raw (i.e. seasonally adjusted) data or in data adjusted for long-term trend;
- measure the long-term trend and its rate of change; and
- produce trend-adjusted data.

If trend adjustment is not desired the turning point routine can be used on the raw data to produce a chronology of turning points in "classical cycles" (i.e. movements in levels) . With the trend-adjustment option, the program produces a chronology of "growth cycles".

The main steps in the PAT method are as follows:

- first estimation and extrapolation of long-term trend (75 month moving average);
- calculation of deviations from moving average trend;
- correction for extreme values;
- identification of tentative turning points and determination of cyclical phases, i.e. expansions and contractions (Bry-Boschan routine);
- new estimation and extrapolation of long-term trend in original series by calculation and correction of moving averages over cyclical phases (PAT trend);
- calculation of deviations from PAT trend;
- identification of final turning points in original series (Bry-Boschan routine).

The estimation of peak and trough dates is a crucial step in the PAT procedure. First estimates are made using the Bry-Boschan routine which begins by calculating a moving-average trend estimate for the identification of turning points. The routine then executes a series of tests on the deviations from this first trend estimate so as to eliminate extreme values and turning points that are judged to be too close together. The Bry-Boschan routine specifies a minimum duration of five months for a phase and fifteen months for a cycle.

These operations are applied to various smoothed curves in order to identify turning points which coincide more and more closely with observable variation in the original series. Lastly, the turning points are sought in the original series within the five months on both sides of the turning points found at the preceding stage. The points thus identified are taken as the preliminary turning points.

7.3 The Hodrick-Prescott Method

As noted above, “classical” business cycles are measured in the level of time series, while growth cycles are measured in the deviation-from-trend or ratio-to-trend series. However, economic growth is the main focus of most forecasters and cyclical movements in the growth rate are of key interest. The growth cycle is closely linked to fluctuations in the growth rate and is the most frequently used approach in cyclical analysis.

Trend estimation is, however, a crucial step in the growth cycle approach. A commonly used detrending method, which measures the trend directly and then removes it, is the Hodrick-Prescott (HP) filter.

The HP filter is a simple and flexible tool for economic analysis and it is an optimal extractor of a trend, which is stochastic but moves smoothly over time and is uncorrelated with the cycle. HP filter requires computation of the trend component Y * for t=1,2,3…of a seasonally adjusted series Y. T is estimated to minimise:

$$\sum_{t=1}^{T} (Y_t - Y^*_t)^2 + \lambda \sum_{t=2}^{T-1} [(Y^*_{t+1} - Y^*_t) - (Y^*_t - Y^*_{t-1})]^2$$

where λ is the weighting factor that controls how smooth the resulting trend is. A low value of λ will produce a trend that follows the seasonally adjusted series more closely, whereas a high value of λ will not pick-up short-term fluctuations in the seasonally adjusted series. The arbitrary choice of λ is a main weakness of the method and in most applications the value of λ is set to 1 600, the value originally chosen by Hodrick and Prescott for quarterly data.

In this study, the HP filter has been computed within the model based approach of the TRAMO-SEATS program for seasonal adjustment by setting a value of λ of 129.119,77 for data with monthly frequency. The model based HP filter is calculated on the seasonally adjusted or trend-cycle data with a second order ARIMA model (0 2 2) (0 0 0) with parameters -1.925421 and 0.928102 corresponding to the chosen HP parameter λ with a maximum cycle length of 10 years (Tau set to 119.090655). In this study, the HP filter is applied to the trend-cycle series because the focus is on cyclical turning points and no major difference was found in this respect between trend-cycle and seasonally adjusted data.

The model based HP filter approach has been developed by Kaiser and Maravall and implemented in the TRAMO-SEATS program within the DEMETRA software by Jens Dossé. In the DEMETRA application of the HP model based approach used in this study, outliers classified as level shifts in the time series have been included in the trend component.

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ANNEX 1: LIST OF ANALYSED CYCLICAL INDICATORS

Indicator	Series name used in analytical tables (Annex 2)	Subject Area	Frequency	Starting date
BRAZIL				
Business situation, future tendency, industry	BusinessSit FT	Tendency surveys	Quarterly	1996
Business situation, tendency, industry	BusinessSit P	Tendency surveys	Quarterly	1996
Capacity utilisation	CapacityUtilis	Tendency surveys	Quarterly	1978
Coffee production	Coffee	Real	Monthly	1985
Crude steel production	CrudeSteel	Real	Monthly	1978
Employment, future tendency, industry	EmploymentFT	Tendency surveys	Quarterly	1978
Exports	Exports	External	Monthly	1978
Export order books, industry	ExpOrderBooks	Tendency surveys	Quarterly	198
Finished goods stocks, industry	FinGoodsStocks	Tendency surveys	Quarterly	1979
Long-term interest rate, TJLP	LTInterestrate	Financial	Monthly	1995
Money supply M4	MoneyM4	Financial	Monthly	1995
Money supply M1	MoneyM1	Financial	Monthly	1995
Money supply M2	MoneyM2	Financial	Monthly	1995
Order books, industry	OrderBooks	Tendency surveys	Quarterly	1978
Order inflow, industry	OrdersInflow	Tendency surveys	Quarterly	1979
Short-term interest rate, Federal Funds	STInterstRate	Financial	Monthly	1995
Production, future tendency, industry	ProductionFT	Tendency surveys	Quarterly	1979
Selling prices, future tendency, industry	SellingPricesFT	Tendency surveys	Quarterly	1979
Share price index	SharePriceIndex	Financial	Monthly	1995
Terms of trade	TermsofTrade	External	Monthly	1985
Exchange rate USD	USDExchange	Financial	Monthly	1994
CHINA				
Business situation, future tendency, industry	BusinessSitFT	Tendency surveys	Quarterly	1999
Business situation, tendency, industry	BusinessSitP	Tendency surveys	Quarterly	1999
Caustic soda production	CausticSoda	Real	Monthly	1990
Employment, future tendency, industry	EmploymentFT	Tendency surveys	Quarterly	1999
Exports	Exports	External	Monthly	1992
Exports to Asia	ExportsAsia	External	Monthly	1993
Exports to Japan	ExportsJapan	External	Monthly	1993
Exports of non ferrous metal products	ExportsNFMetal	External	Monthly	1994
Finished goods stocks, industry	FinGoodsStocks	Tendency surveys	Quarterly	1999
Imports	Imports	External	Monthly	1992
Imports from Asia	ImportsAsia	External	Monthly	1993
Imports from Japan	importsJapan	External	Monthly	1993
Industrial sales	IndustrialSales	Real	Monthly	1993
Industrial sales, light industry	IndustrialSalesLI	Real	Monthly	1993
Industrial sales, heavy industry	IndustrialSalesH	Real	Monthly	1993
Money supply M1	MoneyM1	Financial	Monthly	1990
OECD Composite Leading Indicator for Japan	OECDCLIJapan	External	Monthly	1960
Order books, industry	OrderBooks	Tendency surveys	Quarterly	1999
Plated glass production	PlatedGlass	Real	Monthly	1990
Automobile production	Automobiles	Real	Monthly	1990
Chemical fertilizer production	ChemicalFertiliz	Real	Monthly	1990
Electrical power generated	Power	Real	Monthly	1990
Steel production	Steel	Real	Monthly	1990
Steel products production	Steelproducts	Real	Monthly	1990
Selling prices, future tendency, industry	SellingPricesFT	Tendency surveys	Quarterly	1999
Sulfuric acid production	SulphasicAcid	Real	Monthly	1990

Indicator	Series name used in analytical tables (Annex 2)	Subject Area	Frequency	Starting date
INDIA				
Bank credit to commercial sector	BankCredit	Financial	Monthly	1995
Business Confidence, industry	BusinessConf	Tendency surveys	Quarterly	1997
Capacity utilization	CapacityUtilisa	Tendency surveys	Quarterly	1997
Deposit rate, major banks, high	DepRateMBH	Financial	Monthly	1997
Deposit rate, major banks, low	DepRateMBL	Financial	Monthly	1997
Economic conditions, industry	EconomicCond	Tendency surveys	Quarterly	1997
Real exchange rate, 5 countries, trade weighted	FXReal5Count	External	Monthly	1993
Exports	Exports	External	Monthly	1995
Financial position, industry	FinancPosition	Tendency surveys	Quarterly	1997
Industrial production, basic goods	IIPBasicGoods	Real	Monthly	1995
Industrial production, capital goods	IIPCapitalG	Real	Monthly	1995
Industrial production, consumer goods	IIPConsumerG	Real	Monthly	1995
Industrial production, consumer goods, durable	IIPConsGDura	Real	Monthly	1995
Industrial production, , consumer goods, non durable	IIPConsGNDur	Real	Monthly	1995
Imports	Imports	External	Monthly	1995
Imports from Japan	ImportsJapan	External	Monthly	1993
Imports from United States	ImportsUSA	External	Monthly	1993
Share price index, Bombay Stock Exchange (Dollex)	IndBSEDollex	Financial	Monthly	1995
Share price index, BSE, (100Natex))	IndBSENat100	Financial	Monthly	1995
Share price index, BSE, (30Senex)	IndBSESens30	Financial	Monthly	1995
Share price index, BSE, (S&P,CNX,Nifty)	IndSPNifty	Financial	Monthly	1995
Exchange rate INR/USD	USDexchrate	Financial	Monthly	1995
Industrial production, electricity, gas and water	IIIPElgaswater	Real	Monthly	1995
Industrial production, manufacturing	IIPManufactur	Real	Monthly	1995
Industrial production, intermediate goods	IIPintermediat	Real	Monthly	1995
Investment climate	InvestClimate	Tendency surveys	Quarterly	1997
OECD Composite Leading Indicator for Japan	JPNCLI	External	Monthly	1960
Money supply M1	MoneyM1	Financial	Monthly	1995
Money supply M3	MoneyM3	Financial	Monthly	1995
Wholesale prices	WPI	Real	Monthly	1995
INDONESIA				
Bank credit to commercial banks	BankCredit	Financial	Monthly	1990
Cargo loaded, 4 main ports	CargoLoaded	External	Monthly	1991
Cargo unloaded, 4 main ports	CargoUnload	External	Monthly	1991
OECD Composite Leading indicator for Japan	CLIJapan	External	Monthly	1960
OECD Composite Leading indicator for USA	CLIUSA	External	Monthly	1960
Coal production	Coal	Real	Monthly	1990
Crude oil production	CrudeOil	Rea	Monthly	1990
Exports	Exports	External	Monthly	1990
Exports, excluding oil and gas	ExportsExclOil	External	Monthly	1990
Exports of shrimps	ExportShrimps	External	Monthly	1990
Exports of plywood	ExportPlywood	external	Monthly	1992
Exchange rate USD	ForexRupiUSD	Financial	Monthly	1990
Imports	Imports	External	Monthly	1990
Imports of capital goods	ImportCapG	External	Monthly	1990
Imports of consumer goods	ImportConsG	External	Monthly	1990
Imports, excluding oil and gas	ImportsExclOil	External	Monthly	1990
Imports of raw materials	ImportRawMat	External	Monthly	1990
Call money rate	IntCallMoneyR	Financial	Monthly	1990
Share price index, Jakarta Stock Exchange Composite	JSXComposite	Financial	Monthly	1990
Natural gas production	NaturalGas	Real	Monthly	1990
Nickel Ore production	NickleOre	Real	Monthly	1990
Time deposits, 1 months	TimeDeposits	Financial	Monthly	1990
Tin Ore production	TinOre	Real	Monthly	1990

Indicator	Series name used in analytical tables (Annex 2)	Subject Area	Frequency	Starting date
RUSSIA				
Balance of payments, current	Bopcurrent	External	Quarterly	1994
Balance of payments, goods	BopGoods	External	Quarterly	1994
Business situation, construction	BuildBusTE	Tendency surveys	Quarterly	1994
Employment, future tendency, construction	BuildEmplFT	Tendency surveys	Quarterly	1994
Consumer price index, all items	CPIAll	Real	Monthly	1992
Crude steel production	CrudeSteel	Real	Monthly	1997
Exchange rate Euro	ExchRateEuro	External	Monthly	1991
Real Gross Domestic Product	GDP	Real	Quarterly	1995
Crude oil price, world	WorldPriceOil	External	Monthly	1980
Inter bank interest rate	InterBankRate	Financial	Monthly	1997
Demand level, industry	MfgDemand	Tendency surveys	Monthly	1996
Finished goods stocks, industry	MfgFinGStocks	Tendency surveys	Monthly	1996
Business confidence, industry	MfgConfInd	Tendency surveys	Monthly	1998
Order books level, industry	MfgOrderBooks	Tendency surveys	Monthly	1996
Production, future tendency, industry	MfgProdFT	Tendency surveys	Monthly	1996
Production, tendency, industry	MfgProdFT	Tendency surveys	Monthly	1996
Selling prices, future tendency, industry	MfgSelPriceFT	Tendency surveys	Monthly	1996
Natural gas production	NaturalGas	Real	Monthly	1990
Net trade	NetTrade	External	Monthly	1994
Employment, future tendency, retail trade	RetEmplFT	Tendency surveys	Quarterly	1997
Stock level, retail trade	RetStocks	Tendency surveys	Quarterly	1997
Share price index, Moscow stock exchange	SharePrices	Financial	Monthly	1996
SOUTH AFRICA				
Business situation, future tendency, construction	BuildBusSitFT	Tendency surveys	Quarterly	1990
Confidence indicator, construction	BuildConfidence	Tendency surveys	Quarterly	1990
Order inflow, construction	BuildOrderInfl	Tendency surveys	Quarterly	1990
Business situation, tendency, retail trade	RetailBusSitT	Tendency surveys	Quarterly	1990
Business situation, future tendency, retail trade	RetailBusSitFT	Tendency surveys	Quarterly	1990
Confidence indicator, retail trade	RetailConf	Tendency surveys	Quarterly	1990
Employment, tendency, retail trade	RetailEmploym	Tendency surveys	Quarterly	1990
Order inflow, retail trade	RetailOrderInfl	Tendency surveys	Quarterly	1990
Business situation, tendency, industry	MfgBusSitT	Tendency surveys	Quarterly	1990
Business situation, future tendency, industry	MfgBusSitFT	Tendency surveys	Quarterly	1990
Confidence indicator, industry	MfgConfidence	Tendency surveys	Quarterly	1990
Capacity utilization, industry	MfgCapacity	Tendency surveys	Quarterly	1986
Employment, future tendency, industry	MfgEmploymFT	Tendency surveys	Quarterly	1990
Order inflow, industry	MfgOrderInflow	Tendency surveys	Quarterly	1990
Production, future tendency, industry	MfgProductionFT	Tendency surveys	Quarterly	1990
Selling prices, future tendency, industry	MfgSellPriceFT	Tendency surveys	Quarterly	1990
Consumer confidence	ConsConfidence	Tendency surveys	Quarterly	1990
Economic situation, future tendency, consumers	ConsEconSitFT	Tendency surveys	Quarterly	1990
Retail sales of passenger cars	SalesPassCars	Real	Monthly	1991
Wholesale sales, nominal	WholeSalesVal	Real	Monthly	1985
Wholesale sales, real	holeSalesVol	Real	Monthly	1985
Gold price, South Africa	GoldZaf	External	Monthly	1971
Long-term government bonds	LTGovBond	Financial	Monthly	1985
Real Gross Domestic Product	RealGDP	Real	Quarterly	1960
Exports	Exports Imports	External	Monthly	1990

ANNEX 2: EVALUATION RESULTS OF ANALYSED CYCLICAL INDICATORS

BRAZIL

Test results for series that satisfy the selection criteria

Series	Score	Characteristics		Cross Spectral Analysis		NBER Analysis			Dynamic Factor Analysis		
	Number of tests with acceptable results	Freq. (1)	Transf. (2)	Coherence (3)	Mean delay (3)	Cross-correlation (4)		Turning point (TP) behaviour (5)	Common component variance over series variance (6)	Cross-correlation between common components (7)	Cyclical timing Classification of series (8)
						r max	t max	t max			
BusinessSit FT	5	Q	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
BusinessSit P	4	Q	PAT	YES	COIN	HIGH	LAG	LEAD	HIGH	COIN	COIN
CapacityUtilis	3	Q	PAT	YES	LAG	HIGH	LAG	COIN	HIGH	COIN	COIN
Coffee	6	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	LEAD	LEAD
CrudeSteel	5	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	COIN	LEAD
EmploymentFT	4	Q	PAT	YES	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
Exports	5	M	PAT	NO	COIN	LOW	LEAD	COIN	HIGH	LEAD	LEAD
ExpOrderBooks	3	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	LOW	COIN	LAG
FinGoodsStocks	3	Q	PAT	YES	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
LTInterestrate	4	M	PAT	NO	COIN	HIGH	LEAD	LAG	HIGH	COIN	COIN
MoneyM4	4	M	PAT	NO	LEAD	LOW	LEAD	LEAD	LOW	COIN	COIN
MoneyM1	3	M	PAT	NO	COIN	LOW	LEAD	LAG	HIGH	COIN	COIN
MoneyM2	4	M	PAT	NO	LEAD	LOW	LAG	LAG	HIGH	COIN	LEAD
OrderBooks	5	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	LEAD	LEAD
OrdersInflow	4	Q	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
STInterstRate	5	M	PAT	NO	LEAD	HIGH	LEAD	LAG	HIGH	COIN	COIN
ProductionFT	5	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	COIN	LEAD
SellingPricesFT	5	Q	PAT	NO	LEAD	LOW	LEAD	LAG	HIGH	LEAD	LEAD
SharePriceIndex	4	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
TermsofTrade	6	M	PAT	NO	LEAD	LOW	LEAD	LEAD	LOW	LEAD	LEAD
USDExchange	5	M	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	COIN	LAG

(1) Frequency: monthly (M), quarterly (Q)
(2) Cross spectral statistics between components and industrial production calculated from data de-trended by the Phase Average Trend method (PAT) or Hodrick-Prescott (HP) filter over common sample period 1997-2003
(3) Data on coherence and mean delay relate to the cyclical frequencies (2 to 8 years). Acceptable coherence indicated for values above o.30. Series with a mean delay of less than one in absolute value are classified as coincident. Series with values above 1 are classified as leading and series with values below -1 are classified as lagging.
(4) High indicated for r max above 0.50
(5) Leading behaviour if median lag above 2, coincident behaviour if median lag between 2 and -2 and lagging behaviour if median lag below -2.
(6) Dynamic factor analysis run over common sample period 1997-2003. High common component variance indicated for ratio values above 0.30
(7) Dynamic factor analysis run over common sample period 1990-2003. High correlations at positive (negative) lags indicate a leading (lagging) behaviour of the indicator with respect to the reference series. Indicators with the highest correlation at zero lag are classified as coincident with respect to the reference series.
(8) Dynamic factor analysis run over common sample period 1990-2003. Cyclical timing classification of the indicators based on the common parts with respect to that of the reference series is performed by calculating the mean delays from the first row of the common components spectral density matrix. The automatic classification is based on the following rules: if mean delay is between -1 and 1, then the indicator is classified as coincident and if mean delay is higher than 1 (-1), then the indicator is leading (lagging) by more than one period.

CHINA

Test results for series that satisfy the selection criteria

Series	Score	Characteristics		Cross Spectral Analysis		NBER Analysis			Dynamic Factor Analysis		
	Number of tests with acceptable results	Freq. (1)	Transf. (2)	Coherence (3)	Mean delay (3)	Cross-correlation (4)		Turning point (TP) behaviour (5)	Common component variance over series variance (6)	Cross-correlation between common components (7)	Cyclical timing classification of series (8)
						r max	t max	t max			
BusinessSitFT	3	Q	HP	YES	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
BusinessSitP	2	Q	HP	NO	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
CausticSoda	4	M	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
EmploymentFT	2	Q	HP	NO	COIN	LOW	LEAD	COIN	HIGH	COIN	COIN
Exports	2	M	PAT	NO	COIN	LOW	COIN	COIN	HIGH	COIN	COIN
ExportsAsia	4	M	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
ExportsJapan	4	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	COIN	COIN
ExportsNFMetal	1	M	PAT	NO	COIN	LOW	COIN	COIN	LOW	COIN	COIN
FinGoodsStocks	7	Q	HP	YES	LEAD	HIGH	LEAD	LEAD	HIGH	COIN	LEAD
Imports	3	M	PAT	NO	COIN	LOW	LEAD	COIN	HIGH	COIN	COIN
ImportsAsia	4	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
importsJapan	4	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
IndustrialSales	5	M	PAT	YES	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
IndustrialSalesLI	5	M	PAT	YES	COIN	HIGH	LEAD	LAG	HIGH	COIN	COIN
IndustrialSalesH	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
MoneyM1	3	M	PAT	NO	LEAD	LOW	LEAD	COIN	LOW	COIN	COIN
OECDCLIJapan	2	M	PAT	NO	COIN	LOW	COIN	LEAD	LOW	COIN	COIN
OrderBooks	3	Q	HP	YES	COIN	HIGH	COIN	LAG	HIGH	COIN	COIN
PlatedGlass	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
Automobiles	6	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	LEAD
ChemicalFertiliz	4	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
Power	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
Steel	5	M	PAT	NO	COIN	HIGH	LEAD	LAG	HIGH	COIN	LEAD
Steelproducts	4	M	PAT	NO	LAG	LOW	LEAD	LEAD	LOW	COIN	LEAD
SellingPricesFT	4	Q	HP	YES	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
SulphasicAcid	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN

(1) Frequency: monthly (M), quarterly (Q)
(2) Cross spectral statistics between components and industrial production calculated from data de-trended by the Phase Average Trend method (PAT) or Hodrick-Prescott (HP) filter over common sample period 1997-2003
(3) Data on coherence and mean delay relate to the cyclical frequencies (2 to 8 years). Acceptable coherence indicated for values above o.30. Series with a mean delay of less than one in absolute value are classified as coincident. Series with values above 1 are classified as leading and series with values below -1 are classified as lagging.
(4) High indicated for r max above 0.50
(5) Leading behaviour if median lag above 2, coincident behaviour if median lag between 2 and -2 and lagging behaviour if median lag below -2.
(6) Dynamic factor analysis run over common sample period 1997-2003. High common component variance indicated for ratio values above 0.30
(7) Dynamic factor analysis run over common sample period 1990-2003. High correlations at positive (negative) lags indicate a leading (lagging) behaviour of the indicator with respect to the reference series. Indicators with the highest correlation at zero lag are classified as coincident with respect to the reference series.
(8) Dynamic factor analysis run over common sample period 1990-2003. Cyclical timing classification of the indicators based on the common parts with respect to that of the reference series is performed by calculating the mean delays from the first row of the common components spectral density matrix. The automatic classification is based on the following rules: if mean delay is between -1 and 1, then the indicator is classified as coincident and if mean delay is higher than 1 (-1), then the indicator is leading (lagging) by more than one period.

INDIA

Test results for series that satisfy the selection criteria

Series	Score	Characteristics		Cross Spectral Analysis		NBER Analysis			Dynamic Factor Analysis		
	Number of tests with acceptable results	Freq. (1)	Transf. (2)	Coherence (3)	Mean delay (3)	Cross-correlation (4)		Turning point (TP) behaviour (5)	Common component variance over series variance (6)	Cross correlation between common components (7)	Cyclical timing classification of series (8)
						r max	t max	t max			
BankCredit	1	M	PAT	NO	COIN	LOW	COIN	COIN	LOW	LAG	LAG
BusinessConf	3	Q	HP	YES	LAG	HIGH	COIN	COIN	HIGH	COIN	COIN
CapacityUtilisa	1	Q	HP	NO	COIN	LOW	COIN	COIN	HIGH	COIN	COIN
DepRateMBH	4	M	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
DepRateMBL	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
EconomicCond	3	Q	HP	YES	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
FXReal5Count	6	M	PAT	NO	COIN	HIGH	LEAD	LEAD	LOW	LEAD	LEAD
Exports	1	M	PAT	NO	LAG	HIGH	COIN	LAG	LOW	LAG	LAG
FinancPosition	3	Q	HP	YES	LAG	HIGH	LAG	COIN	HIGH	COIN	COIN
IIPBasicGoods	4	M	PAT	YES	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
IIPCapitalG	3	M	PAT	NO	LAG	HIGH	COIN	LEAD	HIGH	COIN	COIN
IIPConsumerG	4	M	PAT	YES	LAG	HIGH	COIN	COIN	HIGH	COIN	COIN
IIPConsGDura	2	M	PAT	NO	LAG	LOW	LAG	LAG	HIGH	LAG	LAG
IIPConsGNDur	2	M	PAT	NO	LAG	LOW	COIN	COIN	HIGH	COIN	COIN
Imports	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
ImportsJapan	6	M	PAT	NO	LEAD	HIGH	LEAD	COIN	HIGH	LAG	LEAD
ImportsUSA	7	M	PAT	NO	LEAD	HIGH	LEAD	LEAD	LOW	LEAD	LEAD
IndBSEDollex	4	M	PAT	NO	LAG	LOW	LEAD	LEAD	HIGH	COIN	COIN
IndBSENat100	3	M	PAT	NO	LAG	LOW	COIN	LEAD	HIGH	COIN	COIN
IndBSESens30	3	M	PAT	NO	LAG	HIGH	COIN	COIN	HIGH	COIN	COIN
IndSPNifty	3	M	PAT	NO	LAG	HIGH	COIN	COIN	HIGH	COIN	COIN
USDexchrate	4	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	COIN	COIN
IIIPElgaswater	3	M	PAT	NO	COIN	LOW	LAG	LEAD	HIGH	COIN	COIN
IIPManufactur	4	M	PAT	YES	LAG	HIGH	COIN	COIN	HIGH	COIN	COIN
IIPintermediat	3	M	PAT	YES	LAG	HIGH	COIN	COIN	HIGH	COIN	COIN
InvestClimate	3	Q	HP	YES	COIN	HIGH	LAG	COIN	HIGH	COIN	COIN
JPNCLI	5	M	PAT	YES	LAG	HIGH	COIN	LEAD	HIGH	COIN	COIN
MoneyM1	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
MoneyM3	5	M	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	COIN	LAG
WPI	6	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	LEAD	LEAD

(1) Frequency: monthly (M), quarterly (Q)
(2) Cross spectral statistics between components and industrial production calculated from data de-trended by the Phase Average Trend method (PAT) or Hodrick-Prescott (HP) filter over common sample period 1997-2003
(3) Data on coherence and mean delay relate to the cyclical frequencies (2 to 8 years). Acceptable coherence indicated for values above o.30. Series with a mean delay of less than one in absolute value are classified as coincident. Series with values above 1 are classified as leading and series with values below -1 are classified as lagging.
(4) High indicated for r max above 0.50
(5) Leading behaviour if median lag above 2, coincident behaviour if median lag between 2 and -2 and lagging behaviour if median lag below -2.
(6) Dynamic factor analysis run over common sample period 1997-2003. High common component variance indicated for ratio values above 0.30
(7) Dynamic factor analysis run over common sample period 1990-2003. High correlations at positive (negative) lags indicate a leading (lagging) behaviour of the indicator with respect to the reference series. Indicators with the highest correlation at zero lag are classified as coincident with respect to the reference series.
(8) Dynamic factor analysis run over common sample period 1990-2003. Cyclical timing classification of the indicators based on the common parts with respect to that of the reference series is performed by calculating the mean delays from the first row of the common components spectral density matrix. The automatic classification is based on the following rules: if mean delay is between -1 and 1, then the indicator is classified as coincident and if mean delay is higher than 1 (-1), then the indicator is leading (lagging) by more than one period.

INDONESIA

Test results for series that satisfy the selection criteria

Series	Score	Characteristics		Cross Spectral Analysis		NBER Analysis			Dynamic Factor Analysis		
	Number of tests with acceptable results	Freq. (1)	Transf. (2)	Coherence (3)	Mean delay (3)	Cross-correlation (4)		Turning point (TP) behaviour (5)	Common component variance over series variance (6)	Cross-correlation between common components (7)	Cyclical timing classification of series (8)
						r max	t max	t max			
BankCredit	5	M	PAT	NO	LAG	HIGH	LAG	COIN	HIGH	LEAD	LEAD
CargoLoaded	5	M	PAT	NO	LAG	HIGH	LAG	LAG	HIGH	LEAD	LEAD
CargoUnload	4	M	PAT	YES	LAG	HIGH	COIN	LAG	HIGH	COIN	COIN
CLIJapan	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
CLIUSA	4	M	PAT	NO	LAG	LOW	LAG	COIN	HIGH	LEAD	LEAD
Coal	6	M	PAT	NO	LEAD	LOW	LEAD	LEAD	LOW	LEAD	LEAD
CrudeOil	3	M	PAT	NO	LAG	LOW	LAG	LEAD	HIGH	LAG	LAG
Exports	3	M	PAT	NO	COIN	LOW	COIN	LEAD	HIGH	COIN	COIN
ExportsExclOil	3	M	PAT	NO	LAG	LOW	LAG	LEAD	HIGH	COIN	COIN
ExportShrimps	2	M	PAT	NO	LAG	LOW	LAG	LAG	HIGH	LAG	LAG
ExportPlywood	3	M	PAT	NO	COIN	LOW	COIN	LEAD	HIGH	COIN	COIN
ForexRupiUSD	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
Imports	6	M	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
ImportCapG	2	M	PAT	NO	COIN	LOW	COIN	COIN	HIGH	COIN	COIN
ImportConsG	7	M	PAT	NO	LEAD	HIGH	LEAD	LEAD	LOW	LEAD	LEAD
ImportsExclOil	2	M	PAT	NO	COIN	LOW	COIN	COIN	HIGH	COIN	COIN
ImportRawMat	4	M	PAT	NO	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
IntCallMoneyR	7	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
JSXComposite	3	M	PAT	NO	COIN	LOW	COIN	LEAD	HIGH	COIN	COIN
NaturalGas	4	M	PAT	NO	LEAD	LOW	LEAD	COIN	HIGH	LAG	LAG
NickleOre	8	M	PAT	NO	LEAD	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
TimeDeposits	4	Mt	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
TinOre	2	M	PAT	NO	COIN	LOW	LAG	LAG	HIGH	COIN	COIN

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RUSSIAN FEDERATION

Test results for series that satisfy the selection criteria

Series	Score	Characteristics		Cross Spectral Analysis		NBER Analysis			Dynamic Factor Analysis		
	Number of tests with acceptable results	Freq. (1)	Transf. (2)	Coherence (3)	Mean delay (3)	Cross-correlation (4)		Turning point (TP) behaviour (5)	Common component variance over series variance (6)	Cross-correlation between common components (7)	Cyclical timing classification of series (8)
						r max	t max	t max			
Bopcurrent	7	Q	PAT	NO	LEAD	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
BopGoods	6	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	LEAD	LEAD
BuildBusTE	3	Q	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
BuildEmplFT	3	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	LAG	LAG
CPIAll	6	M	HP	NO	LEAD	LOW	LEAD	LEAD	HIGH	LEAD	LEAD
CrudeSteel	4	M	HP	YES	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
ExchRateEuro	7	M	PAT	YES	LEAD	LOW	LEAD	LEAD	LOW	LEAD	LEAD
GDP	2	Q	HP	NO	COIN	LOW	LEAD	COIN	HIGH	COIN	COIN
WorldPriceOil	4	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	COIN	COIN
InterBankRate	4	M	HP, I	YES	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
MfgDemand	5	M	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
MfgFinGStocks	4	M	PAT, I	NO	LEAD	LOW	LEAD	LEAD	LOW	COIN	LAG
MfgConfInd	5	M	HP	YES	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
MfgOrderBooks	5	M	HP	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
MfgProdFT	4	M	HP	YES	COIN	HIGH	COIN	COIN	HIGH	COIN	COIN
MfgProdTE	4	M	HP	YES	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
MfgSelPriceFT	6	M	HP	NO	LEAD	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
NaturalGas	6	M	PAT	NO	LEAD	HIGH	LEAD	LEAD	HIGH	COIN	LEAD
NetTrade	6	M	PAT	NO	LEAD	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
RetEmplFT	6	Q	HP	YES	LEAD	HIGH	LEAD	LEAD	HIGH	COIN	LAG
RetStocks	6	Q	HP, I	YES	LEAD	HIGH	LEAD	LEAD	HIGH	LAG	LAG
SharePrices	4	M	HP	YES	COIN	HIGH	LAG	LEAD	HIGH	COIN	COIN

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SOUTH AFRICA

Test results for series that satisfy the selection criteria

Series	Score	Characteristics		Cross Spectral Analysis		NBER Analysis			Dynamic Factor Analysis		
	Number of tests with acceptable results	Freq. (1)	Transf. (2)	Coherence (3)	Mean delay (3)	Cross-correlation (4)		Turning point (TP) behaviour (5)	Common component variance over series variance (6)	Cross-correlation between common components (7)	Cyclical timing classification of series (8)
						r max	t max	t max			
BuildBusSitFT	4	Q	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
BuildConfidence	4	Q	HP	YES	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
BuildOrderInfl	4	Q	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
RetailBusSitT	6	Q	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
RetailBusSitFT	7	Q	PAT	NO	LEAD	HIGH	LEAD	LEAD	HIGH	LEAD	LEAD
RetailConf	5	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	HIGH	COIN	LEAD
RetailEmploym	2	Q	PAT	NO	COIN	LOW	LAG	LEAD	LOW	COIN	LEAD
RetailOrderInfl	4	Q	PAT	YES	LAG	HIGH	LEAD	LAG	HIGH	COIN	COIN
MfgBusSitT	4	Q	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	LEAD
MfgBusSitFT	2	Q	PAT	NO	COIN	LOW	LEAD	COIN	HIGH	COIN	COIN
MfgConfidence	5	Q	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
MfgCapacity	3	Q	PAT	NO	LEAD	LOW	LEAD	LEAD	LOW	LAG	COIN
MfgEmploymFT	4	Q	PAT	NO	COIN	HIGH	LEAD	LEAD	HIGH	COIN	LAG
MfgOrderInflow	3	Q	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
MfgProductionT	3	Q	PAT	NO	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN
MfgSellPriceFT	5	Q	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
ConsConfidence	4	Q	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
ConsEconSitFT	4	Q	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
SalesPassCars	5	M	PAT	YES	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
WholeSalesVal	3	M	PAT	YES	LAG	HIGH	LAG	LEAD	HIGH	COIN	COIN
holeSalesVol	6	M	PAT	YES	COIN	HIGH	LEAD	LEAD	HIGH	COIN	COIN
GoldZaf	4	M	PAT	NO	COIN	LOW	LEAD	LEAD	HIGH	COIN	COIN
LTGovBond	2	M	PAT, I	NO	COIN	LOW	LEAD	LEAD	LOW	COIN	LAG
RealGDP	2	Q	PAT	YES	LAG	HIGH	LAG	LAG	HIGH	COIN	COIN
Exports	5	M	PAT	YES	COIN	HIGH	COIN	LEAD	HIGH	COIN	COIN
Imports	5	M	PAT	YES	COIN	HIGH	LEAD	COIN	HIGH	COIN	COIN

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