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Business Cycle Composite Indicators

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BACKGROUND

- Developed Composite Leading Index (CLI) in 1986

- Referenced Gross Domestic Product (GDP) prior to the development of Composite Coincident Index (CCI)

- Presently compiles CLI and CCI, and developing the Composite Lagging Index (CGI)

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Business Cycles

Source	Definition
National Bureau of Economic Research (NBER)	Recurrent sequences of alternating phases of expansion and contraction in the levels of a large number of economic and financial time series.
Investopedia Link: http://www.investopedia.com/terms/b/businesscycle.asp	The fluctuations in economic activity that an economy experiences over a period of time. A business cycle is basically defined in terms of periods of expansion or recession.
Economic Cycle Research Institute Link: https://www.businesscycle.com/ecri-business-cycle-definition	- Alternating periods of recession and recovery. - A type of fluctuation in aggregate economic activity in market-oriented economies.
Organisation for Economic Cooperation and Development (OECD) Link: https://stats.oecd.org/glossary/detail.asp?ID=244 https://stats.oecd.org/glossary/detail.asp?ID=245	- Recurrent sequences of alternating phases of expansion and contraction in economic activity. - A type of fluctuation found in aggregate economic activity of nations that organise their work mainly in business enterprises.
Singapore Department of Statistics Link: http://www.singstat.gov.sg/docs/default-source/default-document-library/publications/publications_and_papers/leading_indicators/ip-e25.pdf	Recurrent sequences of alternating phases of expansion and contraction in economic activity. a)Classical cycles (fluctuation in levels) b)Growth cycles (fluctuation in output-gap) c)Growth rate cycles (fluctuation in growth rate)

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Growth Cycles

Definition

Recurrent fluctuations in the series of deviations from trend

- Singapore adopts growth cycle chronology

  Additional references:
  Economic Survey of Singapore 2nd Quarter 2004
  Economic Survey of Singapore 2011

- economic activity on upward trend generally
- trend deviation series display clearer turning points than classical cycles in periods with very high long-term trends, esp. for series that are dominated by trend

Note: Timing difference between turning points in growth and classical cycles is normally not big in practice
[Quoted: Cyclical Indicators and Business Tendency Surveys, OECD, Paris 1997]

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Procedures involved to develop CLI / CCI

Steps

1) Identification of reference series
2) Selection of indicators
3) Assessment of indicators
4) Compilation of composite index
5) Assessment of composite index
6) Repeat from step 2 onwards until ideal composite index is found.

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Indicators Selection Criteria

Economic Significance

- Economic relevance
- Statistical adequacy

Timeliness

- Currency
- Periodicity

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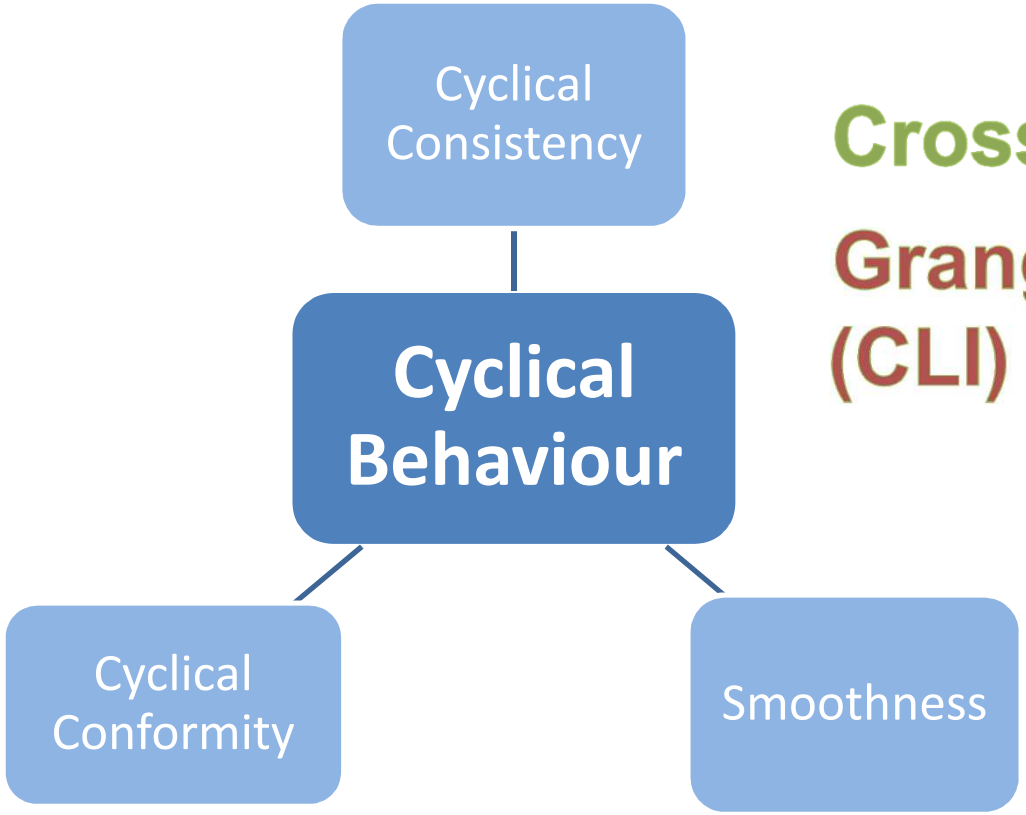
Assessment Criteria
Indicators / Composite Index



Cross-correlation

Granger causality test (CLI)

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Compilation of CLI / CCI

Largely in line with The Conference Board's (TCB) approach

1) Compute month-on-month changes for each component using symmetric percent change formula
2) Compute the standardization/normalization factor for each component using the computed month-on-month changes
3) Apply the standardization factor to the month-on-month changes to equalize volatility of each component
4) Sum the components' adjusted month-on-month changes for each month to obtain the growth rate of the composite index
5) Level of the composite index is computed using symmetric percent change formula

Additional pre-processing

- Components are seasonally-adjusted to remove seasonal fluctuations
- Quarterly components are interpolated into monthly data using cubic spline

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Compilation formula

Pre-processing

- Seasonally-adjust each component to remove seasonal fluctuations
- Quarterly components are interpolated into monthly data using cubic spline

Computation

1) Month-on-month changes for each component (*n* components)
2) Standardization/normalization factor for each component
3) Standardized month-on-month for each component
4) Sum the components' adjusted month-on-month
5) Level of the composite index

1) $x_t^i = \frac{X_t^i - X_{t-1}^i}{\left(\frac{X_t^i + X_{t-1}^i}{2}\right)} * 100$ or $x_t^i = X_t^i - X_{t-1}^i$

2) $r_m^i = \frac{\frac{1}{sd(x_m^i)}}{\sum_{k=1}^{n} \frac{1}{sd(x_m^k)}}$ where $sd(x_m^i) = \frac{1}{m-1}\sum_{t=1}^{m}(x_t^i - \bar{x}^i)^2$

3) $y_t^i = r_t^i x_t^i$

4) $c_t = \frac{\sum_{i=1}^{n} y_t^i}{\sum_{i=1}^{n} r_t^i}$

5) $CI_t = \left(\frac{200 + c_t}{200 - c_t}\right) CI_{t-1}$ where $CI_{base\_year} = 100$

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Identification of CLI turning points

- **Step 1: Obtain 6-month smoothed annualized growth rate (SMSAGR)**

$$SMSAGR(t) = \left[\left(\frac{CLI(t) * 12}{\sum_{i=1}^{12} CLI(t-i)}\right)^{\frac{12}{6.5}} - 1\right] * 100$$

- **Step 2: Identify Turning Points**

  Bry-Boschan algorithm is used to identify the turning points (peaks and troughs) of CLI SMSAGR

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Identification of CCI growth cycles

- **Step 1: Trend Estimation**

  Double Hodrick-Prescott (HP) filter to obtain smoothed de-trended cycle.

  Comparison of de-trending methods: OECD Ronny Nilsson and Gyorgy Gyomai
  Link: http://www.oecd.org/std/leading-indicators/41520591.pdf

- **Step 2: Identify Turning Points**

  Bry-Boschan algorithm is used to identify the turning points (peaks and troughs) of de-trended CCI.

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Updates / Monitoring

Annual

- ✓ updating of CCI growth cycle chronology (last updated in 2011)
- ✓ monitoring of CLI/CCI
- ✓ assessment of relevancy of indicators (no changes to indicators since 2004, other than data updates / rebasing of indicators)

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Leading Indicators

Components	Frequency of components
Total New Companies Formed	Monthly
Money Supply (M2)	Monthly
Stock Exchange of Singapore Indices	Monthly
Business Expectations for Wholesale Trade	Quarterly
Business Expectations for Stock of Finished Goods (Manufacturing)	Quarterly
US Purchasing Managers' Index (Manufacturing)	Monthly
Total Non-oil Seaborne Cargo Handled	Monthly
Domestic Liquidity Indicator	Monthly
Total Non-oil Retained Imports	Monthly

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Coincident Indicators

Components	Frequency of components
Gross Domestic Product (2010 = 100)	Quarterly
Index of Industrial Production (2011 = 100)	Monthly
Non-oil Domestic Exports (2012 = 100)	Monthly
Total Employment	Monthly
Retail Sales Index (2014 = 100)	Monthly

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Lagging Indicators

Components	Frequency of components
Unit Business Cost Index of Manufacturing (2010 = 100)	Quarterly
Unit Labour Cost Index of Manufacturing (2010 = 100)	Quarterly
Total Unemployment Rate [Reciprocal]	Quarterly
Gross Fixed Capital Formation (2010 = 100)	Quarterly
Consumer Price Index (2014 = 100)	Monthly

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Thank You

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A National Statistical System of Quality, Integrity and Expertise

Our Mission

We provide Reliable, Relevant and Timely Statistics to support Singapore's Social and Economic Development

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