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MEASURING BUSINESS CYCLES: A CROSS COUNTRY ANALYSIS

Deepa Soni¹ and Mamta Kumawat²

Mohanlal Sukhadia University, Udaipur (Rajasthan)

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ABSTRACT

The paper presents Business Cycle chronology for India, USA, UK, Japan, China using growth rate cycle method from the period 1991 to 2018. Paper uses cyclic series of Index of Industrial production as a reference cycle to identify the turning points as it is available at monthly frequency. Study also compares Duration, Amplitude & Slope of expansion & contraction phase of the selected countries & found that expansion is more stable for India and highly volatile for Japan while contraction is more volatile in India and least volatile for USA. To sum up, we can say that duration of contraction period is less than the duration of expansion period for all the economies except for the Japan. Amplitude shows that variation in the growth rate during each phase is highest for India. Amplitude of USA and China during contraction phase is higher than expansion phase which suggest that negative growth of these economies during the recession phase is higher as compared to the positive growth occurs during the expansion period. However, slope of all economies is more or less same.

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INTRODUCTION

Economic expansion and slowdown are inherent in economic systems. Identifying mechanism through which prolong expansion and recession occurs is the focus of macroeconomic theory & policy. Business cycle is the fluctuation in economic activity that economy experience over a period of time. These fluctuations include output from all sectors including household, non-profits as well as business output. Classical economist had denied existence of business cycle. Sismondi was the first to discover the existence of cycle by examining an economic crisis that occurred during peace time. The very conceptual aspect of the business cycle can best be defined by the definition given by the Burns and Mitchell (1946) as follows-

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

same time (Klein, 1994, p.4). As noted by Moore (1982): *No single measure of aggregate economic activity is called for in the definition because several such measures appear relevant to the problem, including output, employment, income, and trade, and no single measure is either available for a long period or possesses all the desired attributes*

Two features of a business cycle emerge from the above discussion. First, a genuine business cycle is marked by three “Ps” (Banerji, 1999). In other words, movements in economic activity have to be *pronounced, pervasive, and persistent* enough to fall into the category of a recession or expansion. Second, a single measure of economic activity cannot represent aggregate economic activity. Instead, a composite index of indicators that represents current economic activity (coincident index) is needed to identify and measure business cycles.

Thus, for the aggregate economic activity analysis of series such as retail sales, industrial production and GDP may be regarded as attempts to gauge the current state of demand and output production in the economy. Despite the fact that composite coincident index should be used, in recent years instead of using composite coincident index which is more complex, Very often, a single adequate measure of economic activity is used to date recessions. Eg. GDP or IIP.

Rest of the paper is organized as follows- Section 2 pertains the review of the earlier literature on business cycles. Section 3 entails is the brief discussion on methodology part. Section 4

*Corresponding author: **Deepa Soni**
Mohanlal Sukhadia University, Udaipur (Rajasthan)

extract the business cycles chronology for India, USA, UK, Japan and china. Section 5 is the summary and conclusions based on the overall study.

Review of Literature

Some of the path breaking studies on Business Cycle can be studied as under-

Radhika Pandey, Ila Patnaik and Ajay Shah (2018) in their paper presents the business cycle chronology for the Indian economy for two distinct phases – First for the pre-1991 period when the cycles were mainly driven by monsoon shocks and second for the post 1991 phase and found that conventional business cycles driven by investment-inventory fluctuations. The paper sheds light on the economic conditions that shaped the nature of cycles in the two phases.

Dua and Banerji (2012) identified business cycle monthly chronology for India using the classical approach. The authors identified periods of expansion and contraction based on the consensus of cyclical co-movements in the broad measures of output, income, employment and domestic trade measures. The authors constructed a coincident indicator using gross domestic product, general index of monthly industrial production, wages to workers in factory sector, monthly registered unemployed and Industrial production of consumer goods. The chronology of turning points by Dua and Banerji (2012) is also part of the Economic Cycle Research Institute (ECRI) chronology for India.

Chitre (2004) identified turning points in an index based on 94 monthly series for the period 1951-1982. After considerable experimentation, 11 monthly economic indicators are selected to determine the reference dates in India's overall economic activity. The author identified 8 peaks and 8 troughs using this index of 11 series.

Mohanty *et al.* (2003) identified 13 growth cycles of varying durations during the period 1970-71 to 2001-02 using monthly Index of industrial production (IIP) series. The computation of cycles are based on the dates identified using the Bry-Boschan algorithm.

Mall (1999) used the growth cycle approach to examine the cyclical behaviour of the Indian economy since 1950. The author identified six sets of turning points in Index of industrial production (IIP (Manufacturing)) as the peaks and troughs of the cycle in the period.

Present research work is an attempt to enrich the available literature by identify the turning points of India, USA, UK, Japan and china using the growth rate cycle approach from the period 1991 to 2018. The basis of selection of the above economies was that they are the top five economies based on Purchasing Power Parity.

METHODOLOGY

The business cycle is characterized by expansion and contraction. During expansion, the economy experience growth, while in a contraction period economy decline. There are three basic approaches for extracting business cycles namely- Classical approach, Growth cycle and Growth rate cycle approach. **Classical Business Cycles** measures ups and downs of the economy on the basis of the absolute levels of the

key coincident indicators. **Growth Cycle-** This approach consider the series as a deviation from its long-term trend which in Zarnowitz's terminology (1992) are known as growth cycles. **Growth Rate cycle-** Growth rate cycles are simply the cyclical upswings and downswings in the growth rate of economic activity. The growth rate used is the "six-month smoothed growth rate" concept, initiated by Moore to eliminate the trend. Growth rate cycle was used at Economic Council for International Research (ECRI), which was founded by Moore to monitor international economies in real time.

However, of the three approaches, business cycles and growth rate cycles are more suitable for real-time monitoring and forecasting, while growth cycles are more suitable for historical analysis (Klein, 1998). present research work adopts Growth rate cycle method to extract the cycles.

Determination of Turning Points and Dating Business Cycle using and Growth Rate Cycles approach

After deciding about the selection of growth rate cycle method for extracting the cycles, the next step is to identify the cyclical component of a particular time series. The practice of separating the trend and cyclical components using linear time series methods are well established. There are several approaches to de-trending economic time-series like- by assuming deterministic time trend, Hodrick Prescott filter, Band Pass filter method, etc. Present research work applied the Hodrick Prescott filter method to detrend the series.

Hodrick-Prescott (HP) filter

The HP filter refers to data-smoothing technique, which is commonly applied to remove short term fluctuation associated with the business cycle. Smoothed series are obtained by minimized the variance of seasonally adjusted series around its trend component. The filter removes non-stationary components i.e. unit root. The HP filter defines cyclic components of a time series y_t as –

$$y_t^c = \left[\frac{\lambda(1-L)^2(1-L^{-1})^2}{1 + \lambda(1-L)^2(1-L^{-1})^2} \right] y_t$$

Where λ is penalty variable for smoothening of the series $\lambda = 1600$ for quarterly data and for monthly series a value in the range of 100,000 – 150,000

Choosing Indicator/Reference series for Measuring Business Cycle

In business cycle a reference series is the benchmark series that captures fluctuations in the aggregate economic activity and on the basis of this series lead or lag behavior of other variables will forecast. Although Different countries use a variety of leading indicators like average work-week, index of overtime hours, application for unemployment compensation, new companies registered, new order, vendor performance, construction, stock prices, money supply, changes in sensitive material prices, index of consumer expectation etc. The leading indicator analysis of industrial output is used for gauging economic condition for the country as a whole (OECD) as Industrial production or manufacturing output data which are mostly available on a monthly basis have often been used as the reference series for leading indicator analysis.

Table 1 Analysis of Business Cycle for India

Dates of Peaks and Troughs		Duration (in Months)			Amplitudes		Slope	
Trough	Peak	Contraction	Expansion	Full Cycle	Contraction	Expansion	Contraction	Expansion
		P-T	T-P	P-P	P-T	T-P	P-T	T-P
	1991(3)							
1994(1)	1996(4)	34	27	61	-7.49	6	55.74	44.26
1997(1)	1997(11)	9	10	19	-3.81	2.57	47.37	52.63
1998(10)	2000(11)	11	25	36	-2.87	3.67	30.56	69.44
2002(1)	2004(4)	14	27	41	-2.51	3.43	34.15	65.85
2005(3)	2008(3)	11	36	47	-9.99	15.35	23.40	76.60
2009(2)	2011(3)	11	25	36	-14.98	19.07	30.56	69.44
2012(11)	2016(3)	20	40	60	-16.74	10.89	33.33	66.67
2017(7)		16			-10.83		37.33	
Average		15.75	27.14	42.86	-8.65	8.71	36.55	63.56
Standard Deviation		8.17	9.55	14.76	5.45	6.51	10.33	11.15

Table 2 Analysis of Business Cycle for China

Dates of Peaks and Troughs		Duration (in Months)			Amplitudes		Slope	
Trough	Peak	Contraction	Expansion	Full Cycle	Contraction	Expansion	Contraction	Expansion
		P-T	T-P	P-P	P-T	T-P	P-T	T-P
	1992(2)							
1993(10)	1996(12)	20	38	58	-0.08	0.07	34.48	65.52
1998(1)	1999(1)	13	12	25	-0.09	0.15	52.00	48.00
2002(2)	2004(2)	37	24	61	-0.17	0.16	60.66	39.34
2005(2)	2007(9)	12	31	43	-0.15	0.11	27.91	72.09
2008(11)	2011(2)	14	27	41	-0.11	0.09	34.15	65.85
2012(6)	2013(8)	16	14	30	-0.03	0.03	53.33	46.67
2016(1)	2017(6)	29	17	46	-0.02	0.02	63.04	36.96
2018(7)		13			-4.95			
Average		19.25	23.29	43.43	-0.7	0.09	46.51	53.49
Standard Deviation		9.10	9.52	13.25	1.72	0.05	14.11	14.11

Table 3 Analysis of Business Cycle for USA

Dates of Peaks and Troughs		Duration (in Months)			Amplitudes		Slope	
Trough	Peak	Contraction	Expansion	Full Cycle	Contraction	Expansion	Contraction	Expansion
		P-T	T-P	P-P	P-T	T-P	P-T	T-P
1991(3)	1994(9)		42			0.03		
1996(1)	2000(6)	16	53	69	-0.05	0.06	23.19	76.81
2001(11)	2004(6)	17	31	48	-0.08	5.19	35.42	64.58
2005(9)	2007(11)	15	26	41	-5.15	0.05	36.59	63.41
2009(2)	2010(6)	15	16	31	-0.13	0.17	48.39	51.61
2011(12)	2014(11)	18	35	53	-0.09	0.03	33.96	66.04
2016(4)	2018(2)	17	22	39	-0.06	0.05	43.59	56.41
Average		16.33	32.14	46.83	-0.93	0.80	36.85	63.15
Standard Deviation		1.21	12.54	13.24	2.07	1.94	8.67	8.67

Table 4 Analysis of Business Cycle for UK

Dates of Peaks and Troughs		Duration (in Months)			Amplitudes		Slope	
Trough	Peak	Contraction	Expansion	Full Cycle	Contraction	Expansion	Contraction	Expansion
		P-T	T-P	P-P	P-T	T-P	P-T	T-P
1991(4)	1994(5)		37			0.05		
1995(10)	1997(7)	17	21	38	-0.05	0.04	44.74	55.26
1999(2)	2000(4)	19	14	33	-0.04	0.05	57.58	42.42
2003(5)	2004(3)	37	10	47	-0.06	0.06	78.72	21.28
2005(3)	2008(4)	12	37	49	-0.06	0.06	24.49	75.51
2009(2)	2010(8)	10	18	28	-0.11	0.14	35.71	64.29
2012(7)	2014(12)	23	29	52	-0.09	7.55	44.23	55.77
2016(11)	2018(4)	23	17	40	-7.54	0.04	57.50	42.50
2018(12)		8			-0.03			
Average		18.63	22.88	41	-1.00	1.00	49.00	51.00
Standard Deviation		9.33	10.30	8.79	2.64	2.65	17.55	17.55

Dating and Analysis of Business cycles

Therefore the present study had chosen the monthly data of IIP as a reference cycle to identify the expansion and contraction for the selected countries. IIP Data for these countries are taken from the world bank.

The present section pertains to the dating and analysis of business cycle for India and few selected leading economies of the world viz. USA, UK, JAPAN and China.

Table 5 Analysis of Business Cycle for Japan

Dates of Peaks and Troughs		Duration (in Months)			Amplitudes		Slope	
Trough	Peak	Contraction P-T	Expansion T-P	Full Cycle P-P	Contraction P-T	Expansion T-P	Contraction P-T	Expansion T-P
	1991(1)	-	-	-	-	-	-	-
1994(1)	1994(12)	36	11	47	-0.08	0.09	76.60	23.40
1996(4)	1997(3)	16	11	27	-0.09	0.09	59.26	40.74
1998(8)	2000(6)	17	22	39	-0.15	0.16	43.59	56.41
2001(12)	2004(7)	18	31	49	-0.19	0.16	36.73	63.27
2005(7)	2008(1)	12	30	42	-0.08	0.11	28.57	71.43
2009(2)	2010(2)	13	12	25	-0.36	0.59	52.00	48.00
2011(4)	2012(3)	14	11	25	-0.43	0.29	56.00	44.00
2013(1)	2014(1)	10	12	22	-0.23	0.16	45.45	54.55
2016(5)	2017(2)	28	9	37	-0.12	0.11	75.68	24.32
2018(9)		19			-0.11			
Average		18.3	16.56	34.78	-0.18	0.20	52.62	47.35
Standard Deviation		7.96	8.73	10.26	0.12	0.16	77.60	16.30

Note: P-T represents Peak to Trough
 T-P represents Trough to Peak
 P-P represents Peak to Peak

Table 6 Comparative Analysis of Business Cycles

Economy	Contraction						Expansion							
	Duration			Amplitude		Slope	Duration			Amplitude		Slope		
	Mean	SD	CV	Mean	CV	Mean	CV	Mean	SD	CV	Mean	CV	Mean	CV
India	15.75	8.17	51.89	8.65	0.63	36.55	0.28	27.14	9.55	35.17	8.71	0.74	63.56	0.17
China	19.25	9.1	47.27	-0.7	2.45	46.51	0.3	23.29	9.52	40.87	0.09	0.55	53.49	0.26
USA	16.33	1.21	7.41	-0.93	2.22	36.85	0.23	32.14	12.54	39	0.8	2.45	63.15	0.14
UK	18.63	9.33	50.12	-1	2.64	49	0.35	22.88	10.3	45.03	0.1	2.65	51	0.34
JAPAN	18.3	7.96	43.49	0.18	0.66	52.62	1.47	16.56	8.73	52.75	0.2	0.8	47.35	0.34

The study period of analysis was taken from year 1991 to 2018 using growth rate cycle method. For analysis of all the economies, the reference cycle of IIP (Index of Industrial Production) was taken.

The main characteristics of cyclical phases are their duration, amplitude, and slope. The duration of a recession/downturn, is the number of months from a peak to the next trough of a variable. Likewise, the duration of a recovery/upturn, is the number of months it takes for a variable to reach its peak after the previous trough.

The amplitude of a recession/downturn, A_c , measures the change in the series (yt) from a peak ($y0$) to the next trough (yk), i.e., $A_c = yk - y0$. The amplitude of a recovery/upturn, A_u , measures the change in yt from a trough (yk) to the level reached to its peak level ($yk+p$), i.e., $A_u =$

$yk+p - yk$. Finally, the slope of a recession/downturn is the ratio of the amplitude to the duration of the recession/downturn. Thus, the slope measures the violence (or speed) of a given cyclical phase. Analysis of the result is as follows-

India: Table-1 shows business cycle chronology for the Indian economy since 1991 and gives dating of peak & trough and duration of expansion and contractions for the period 1991 to 2018. In India, total 7 growth cycle of various durations were identified. The average duration of full cycle was 42.86 months with standard deviation of 11.15 months. From this table, further it can be inferred that the highest contraction was of 34 months from March 1991 to Jan 1994. The average period of contraction was 15.75 months with standard deviation of 8.17 months. In contrast, average amplitude for contraction period is (-8.65) with highest (-16.74) for the period of 2012 to 2016.

There were five periods of expansion of more than 20 months and two periods of expansions were above 35 months. The maximum period of expansion was of 40 months from November 2012 to March 2016. The average period of expansion was 27.14 months with standard deviation of 9.55 months similarly, average amplitude for expansion is 8.71. Thus, average period of expansion is more than average period of contraction for India.

China: Table-2 shows business cycle chronology for the China since 1992 and gives dating of peak & trough and duration of expansion and contractions for the period 1992 to 2018. Total seven growth cycle of various durations were identified in China. Maximum period of contraction was of 37 months. The average period of contraction was 19.25 months with standard deviation of 9.10 months.

As far as expansion period is concerned the maximum period of expansion was of 38 months from October 1993 to December 1996 with the average period of expansion was of 23.29 months with standard deviation of 9.52 months.

USA: Table-3 shows analysis of business cycle for USA from March 1993 to February 2018. From the table it can be observed that contraction period for USA varies between 15 months to 18 months whereas the period of expansion varies between minimum 16 months to maximum 53 months. During six business cycles from March 1993 to February 2018 the contraction period was rather constant with mean value of 16.33 months and standard deviation of 1.21. The maximum period of expansion was of 53 months from Jan 1996 to June 2000. The average period of expansion was of 32.14 months with standard deviation of 12.54 months.

UK: For UK total 7 growth cycles were identified with average duration of 41 month and standard deviation of 8.79 months. Table-4 display dates of peak and trough and duration of

contraction and expansion for United Kingdom from April 1991 to December 2018. The average period of contraction was 18.625 months with standard deviation of 9.33 months and the average period of expansion was 22.875 months with standard deviation of 10.302. Result suggest that there is a high degree of variability in amplitude & slope during both expansion & contraction phase.

Japan: For Japan total 9 growth cycles were identified with average duration of 34.78 months & standard deviation of 10.26 months. Table-5 exhibits the dates of peaks and trough for Japan for the period January 1991 to September 2018. The average period of contraction was of 18.30 months with standard deviation of 7.96 months and the average period of expansion was of 16.56 months with standard deviation of 8.73 months. Thus, for Japan the average duration of contraction was more as compared to average period of expansion. The slope of expansion & contraction of Japan shows high degree of variability as compare to other four economies.

CONCLUSION AND SUMMARY

On the basis of the above result it can be corroborated that contraction period is highest for China, while least for India however, variability (coefficient of variation) is highest for India during contraction phase (Table-6). Again so far as amplitude is concerned, India shows highest average with least variation and it is highly scattered for UK. However, the speed of the cyclic phase (contraction) shown by slope depicts high degree of variation for Japan & more stable for USA.

On the other hand average so far as the expansion period is concerned, it is highest for USA & least for Japan with greater variation in Japan & least for India. Amplitude shows least variation for China & highest for UK. Result of slope for expansion period depicts high degree of stability for USA & greater variability for Japan and UK.

To sum up, we can say that duration of contraction period is less than the duration of expansion period for all the economies except for the Japan. Amplitude shows that variation in the growth rate during each phase is highest for India. Amplitude of USA and China during contraction phase is higher than expansion phase which suggest that negative growth of these economies during the recession phase is higher as compared to the positive growth occurs during the expansion period. However, slope of all economies is more or less same.

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