

## A Statistical Investigation of Business Cycles Characteristics in Pakistan

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### Abstract

*This study investigates the business cycle characteristics for Pakistan using three sets of variables namely expenditure components of GDP, nominal variables and real variables. The findings reveal that the volatility of expenditure components are greater than GDP during the full sample of 1973 to 2015. Whereas, in the Pre-SAP and Post-SAP periods i.e. 1973-1988 and 1989-2015, real variables and nominal variables show more volatility than GDP. And, in terms of co-movement, expenditure components of GDP showed strong pro-cyclicality and relationship with GDP against other sets of variables. Moreover, the nominal variables show positive persistence and the business cycles caused by it, lasting for a long time against real variables and expenditure components of GDP. Furthermore, the results show that the correlation between CPI and GDP across all periods is counter cyclical. The stability test results show that business cycles features remained stable during two time periods.*

**Key Words:** Business Cycles, GARCH, Volatility, SAP

**JEL Classification:** E32.

### Background of the Study

Since great depression, studies on business cycles got serious attention from the policy makers in both the developing and developed countries. They developed various approaches for the measurement of business cycles. Normally, the growth fluctuations contain irregular movements between expansion or boom periods and recession or contraction periods. This display of changing growth rate in an economy is usually known as the business cycle.

Cashin, et al. (1999) and Harding and Pagan (2005) presented two different approaches for the explanation of business cycles. The first approach is known as the classical cycle. They defined the business cycle as a situation where a serial pattern exhibits in expansions and contractions of economic activity at aggregate level (Burns and Mitchell 1946). Whereas, Lucas (1977) and Kydland and Prescott (1991) defined the business cycle the deviations of aggregate real output from the trend. Under this methodology, in the business

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cycle, the trend can be detached from the data and then the cyclical component can be examined.

Similarly, in literature, there are different schools of thought suggesting a variety of theoretical models for investigating the disposition, causes and dissemination of business cycle fluctuations. Among them, the main driving force is shocks or disturbances that cause fluctuation or generate the cycle. As per the Keynesian business cycle, market expectations are also volatile about future sales and profits. Monetarists are of the view that variations in monetary growth rate causes to the business cycle, New Classical theory referred it due to unexpected fluctuations in aggregate demand and random shocks to total factor productivity that are caused by technological change. These theories added important contributions to the understanding of the salient features of macroeconomic fluctuations. All had experienced remarkable developments with the improvements in econometric and statistical methods since the revolutionary research on the statistical testing of business cycles (Burns & Mitchell, 1946).

From the history of Pakistan, it is evident that economic variations in Pakistan qualitatively follow the typical characters of the business cycles of developed economies. For instance, the higher degree of co-movement of manufacturing and services output with GDP can simply be attributed to the structural changes experienced by the Pakistan economy. Conversely, the common pattern of the co-movement among the macro-variables has been substantively changed. The situation worsened during the 1980s, when the Pakistan economy was facing a huge fiscal deficit and their revenue receipts were too low. Due to these and other macroeconomic problems faced by the economy of Pakistan, structural and institutional reforms were needed. Authorities in Pakistan were forced by the situation at that time to accept policy packages proposed by IMF under the title of structural adjustment program (SAP) in 1988 for the macroeconomic stability. The policy package proposed by the IMF, adopted by authorities in Pakistan, however, exaggerated the instability in the economy.

The present study aims to investigate the statistical characteristics of volatility, persistence and comovement of business cycles for the Pakistan economy during 1973-2015. This study is different from other studies in three ways. First, it is the first study which investigates the statistical properties of business cycles in Pakistan. Second, a large and up-to-date span of data covering the period 1973-2015 is used. Third, this paper is the first exercise to comprehensively document an exhaustive set of stylized facts for the economy of Pakistan in the pre and poststructural adjustment program initiated by IMF. Fourth, we conducted a stability analysis for each property being analyzed.

## **Literature Review**

In literature, since the work of Kydland and Prescott (1982), we can find a lot of empirical literature on the business cycle phenomenon. Shapiro and Watson (1988) address the business cycle incidence and long-run movements of output and prices. They found that supply shocks like shocks to technology, oil prices and labor supply are the main drivers that affect output in the long run. Karras and Song (1996) analyzed the sources of output volatility in twenty-four OECD economies by using annual data. The results showed that the more variable the money supply is, the more pronounced would be the business cycle as hypothesized by real business cycle theory. Kydland and Zarazaga (1997) tested whether real against nominal shocks are the primary source of economic fluctuations in Argentina.

Their results revealed that nominal factors are unable to show any important fraction of business cycle fluctuations of Argentina. Kose et al. (2003) studied the degree of similarities and differences in business cycle features for some of the Asian countries and equates with those of the G-7 countries. Volatility properties of investment and government spending vary significantly across sampled countries. For the cross-country correlations of output fluctuations, the results revealed that business cycle fluctuations in the Asian economies display a high degree of co-movement.

Lane (2003) study results showed that factors including domestic and external are contributing to pro-cyclical forces on macroeconomic policies in EMEs. Further, he stated that to realize the business cycles in EMEs, the existence of foreign debt and credit market frictions should be kept in mind. Ahmed (2003) analyzed the sources of economic fluctuations for six Latin American countries. The study investigates whether economic fluctuations are caused by external shocks or by domestic shocks. His results suggest that external factors have a smaller portion in the elucidation of the variation in domestic output. Aries et al. (2007) concluded that since 1983, the factor determining business cycle volatility declines is productivity shocks. Apergis and Panethimitakis (2007) examined the performance of basic macroeconomic variables concerning the business cycles in Greek. The authors concluded that real shocks were the main forces that drive the economy, suggesting that demand policies are unsuccessful. Calderon and Fuentes (2010) have tested business cycles of EMEs and inspected the co-movements of cycles among their sample of 23 EMEs and 12 developed countries. Results showed that exchange rate and term of trade shocks have an influential role in elucidation the sources of business cycles. Ghate et al. (2013) analyzed the business cycle in India and found that the level of volatility of macroeconomic variables in the post-reform period is still high and can be compared to emerging economies. Djennas (2016) assessed the role of Islamic finance in an economic system via modeling a composite index for analyzing the risk of crisis caused by financial openness and its impact on growth and volatility of business cycle and found that those countries that adopt the principles of Islamic finance are strongly positioned to avoid various situations of crisis and economic downturns. Mckay and Reis (2016) analyzed the role of automatic stabilizers in the US business cycle. They measured the effects of the tax-and-transfer system on the dynamics of the business cycle in the US and found that that the conventional argument that stabilizing disposable income will stabilize aggregate demand plays a negligible role in the dynamics of the business cycle.

## **Data and Methodology**

Three categories of variables including the expenditure components to GDP, real variables and nominal variables has been selected for the empirical analysis. The expenditure components consist of Gross Domestic Product, gross total consumption, Government consumption, private consumption, gross total investment, fixed investment, Government investment and private investment. Similarly, the real variables selected are Employment, Agriculture as a percentage of GDP, agricultural employment, the industry as a percentage of GDP, industrial employment, services as a percentage of GDP, services employment, capital stock, wages rate. Whereas, the nominal variables are Money Supply (M1), Money Supply (M2), Velocity of Money (V1), Velocity of Money (V2), Terms of Trade, Consumer Price Index and Nominal Interest Rate. Hodrick Prescott filter method has been

applied for separating the short term cyclical components of the data from the long run trend components of the data.

The time period of the study is from 1973 to 2015. The empirical section has been divided into two sections. First, the volatility, co-movement and persistence characteristics of the business cycles have been measured by using the full sample period data of 1973 to 2015. For the measurement of volatility, the GARCH test has been used. On the other hand, for co-movement correlation and first-order autocorrelation is used for measuring persistence. After that, the full sample period of 1973 to 2015 has been divided into two sub-sample periods i.e. pre-SAP period of 1973 to 1988 and post-SAP period of 1989 to 2015. And the statistical features of volatility, co-movement and persistence of the data have been investigated for both the subsample periods. A Bartlett’s test has been employed for examining whether the variance of each time series over time period observed is time invariant or not. This test has been performed on the data of the whole sample ranging from 1973-2015. If the value of Bartlett’s test turned out to be significant at the selected level of significance it means that the variance of the time series is time-invariant and shows stability. To investigate the dynamic stability of the measures of persistence and co-variability or co-movement, we have employed a standard F-test (Chow-test). The data for all the variables are collected from the Economic Surveys of Pakistan, and World Development Indicators of World Bank.

## Results and Discussions

Table 1. Shows the Volatility, Co-Movement and Persistence Characteristics of Expenditure Components of GDP, Real and Nominal Variables for Pakistan from 1973 to 2015.

**Table 1.** Business Cycles Characteristics in Pakistan during 1973-2015

Variables		Business Cycles Characteristics		
		Volatility	Co-movement	Persistence
Expenditure Components of GDP	Gross Domestic Product	1.40	1.00	0.60
	Gross Total Consumption	1.25	0.96	0.35
	Private Consumption	1.24	0.94	0.70
	Government Consumption Expenditure	1.19	0.97	0.91
	Gross total Investment	1.41	0.99	0.66
	Gross fixed Investment	1.44	0.99	0.66
	Public Investment	1.28	0.99	0.85
	Reference Cycle			

<b>Real Variables</b>	Private Investment	1.39	0.99	0.79
	Agriculture Employment	1.08	-0.71	0.80
	Total Employment	1.06	0.69	0.74
	Services Employment	1.08	0.50	0.68
	Real Interest	0.67	0.22	0.88
	Industry as %age of GDP	1.02	-0.73	0.72
	Services as %age of GDP	1.14	0.76	0.70
	Agriculture as %age of GDP	0.96	-0.48	0.92
	<b>Nominal Variables</b>	Money Supply (M1)	1.65	0.88
Money Supply (M2)		1.31	0.37	0.99
Velocity of Money (V1)		1.15	0.65	0.80
Velocity of Money (V2)		1.22	0.95	0.83
Terms of Trade		7.08	-0.83	0.88
Consumer Price Index		0.84	-0.09	0.80
Nominal Interest Rate		1.11	0.32	0.85

*Source: Author's calculation from the data*

Table 1 shows the volatility, co-movement and persistence characteristics of the business cycle of Pakistan during 1973-2015. The GDP has been used as a reference cycle and the rest of the variables would be compared to GDP in terms of volatility, co-movement and persistence characteristics.

As volatility assesses the amplitude of fluctuations and indicates the contribution of a variable to aggregate fluctuations. The volatility of GDP is 1.40. Amongst the expenditure components of GDP, gross total investment and gross fixed investment are more volatile than GDP showing the volatility of 1.41 and 1.44 respectively. While the rest of the variables are less volatile than GDP with government consumption expenditure remaining least volatile component with the volatility of 1.19. Amongst the real variables, all the variables are less volatile than GDP with agriculture as a percentage of GDP the least volatile variable with the volatility of 0.96. While services as a percentage of GDP is the most volatile component among the real variables with the volatility of 1.14. Among the

nominal variables reported, terms of trade is the most volatile variable with the volatility of 7.08. Except for M1 which is more volatile than GDP with a volatility of 1.65, the rest of the variables in the set are less volatile than GDP with CPI the least volatile showing volatility of 0.84.

Co-movement shows the cyclicity of key macroeconomic variables and. Positive co-movement shows that variables and output move in the same direction and vice versa. Co-movement of GDP, with itself is 1.00. While among the expenditure components of GDP, all variables in the set are strongly pro-cyclical. All the components of investment i.e. gross total investment, gross fixed investment, public investment and private investment with co-movement of 0.99. While private consumption expenditure is the weakly pro-cyclical component with co-movement of 0.94. Amongst the real variables, agriculture sector employment, the industry as a percentage of GDP and agriculture as a percentage of GDP are countercyclical with co-movement of -0.71, -0.73 and -0.48 respectively. While the rest of the variables i.e. total employment, services sector employment, real interest rate and services as a percentage of GDP are pro-cyclical with co-movement of 0.69, 0.50, 0.22 and 0.76 respectively. Among the set of nominal variables, terms of trade and consumer price index are countercyclical with co-movement of -0.83 and -0.09 respectively. M1 strongly pro-cyclical with co-movement of 0.88. While the nominal interest rate is weakly pro-cyclical with co-movement of 0.32.

The persistence of GDP is 0.60. Among the expenditure components of GDP, government consumption expenditure shows highly persistence of 0.91. While gross total consumption expenditure shows low persistence of 0.35. Among the real variables, agriculture as a percentage of GDP shows a high persistence of 0.92 and the services sector show low persistence of 0.68. Among the set of nominal variables reported M2 to show high persistence of 0.99 and M1 show low persistence of 0.75. To investigate the characteristics business cycles during pre and post SAP periods in Pakistan more results have been computed by dividing the full sample period into two subsample periods i.e. 1973 to 1988 and 1989 to 2015 by taking 1988 as a structural break period. The results for the pre-SAP period is given in table 2 as below

**Table 2.** Business Cycles Characteristics in Pakistan during 1973-1988

	Variables	Business Cycles Characteristics		
		Volatility	Co-movement	Persistence
<b>Reference Cycle</b>	Gross Domestic Product	1.31	1.00	0.65
<b>Expenditure Components of GDP</b>	Gross Total Consumption	0.77	0.98	-0.38
	Private Consumption	0.81	0.97	0.96
	Government Consumption Expenditure	0.79	0.97	0.97
	Gross total Investment	1.43	0.99	0.58
	Gross fixed Investment	0.85	0.99	-0.62
	Public Investment	1.11	0.99	0.90

	Private Investment	0.71	0.99	-0.46
	Agriculture Employment	1.93	-0.95	-0.55
	Total Employment	1.98	-0.75	0.87
	Services Employment	2.42	0.99	-0.05
	Real Interest	1.21	0.76	0.73
<b>Real Variables</b>	Industry as %age of GDP	1.05	0.70	0.74
	Services as %age of GDP	1.02	-0.97	-0.02
	Agriculture as %age of GDP	1.01	0.97	0.73
	Money Supply (M1)	1.57	0.99	0.65
<b>Nominal Variables</b>	Money Supply (M2)	1.10	0.99	-0.64
	Velocity of Money (V1)	0.71	0.96	-0.05
	Velocity of Money (V2)	0.86	0.95	0.97
	Terms of Trade	0.58	-0.08	0.77
	Consumer Price Index	1.22	-0.75	0.75
	Nominal Interest Rate	0.42	0.66	0.85

*Source: Author's Calculation from the data*

The results showed that the volatility of GDP is 1.31. While amongst the expenditure components of GDP, gross total investment volatility is 1.43. Private investment is the least volatile component with a volatility of 0.71. Amongst the real variables, services sector employment is the most volatile series with the volatility of 2.42 and agriculture as a percentage of GDP is the least volatile series with the volatility of 1.01. Analyzing the nominal variables, narrow money supply (M1) is the most volatile series with a volatility of 1.57. Except for M1, all variables in the set are less volatile than GDP with nominal interest the least volatile series having the volatility of 0.42. Among the three sets analyzed, the nominal variables are the least volatile components.

The co-movement GDP with itself is 1.00. All the expenditure components of GDP are strongly pro-cyclical. The investment components show strong pro-cyclicality with GDP with a co-movement of 0.99 each. Among the set of real variables, agriculture sector employment, total employment, and services as a percentage of GDP are strongly countercyclical with co-movement of -0.95, -0.75 and -0.97 respectively. While other variables are strongly pro-cyclical with industry as a percentage of GDP the weakly pro-cyclical series with co-movement of 0.70. In the set of nominal variables, TOT and CPI are the countercyclical series with co-movement of -0.08 and -0.75. Other variables are strongly pro-cyclical with M1 and M2 strongly pro-cyclical with co-movement of 0.99 and nominal interest is the weakly pro-cyclical series with co-movement of 0.66.

In terms of persistence, the persistence of GDP is 0.65. Among the expenditure components of GDP, gross total consumption expenditures, gross fixed investment, and private investment are negatively persistent with the persistence of -0.38, -0.62 and -0.46 respectively. Private consumption is highly persistent series having persistence of 0.96 among the variables in the set. Among real variables, agriculture sector employment, services employment, and services as a percentage of GDP are negatively and low persistent series in the set with the persistence of -0.55, -0.05 and -0.02. While the rest of the variables show positive and high persistence. Among the nominal variables M2 and V1 showed negative and relatively low persistence as compared to other variables in the set

having persistence of -0.64 and -0.05. The remaining variables in the set show positive and high persistence with V2 showed positive and high persistent with the persistence of 0.97. Similarly, results for the post SAP period are given in Table 3 as below.

**Table 3.** Business Cycles Characteristics in Pakistan during 1989-2015

	Variables	Business Cycles Characteristics		
		Volatility	Co-movement	Persistence
Reference Cycle	Gross Domestic Product	1.30	1.00	0.62
	Gross Total Consumption	0.95	0.93	0.70
Expenditure Components of GDP	Private Consumption	0.93	0.93	0.70
	Government Consumption Expenditure	1.09	0.95	0.71
	Gross total Investment	1.11	0.99	0.82
	Gross fixed Investment	1.15	0.99	0.81
	Public Investment	1.23	0.99	0.85
	Private Investment	1.12	0.98	0.79
	Agriculture Employment	2.41	-0.64	0.69
	Total Employment	1.01	0.87	0.74
Real Variables	Services Employment	0.82	0.11	0.70
	Real Interest	1.47	0.02	0.85
	Industry as %age of GDP	1.09	-0.95	-0.01
	Services as %age of GDP	0.98	-0.23	0.83
	Agriculture as %age of GDP	1.09	0.82	0.42
Nominal Variables	Money Supply (M1)	1.09	0.84	0.75
	Money Supply (M2)	1.85	0.05	0.76
	Velocity of Money (V1)	0.94	0.54	0.80
	Velocity of Money (V2)	1.23	0.95	0.83
	Terms of Trade	4.22	-0.80	0.93
	Consumer Price Index	1.29	-0.08	0.98
	Nominal Interest Rate	2.12	0.09	0.84

Source: Author's Calculation from the data

Table 3 showed that the volatility of GDP is 1.30. Reporting volatility characteristics of expenditure components of GDP, we found that all variables in the set are less volatile than GDP, public investment is the most volatile series in the set with the volatility of 1.23 while private consumption expenditures are least volatile series in the set with the volatility of 0.93. Among the series of real variables, agriculture employment is the most volatile series in the set with the volatility of 2.41 while services sector employment is the least volatile



series in the set with the volatility of 0.82. The real interest is also more volatile than GDP with a volatility of 1.47. Reporting the volatility of nominal variables, we found that TOT is the most volatile series in the set with the volatility of 4.22. While V1 is the least volatile series in the set with the volatility of 0.94. Despite terms of trade, M2 and nominal interest rates are also more volatile than GDP with a volatility of 1.85 and 2.12.

Investigating the co-movement characteristic of GDP, the reference cycle turns 1.00. The expenditure components of GDP show strong pro-cyclicality with GDP with gross total investment, gross fixed investment and public investment are strongly pro-cyclical with GDP with the value of co-movements 0.99 each while gross total consumption expenditures and private consumption expenditures weakly pro-cyclical as compare to other variables in the set with co-movement of 0.93 each. Amongst real variables, agriculture employment, the industry as a percentage of GDP and services as a percentage of GDP are countercyclical with co-movement of -0.64, -0.95 and -0.23 respectively. While, the remaining variables are pro-cyclical, total employment strongly pro-cyclical with a co-movement of 0.87. Among the nominal variables, TOT and CPI show counter cyclical of -0.80 and -0.08 respectively. While the rest of the variables are pro-cyclical.

Measuring the persistence, the results revealed that the persistence of GDP is 0.62. Among the expenditure components of GDP, public investment persistence value is 0.85. Persistence of real variables displays strong persistence except industry as a percentage of GDP, which is negatively low persistent with the value of persistence -0.01. Among the nominal variables, the persistence of CPI is the highest among the set with a value of persistence 0.98. While M1 showed low persistence with a value of 0.75 as compared to the other variables in the set.

### **Stability Analysis Results**

The stability test results are presented in Table 4 below.

**Table 4.** Stability Tests Results of Business Cycles: 1973-2015

	Variables	Business Cycles Characteristics		
		Volatility Bartlett test	Co-movement Chow test	Persistence Chow test
<b>Reference Cycle</b>	Gross Domestic Product	0.41*	1.00	0.02
	Gross Total Consumption	2.82	0.80**	0.59
<b>Expenditure Components of GDP</b>	Private Consumption	8.81***	10.37	0.14
	Government Consumption Expenditure	1.73	6.51	0.05
	Gross total Investment	0.27	0.98	0.00
	Gross fixed Investment	0.95	0.76*	0.00

	Public Investment	0.55	1.12	2.71
	Private Investment	3.79	3.97	2.93***
	Agriculture Employment	4.79***	2.10	2.12
	Total Employment	4.44	9.85***	0.01
<b>Real Variables</b>	Services Employment	11.20*	0.56	0.39
	Real Interest	0.69	3.75	8.80*
	Industry as %age of GDP	1.23	2.38	0.94
	Services as %age of GDP	1.69	2.93**	0.04
	Agriculture as %age of GDP	0.96	7.08**	1.44
<b>Nominal Variables</b>	Money Supply (M1)	0.05	0.65**	0.10
	Money Supply (M2)	2.61	11.27	28.15*
	Velocity of Money (V1)	4.79	3.34	0.06
	Velocity of Money (V2)	5.81***	15.93**	0.07
	Terms of Trade	11.79*	4.88*	1.19
	Consumer Price Index	6.13	9.41	6.84**
	Nominal Interest Rate	1.46	2.57***	0.13

*Source: Author Calculation from the data*

Asterisks \*, \*\* and \*\*\* denotes significance at 1%, 5% and 10% respectively.

Table 4 shows that except aggregate GDP and private consumption, the rest of the stylized facts show signs of stability under expenditure components of GDP. While for real variables, except agriculture employment and services employment, the rest of the variables showed a sign of stability. Among the nominal variables, the stability of the volatility measure of stylized facts across the two subsamples shows that except V2 and TOT, rest of the stylized facts show signs of stability. In terms of co-movement, expenditure components of GDP show that only two stylized facts, gross total consumption and gross fixed investment display signs of instability, for real variables, three stylized facts, total employment, services as percentage of GDP and agriculture as percentage of GDP, being reported are time-invariant while four stylized facts, M1, V2, terms of trade and Nominal interest rate are showing signs of instability among nominal variables. The stability of persistence measure for expenditure components of GDP shows that only private investment shows the instability over time, for real variables, only one real interest is showing stability while for nominal variables only two stylized facts, M2 and CPI of persistence measure are showing signs of stability.

## Conclusion

The findings revealed that expenditure components of GDP showed greater volatility than GDP during the whole sample period. Whereas, during Pre-SAP and Post-SAP periods real

variables and nominal variables were found more volatile than GDP respectively. Whereas, in terms of co-movement expenditure components of GDP showed strong pro-cyclicality with GDP which shows that expenditure components of GDP were showing a strong relationship with GDP against the nominal and real sets of variables during periods. Moreover, the nominal variables showed high positive persistence during all three periods which showed that the business cycles caused by the nominal variables against real variables and expenditure components of GDP variables were lasting for a long time. And in terms of co-movement, all the three sets of variables during Pre-SAP period showed strong cyclicality. Furthermore, the results showed that correlation between CPI and GDP across the whole, Pre and Post-SAP period is countercyclical i.e. -0.09, -0.75 and -0.08 respectively. The stability analysis results reveal that volatility, co-movement, persistence altered across the two periods i.e. pre and post-SAP, the majority of business cycle regularities remain qualitatively remained unchanged and they didn't change the features of the business cycle.

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