

**EXPLORING THE RELATIONSHIP BETWEEN  
FINANCIAL, MACROECONOMIC UNCERTAINTY AND  
BUSINESS CYCLES: A CASE OF PAKISTAN USING  
MEDIATION AND MODERATION ANALYSIS**



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# Pakistan Institute of Development Economics

## CERTIFICATE

This is to certify that this thesis entitled: “**Exploring the Relationship Between Financial, Macroeconomic Uncertainty and Business cycles: A Case of Pakistan using Mediation and Moderation Analysis**” submitted by Mr. Abdul Basit Alias Shahzad is accepted in its present form by the Department of Econometrics and Statistics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in **Master of Philosophy in Econometrics**.

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# *Dedicated*

**To my beloved parents, teacher and friends.**

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## ABSTRACT

The present study is aimed to explore the relationship between business cycle fluctuations and financial, macroeconomic uncertainty in Pakistan economy using yearly time series data from 1998 to 2017. The mediation and moderation analysis are used to derive channels with which outcome variable is affected as a response to independent variable and based on that a theoretical relationship is established between the variables in the consideration. This technique is a-theoretical itself and is used to develop theoretical relationship between variables that are having mix evidence of affecting each other. The objective of this study is to find out how or why business cycle is affected by macroeconomic or financial uncertainty and to use a different approach which addresses the causal relationships. Theories on the business cycles have not clarified whether uncertainty is the outcome or cause of business cycles? And which kind of uncertainty causes business cycles. This study found that in Pakistan the relationship between business cycles and macroeconomic uncertainty is mediated by financial uncertainty. Similarly, the relationship between financial uncertainty and business cycles is also mediated by macroeconomic uncertainty. Implying that, separately financial or macroeconomic uncertainty is statistically insignificant in affecting business cycles. In other words, macroeconomic uncertainty affect business cycles through its impact on financial uncertainty or financial uncertainty affect business cycles through its impact on macroeconomic uncertainty. The direction of relationship between financial uncertainty, macroeconomic uncertainty and business cycle fluctuations is not affected by adding a third variable as interaction of uncertainties i.e. macroeconomic uncertainty and financial uncertainty. The moderation relationship is found to be insignificant from financial uncertainty and macroeconomic uncertainty on business cycles in Pakistan economy.

**Keywords:** Mediation, Moderation, Business cycles, Macroeconomic uncertainty, financial uncertainty, Causality.

## CHAPTER 1

### INTRODUCTION

In recent years, policy makers are facing problem in identifying the patterns of business cycles fluctuations because of the mixed evidence on responsible factors that create business cycle fluctuations. Silvia *et al*(2014). Classical theories have concluded that a fall in productivity will result in decline in overall output which will trigger uncertainty and ultimately results in business cycle fluctuation. Abel & Bernanke suggested that fluctuations in investment cause business cycle fluctuations.

Interest in this topic has been increasing because of growing body of evidence that uncertainty rapidly rises in recessions. The question of whether uncertainty is an exogenous source of business cycle fluctuations or an endogenous response to economic fundamentals is not fully understood. To address this question of causality and identification of exogenous variation in uncertainty is a long standing challenge of uncertainty literature. This challenge arises partly because there is no theoretical consensus on whether the uncertainty that accompanies deep recessions is primarily a cause or effect (or both) of declines in economic activity. Theories in which uncertainty is defined as the time varying volatility of a fundamental shock cannot address this question because, by design, there is no feedback response of uncertainty to other shocks if the



volatility process is specified to evolve exogenously. And, Obviously, models in which there is no exogenous variation in uncertainty, it cannot be used to analyze the direct effect of uncertainty shocks. It is therefore not surprising that many theories for which uncertainty plays a role in recessions reach contradictory conclusions on this question, as we discuss below.

There are two separate views on uncertainty. Classic theories states that uncertainty which is caused by decrease in industrial productivity over time and that such real economic uncertainty when interacted with market frictions, discourages real activity. But the other view is uncertainty decreases economy through its influence on financial markets. Gilchrist, *et al*; All recessions after 1982 have origins in financial markets, and these recessions have significantly different features from recessions where financial markets play a passive role. From this perspective, if financial shocks create time-varying volatility then financial market uncertainty is distinct from economic uncertainty. It could be a key player in recessions, both as a cause and as effect. The Great Recession of 2008, characterized by sharp swings in financial markets, hints at such a linkage. Yet so far the literature has not separated the contribution of financial versus macroeconomic uncertainty to cause business cycle fluctuations.

A rapidly growing literature argues that shocks to uncertainty are significant source of business cycles dynamics. For example see Bloom, (2009), Frnandez *et al*(2011),Gurio,(2012) and Christiano(2014). However, the literature faces two important criticisms. In uncertainty shock theories an exogenous increase in volatility of structural shock causes recession. First, fluctuations in uncertainty may be partially endogenous. The distinction is crucial because if uncertainty is an equilibrium object that is coming from agent's actions, policy options that treat uncertainty as exogenous are subject to Lucas critique. Second some authors Bachmann,*et al*(2014) and Bayer*et al*(2016) have argued that given small and transitory fluctuations in measured volatility, changes in uncertainty have negligible effects Hikarusaijo(2017).

Econometric analyses aimed at understanding the role of uncertainty for business cycle fluctuations face their own challenges, especially when the body of theoretical work does not provide precise identifying restrictions for empirical work. Attempt to identify the “effects “of uncertainty shocks in existing empirical work are primarily based on recursive schemes within the framework of vector-auto regressions VAR. But studies differ according to whether uncertainty is ordered ahead of or after real activity variables in the VAR. While a recursive structure is a reasonable starting point, any presumed ordering of the variables is hard to defend on

theoretical grounds given the range of models in the literature.

Contemporaneous changes in uncertainty can arise both as a cause of business cycle fluctuations and as a response to other shocks. Recursive structures explicitly rule out this possibility since they presume that some variables respond only with a lag to others. It is with these challenges in mind that we return to the question addressed above: Is uncertainty primarily a source of business cycle fluctuations or a consequence of them? And what is the relation of macroeconomic and financial uncertainty to business cycle fluctuations? In econometrics analysis for answering above posed questions of causality a traditional method is simple OLS regression and SVAR. This study addresses above research question with a different approach known as mediation and moderation tests. The mediation analysis will help us to identify how or why financial or macroeconomic uncertainty is linked with business cycle fluctuations. Why this methodology is better than simple regression? Because a correlation between two or more variables does not imply causation between the two variables hence there must be a clear channel with which outcome variable is to be affected by predictor. Similarly whether the relationship between financial uncertainty and business cycles is affected by addition of third variable known as macroeconomic uncertainty or the relationship between macroeconomic uncertainty and business cycles is

affected by addition of third variable financial uncertainty? These types of questions are answered by moderator variables using interaction term into the model. This is methodological contribution of this study. While having mix evidence on the responsible factors which causes business cycle fluctuation there is no theoretical consensus on which factors are actually responsible for creating business cycles in Pakistan economy. Hence this study is an attempt to develop a theoretical relationship between the business cycles and financial, macroeconomic uncertainty using mediation and moderation analysis.

In other words, this study is an attempt to analyze the causal relationship using mediation and moderation for understanding relationship among variables. Theories on business cycles provide tentative idea of correlation between two or more variables because of which it is difficult to conclude causation using single regression estimation. So this study uses set of regressions to find out how or why business cycle fluctuations may be affected by financial and or macroeconomic uncertainty. In addition to this, it is also investigated whether the direction of relationship between business cycle fluctuation and macroeconomic, financial uncertainty is affected by addition of third variable.

### **1.1 Significance of the Study**

The present study benefits policy makers in such a way that in the times of economic downturns, factors responsible for creating fluctuation in

business cycle can be clearly identified and policy options to mitigate the severity of recession and boom can be opted with minimum lags. As, this study clearly separates the financial market uncertainty from macroeconomic uncertainty in causing business cycles fluctuations in Pakistan economy. Available literature on business cycles in Pakistan economy is not based on differentiating the role of two types of uncertainties in causing fluctuation in real economic activity of Pakistan.

## **1.2 Objective**

The primary purpose of study is to answer the research question that: Is there any relationship between financial uncertainty, macroeconomic uncertainty in causing business cycle fluctuations? If yes then, which type of uncertainty actually matters in causing business cycles in Pakistan economy? To answer the above research question present study uses volatility of industrial production as a measure of macroeconomic uncertainty along with control variables as consumption, government purchases of final goods and services, trade openness, and inflation. In addition to this, financial uncertainty is measured using volatility of stock prices is using PSX (KSE 100 index) index. The dependent variable is business cycle which is measured using output gap that is deviation of actual output from potential output. The volatility is calculated using rolling window variance.

## **CHAPTER: 2**

### **LITERATURE REVIEW**

The question whether uncertainty is a source of business cycle fluctuations or an endogenous response to them has not been addressed before as cause and effect or both. There is no theoretical consensus on whether uncertainty is a cause or outcome of decline in economic activity. In most of the theories, uncertainty is modeled as cause or an effect but not both. Thus, the current study tries to fill this literature gap by addressing the above question of cause and effect simultaneously. With this purpose, a brief review of literature has been provided below.

Secil *et al* (2018) Found that an increase in stock market volatility affects the future expectations of non-sophisticated agents about expected price of stocks which cause investment to fall and as a result aggregate demand and employment to fall. The key finding of the study is that financial markets uncertainty has a significant role in causing business cycles. The paper has measured financial uncertainty using stock market uncertainty and its impact is observed on real output measured using industrial production in Turkey.

Hikaru Saiju(2017) found that there is the negative relationship between uncertainty and aggregate output. Because an increase in uncertainty affects informational frictions on the part of agents in such a way that

investment would fall. The paper measure informational frictions using shocks to marginal efficiency of investment and shocks to depreciation rate of capital. The two way causal relationship was identified between uncertainty and aggregate economic activity by investment channel.

Nakamura *et al* (2012) estimated growth rate and volatility shocks for 16 developed economies and found that they are negatively correlated. Theories in which uncertainty plays a vital role are providing different views on the question whether this correlation between uncertainty and growth implies that uncertainty is mainly a cause or a consequence of decline in economic activity. In majority of cases this relationship is modeled either as a cause or effect but not both.

The first part of literature showed an increase in uncertainty will result in loss of investor's confidence which will decrease investment and consumption at aggregate level. Bernanke (1983);McDonalad (1983). The theories always concluded that uncertainty is an exogenous shock to some economic fundamentals like fall in productivity etc. In contrast, the second part of literature showed that uncertainty arises as a response to lower economic growth. Some theories suggest that bad times incentivize risky behavior Bachmann and Moscarini *et al* (2011) or lower information and with it predictability of future outcomes Van Nieuwerburgh *et al*(2006)Fajgelbaum, *et al* (2014). New and unfamiliar economic policies

having highly uncertain economic effects Pastor *et al* (2013), creates greater misallocation of capital across sectors Ai, Li *et al*(2015), or generate endogenous countercyclical uncertainty in consumption growth and investment is costly to reverse Gomes *et al*(2016).

Campbell *et al* (2001) showed that volatility of individual stock prices negatively related with de-trended GDP. Bloom(2009), shows that VXO index of stock market volatility of individual stock prices negatively commoves with industrial production, and positively with cross-sectional dispersion in profits and stock returns. As mentioned changes in uncertainty can be considered as random changes in the standard deviation of idiosyncratic shocks, which impact aggregate economic activity?

The U.S. economy has experienced a slow recovery from the 2007–09 recession economic growth remains below its historical average. One possible contributor to the poor economic performance is economic policy uncertainty. A number of economists have examined the impact of general economic uncertainty on business decisions. Bernanke (1983); Dixit *et al* (1994); Bloom, *et al* (2007); and Bloom (2009, 2014) have shown the adverse impact of general economic uncertainty on business investment decisions. Bloom *et al*(2007) speculate that general economic uncertainty will also adversely impact hiring decisions. Ghosal *et al*(2015) find this



to be the case. Lower investment and employment occur because uncertainty makes firms less sure about the returns associated with capital expenditures or hiring. Since there are non-recoverable costs associated with a decision to invest in capital or hire and train workers, uncertainty makes it prudent to delay capital expenditures or hiring. Uncertainty also worsens information asymmetries between lenders and borrowers.

With greater uncertainty, the chances of bankruptcy increase. As a result, banks tend to delay lending to firms, slowing business expansion Greenwald *et al*(1990). Uncertainty is the main driver of fluctuations in economic activity and a contributor in great recession this is usually discussed by economists and financial press. As Diamond (2010) said, “What is critical right now is not the functioning of labor market, but limits on the demand for labor coming from great caution on the side of both consumers and firms because of the great uncertainty of what’s going to happen next. Recent research by Bloom *et al* (2009) showed that uncertainty shocks can cause fluctuations in macroeconomic activity. Given the brief review of above literature it has been identified that two different views, one which concludes that financial uncertainty cause fluctuation in economic activity.

In contrast the other part of literature states uncertainty cause a loss in investors and firm’s confidence which result in lower employment by

firms and lower investment and consumption by other agents of economy may result in fluctuation in an economic activity. Romer, (1990) found that doubling of stock market volatility which is measured by historical variation in prices reduces durable consumption goods demand and output.

As a result, present study tries to fill the literature gap by combining two strands of literature to quantify which type of uncertainty actually matters in causing business cycles or which type of uncertainty increases as a response to business cycle fluctuations. In addition to this, the study is an attempt to quantify the cause and effect relationship between business cycles and financial, macroeconomic uncertainty by modeling each type of uncertainty as a separate variable to see the relative effect of each as an outcome of business cycle fluctuation or. This study measures the impact of financial and macroeconomic uncertainty on business cycle fluctuation but the financial uncertainty is separated from macroeconomic uncertainty to see which cause more business cycle fluctuation in Pakistan economy.

The above quoted literature does not provide clear channel with which uncertainty affects business cycles. Classic theories concluded that macroeconomic fundamentals like changes in industrial productivity will cause fluctuation in output. Whereas, other part of literature Gilchrist *et*

al, Minski have provided the view that it is evident from great recession of 2008 that financial markets play a vital role in explaining the recessions i.e different phases of business cycles.

The mediation and moderation analysis are used to answer above research question. Macroeconomic uncertainty is measured using industrial production volatility (by taking variance of the series) and financial uncertainty is measured by taking the variance of KSE 100 index (PSX) index and the business cycles are measured using variance of output gap.

## 2.1 Mediation and Moderation

Barron and Kenny (1986) provided the idea of mediation. A variable is said to be mediator when an independent variable X affects Y through M. To investigate this effect a set of regressions is to be estimated and the significance of coefficient of direct and indirect effects is observed. Intuition of mediation is as follows.



The above relationship shows that X affects M and then Y. So this relationship is based on mediational relationship. This method is based on estimating three regression one with effect of X on Y, second with effect of X on Y keeping M (third variable) as mediator and third effect of X on mediator. In research mediation is used when there is conflicting relationship or ambiguous empirical evidence of the correlation between

two or more variables. This study uses mediation to answer a research question whether financial uncertainty affects business cycle fluctuations through its impact on macroeconomic uncertainty or macroeconomic uncertainty affects business cycles through its impact on financial uncertainty. Previously, this relationship in case of Pakistan has not been explored. In addition to this, mediation is used to find how or why two more variables are correlated. Researchers in management science use this method to develop theoretical relationship between variables having less or no theoretical evidence.

### **Moderation:**

The moderation is used to improve understating of causal relationship between two or more variables. A variable is said to be moderator when it strengthen or weaken the direction of relationship between predictor and outcome variable. Studies use moderator generally for two reason (1) does the relationship between Y and X affects by including a third variable into regression. (2) If there exist non-linear relationship between X and Y then moderator (interaction term) can be used to capture its effects. This study uses moderation to understand whether direction of relationship between business cycle fluctuations and financial, macroeconomic uncertainty is affected by addition of third variable moderator. The logic of this can be understood by observing that theories in economics are based on tentative

correlation which is subject to change over time so same model cannot be used to test the same theory over and over again. To account for variation resulting from various factors the econometricians have provided an alternative approaches using which this varying correlation can be observed and measured in a better way.

## **CHAPTER: 3**

### **DATA AND METHODOLOGY**

The data used in the study is yearly time series starting from 1998 to 2017. It has been collected from WDI and Karachi stock exchange. The mediation testing methodology is based on estimating three set of equations so that a channel with which dependent variable is affected by one or more independent variable can be identified. On the other hand, moderation is tested using single regression including an interaction term to see whether the relationship between dependent and independent variable is affected by the addition of this third variable.

In addition to this, the key objective of the present study is to test whether there is any relationship between business cycle fluctuations and financial, macroeconomic uncertainty? First a relationship between business cycle and macroeconomic uncertainty is found keeping financial uncertainty as a third variable to measure whether the relationship between macroeconomic uncertainty and business cycle is weakening or strengthening by addition of a third variable. This third variable financial uncertainty plays the role of moderator. Similarly the moderation is applied to study how or why a relationship exists between financial uncertainty, macroeconomic uncertainty and business cycles. The causal relationship can be better understood by including the mediator and

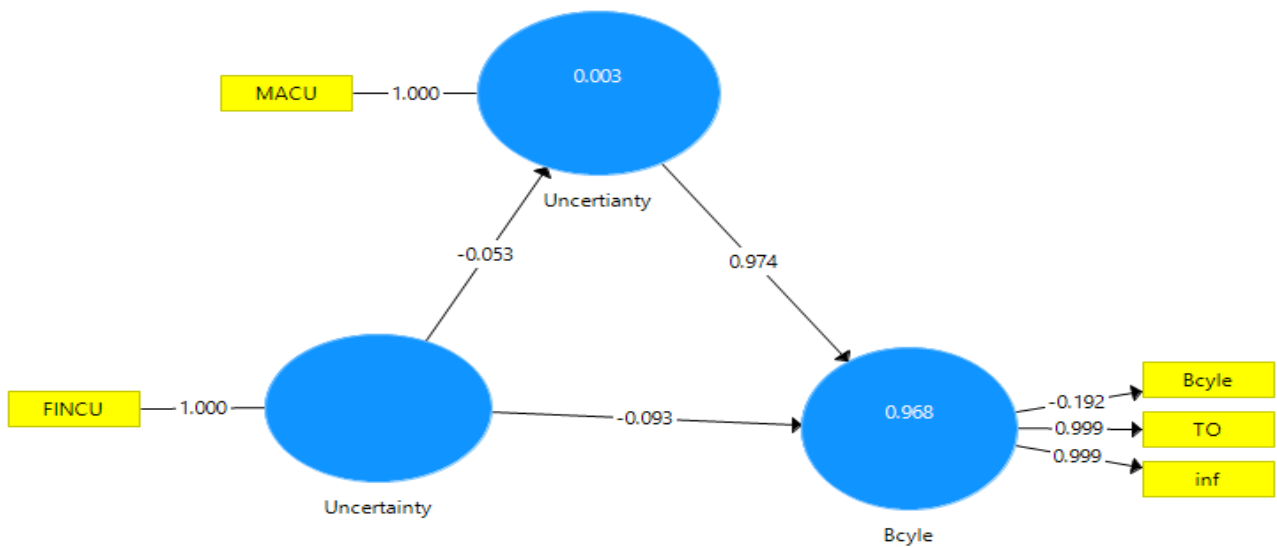
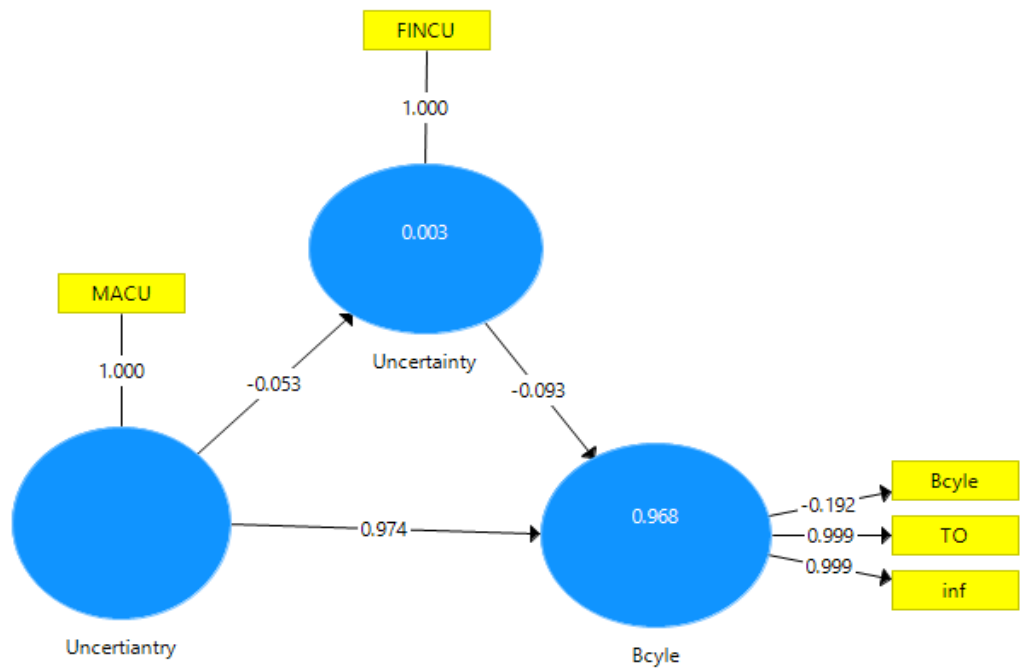
moderator variable in the study because it increases number of possible pair with which X may be correlated to Y. Literature has addressed this question either as cause, effect or both using methods of simple regression or using SVAR but this study fills the methodological gap by answering above posed question using a different approach. Because causality tests measure the relationship only not the channels with which that relationship is established between independent and dependent variable of the study.

Generally, the simultaneous cause and effect relationship is explored using SVAR. That shows the impact of structural shocks on outcome variable using impulse response function. But the problem with that approach is structural shocks are not random they are the part of already existing information set. Due to this weakness in above mentioned traditional method present study answer the question whether there is any relationship between financial, macroeconomic uncertainty and business cycle fluctuation? Using mediation and moderation test. Because cause and effect hypothesis are generally modeled on the view that if predictor coefficient is statistically significantly different from zero then it is only reason of changes in outcome variable. This is fundamentally questionable because there is no clear channel with which independent variable has an impact on dependent variable of the study. So the

methodological contribution of the present study is to find out how or why financial uncertainty, macroeconomic uncertainty are linked with the changes in business cycles? The mediation analysis is going to help us answer the above mentioned question by identifying why or how the relationship between financial uncertainty and business cycles exists? And why or how business cycles are driven by macroeconomic uncertainty? The literature provides mixed evidence on responsible factors that may cause business cycle fluctuation hence this study is aimed to combine all other empirical variables that may result in business cycles fluctuation with financial, macroeconomic uncertainty to develop a theory. This study will also measure the relative importance of each type of uncertainty in causing business cycles. To analyze relationship between business cycle fluctuation and macroeconomic, financial uncertainty a different technique is used so that possible channel with which financial or macroeconomic uncertainty causes business cycle fluctuation will be identified. Once the channel has been found it would be easier to conclude that causation also implies correlation between variables but correlation does not always imply causation. Generally, mediation and moderation analysis are used to develop a theory. This study uses this technique to understand why or how business cycle fluctuation in Pakistan economy caused by either macroeconomic uncertainty, financial uncertainty or both.



The time series yearly data from 1988 to 2017 is used in the present study to answer the above posed research questions because time series data is used in this study thus, it is necessary to check for stationary of series using statistical test. There are three main variables in the study (1) Output gap which is used to measure the business cycles (dependent variable) and (2) Macroeconomic uncertainty is measured using volatility of industrial production of Pakistan (3) For measuring financial uncertainty the volatility of PSX index is used. Rolling window variance is used to measure volatility of PSX index and volatility of industrial production. In order to avoid the omitted variable bias and misspecification problem the relevant control variables are taken, government purchases of final goods and services and trade openness, inflation and consumption. For analysis secondary data is collected from WDI, IFS and Karachi stock exchange.

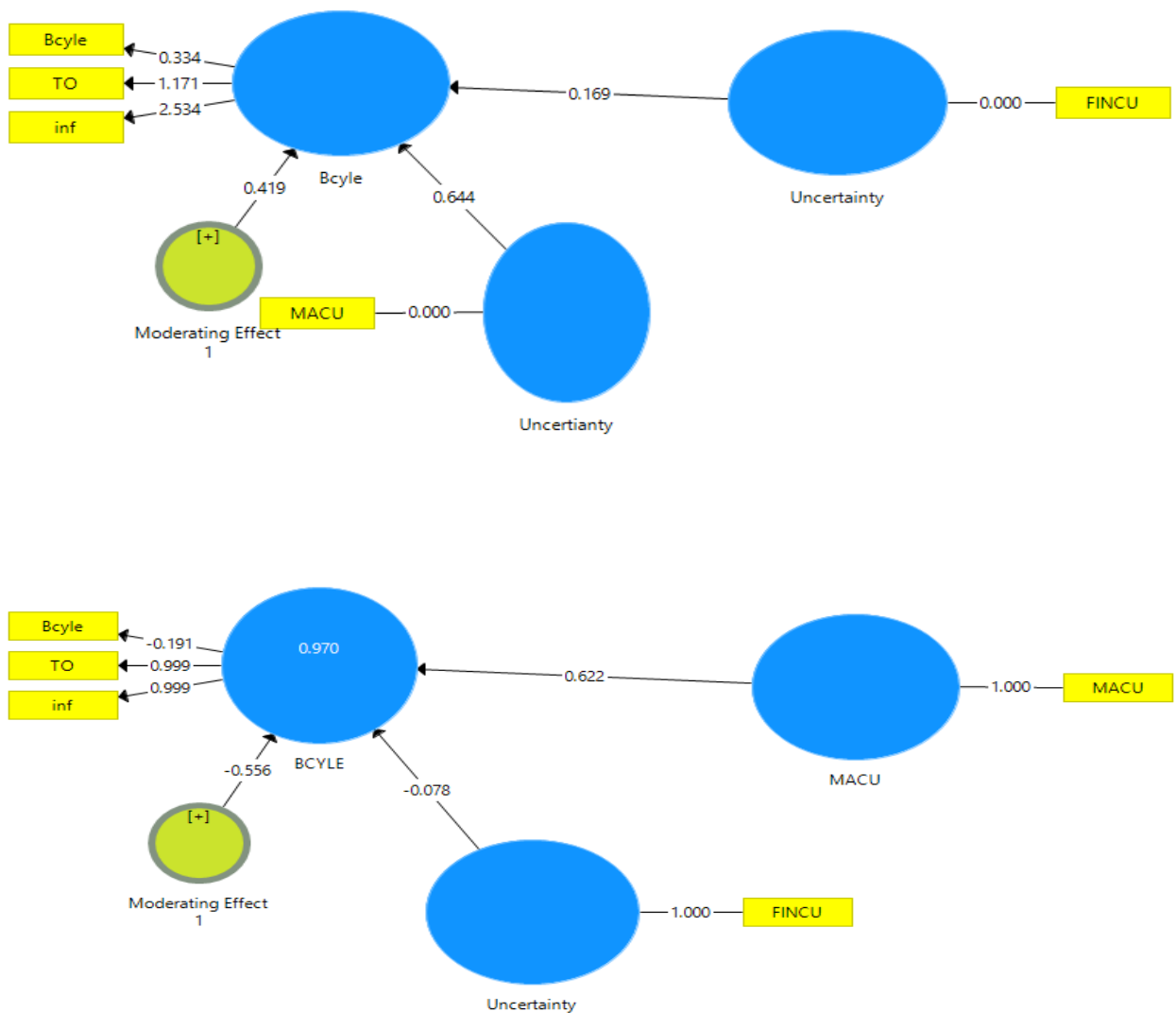


**Figure: 3.1 Conceptual model for testing mediation**

The above model shows that relationship between macroeconomic uncertainty and business cycle fluctuations which is mediated by financial uncertainty. The left side variable is the predictor and right side variable

is outcome variable. The relationship between outcome and predictor is mediated by a third variable which explain how or why predictor and outcome variable are related with each other.

This is the conceptual model for testing the mediation effects. The impact of financial uncertainty on business cycles is explored keeping macroeconomic uncertainty as mediator.



**Figure: 0 Conceptual model for testing moderation**

This is the conceptual model for testing the moderation effects. The business cycles are driven by macroeconomic uncertainty or financial uncertainty but if third predictor is added into the model will it affect the relationship between output and predictor. The mediation is tested using interaction term into the model. In this case the interaction between financial and macroeconomic uncertainty is moderator variable. The moderator will strengthen, weaken or change the direction of relationship between two variables. Next section will provide econometric model for testing above mentioned conceptual models.

### 3.1. Model for testing the Mediation Effects

$$Bcycle_t = \beta_0 + \beta_1 Macu_t + \beta_2 Govt_t + \beta_3 InF_t + \beta_4 Cons_t + \beta_5 To_t + V_{1t} \dots \dots \dots (3.1)$$

$$Bcycle_t = \beta_0 + \beta_1 Macu_t + \beta_2 Fincu_t + \beta_3 Govt_t + \beta_4 InF_t + \beta_5 Cons_t + \beta_6 To_t + V_{2t} \dots \dots \dots (3.2)$$

$$Fincu_t = \beta_0 + \beta_1 Macu_t + + \beta_2 Govt_t + \beta_3 InF_t + \beta_4 Cons_t + B_5 To_t + V_{3t} \dots \dots \dots (3.3)$$

Where Business cycle is measured by changes in output gap that is deviation of actual GDP from potential GDP over the time, FINUC is financial uncertainty measured by changes in PSX index volatility and macroeconomic uncertainty (MAUC) measured by industrial productivity volatility (The volatility series is generated and used as a variable to

account for main variables of study). In addition to above main variables control variables of study are, CONS is Consumption, trade openness is measured as ratio of exports to import (TO), GOVT government expenditure, INF inflation. In addition, above specification shows whether the impact of financial uncertainty on business cycles fluctuations is mediated by macroeconomic uncertainty or not? The purpose of equation one is to test explores the relationship between financial uncertainty and business cycle, controlling for all other factors. Second equation measures the impact of financial uncertainty on business cycle fluctuations controlling for macroeconomic uncertainty and all other factors. The third equation measures the impact of financial uncertainty on macroeconomic uncertainty controlling for all other factors. The key purpose of estimating third equation is to see the causal relationship between mediator variable (macroeconomic uncertainty) and financial uncertainty.

The same model can be used to see the impact of macroeconomic uncertainty on business cycle fluctuation, keeping financial uncertainty as mediator variable. Again, a set of three equations would be estimated to answer the same question of how or why there exist a relationship between business cycles and macroeconomic uncertainty. The econometric specification for testing financial uncertainty as mediator between the

relationship between business cycles and macroeconomic uncertainty is given below.

### 3.2. Model for testing the Mediation Effects

$$Bcycle_t = \beta_0 + \beta_1 Fincu_t + \beta_2 Govt_t + \beta_3 InF_t + \beta_4 Cons_t + \beta_5 To_t + V_{1t} \dots (3.4)$$

$$Bcycle_t = \beta_0 + \beta_1 Macu_t + \beta_2 Fincu_t + \beta_3 Govt_t + \beta_4 InF_t + \beta_5 Cons_t + \beta_6 To_t + V_{2t} \dots (3.5)$$

$$Macu_t = \beta_0 + \beta_1 Fincu_t + \beta_2 Govt_t + \beta_3 InF_t + \beta_4 Cons_t + \beta_5 To_t + V_{3t} \dots (3.6)$$

Aligned with first objective, the second one is to test whether the relationship between business cycles and macroeconomic uncertainty is affected by addition of a third variable say financial uncertainty or vice versa. It is to test whether a third variable addition except control variable into the model will modify the direction of relationship between business cycles and macroeconomic uncertainty by either strengthening, weakening the relationship between predictor and outcome variable. The moderator variable itself and the interaction of independent variable, moderator are used to see the impact of predictor on outcome variable.

### 3.3. Model for testing Moderation Effects

$$Bcycle_t = \beta_0 + \beta_1 Macu_t + \beta_2 Fincu_t + \beta_3 Govt_t + \beta_4 InF_t + \beta_5 Cons_t + \beta_6 To_t + \beta_7 (Macu_t * Fincu_t) + V_{1t} \dots \dots \dots (3.7)$$

Where dependent variable is business cycles, MACU volatility of industrial production is a measure of macroeconomic uncertainty, FINCU is the KSE 100 index (PSX) volatility that is used as moderator (Financial uncertainty) and (FINCU\*MACU) is the interaction between financial uncertainty and macroeconomic uncertainty. All other variables are representing the control variables. We have to estimate two models to account for the role of moderator one is mentioned above another would be to role of macroeconomic uncertainty as moderator between the business cycles and its relationship with financial uncertainty. The theoretical assumptions of mediation and moderation analysis are same as OLS estimation method.

Time series data is used in the present study. Thus, for obtaining meaningful results we need to take into account precautionary tests such as stationarity of variables used in the analysis and testing of Autocorrelation. Literature is full of various tests but this study uses commonly used statistical tests for addressing above mentioned basic time series properties. Stationary of time series is tested using Dickey and

Fuller test but when autocorrelation is suspected then Augmented Dickey and Fuller test will be used so the present study use both.

The Dickey and Fuller test tests the null hypothesis whether a time series has unit root against the alternative hypothesis of no unit root. The econometric specification of unit root test is given below.

**Dickey & Fuller Test**

$$\Delta y_t = \alpha + \beta y_{t-1} + \mu_t \dots\dots\dots(3.8)$$

Where  $\Delta y_t = \text{first difference of time series}$  and the unit root coefficient  $\beta = \delta - 1$ . so the null hypothesis is  $H_0: \beta = 0$  or  $\delta = 1$  and the alternative hypothesis would be  $H_a: \beta < 0$ . The error term  $\mu_t$  is assumed to be purely white noise. Generally the error term is not white noise so the dickey and fuller suggested another form of above equation which controls for the problem of autocorrelation. Augmented term is simply the lag of dependent variable. The lag length is decided by AIC and BIC criterion. There are three specification of this test.

**Augmented Dickey-Fuller (ADF) test for unit roots**

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \mu_t \dots\dots\dots(3.9)$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \mu_t \dots\dots\dots(3.10)$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + \alpha_2 t + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \mu_t \dots\dots\dots(3.11)$$



These three specifications are different from each other with respect to deterministic elements  $\alpha$  and  $\alpha_2$ . The selection of suitable model would be on the basis of plotting the graph of series and observing whether there is deterministic component or not and then choosing model accordingly.

### **3.4 Identification and Construction of Business Cycle for Pakistan Economy**

In recent years decision makers have been challenged to identify the changes in the stages of business cycles-recession, recovery, expansion and slowdown in Pakistan economy. This identification is important for business management in terms of planning production schedules, adjusting inventories and ordering inputs for production process. In government identifying the stage of economic cycle will allow for better preparation for the cyclical rhythms of revenues and spending flows. To identify a cycle in economic and financial series, we recognize that many but not all follow a predictable pattern over business cycle and such can be characterized by statistical properties. The present study employs a number of techniques to identify and characterize a cycle, such as mean, variance, autocorrelation and partial autocorrelation. Similarly, to observe whether a series is above or below the trend during the current expansion, we can use HP filter. The main advantage of using this tool is this allows us to observe whether a series is moving above or below trend relative to the historical values of that series. This feature of HP filter contains important implication for policy that will help policy makers identify the

stage of cycle that is slowdown or acceleration around the trend in any economic time series. The econometric contribution of the present study is that it uses tools of autocorrelation and partial autocorrelation and HP filter for more practical use as these tools are not normally used by researchers to identify the cyclical component into a variable and then modeling it based on some theoretical as well as empirical properties. In next section the plot of variance of output gap which measures business cycle in Pakistan is represented using the HP filter.

### 3.5 Construction of Variables

<b>Variable Name</b>	<b>Measurement</b>	<b>Method</b>	<b>Dep/Ind</b>
Business cycle fluctuations	Literature uses output gap as a measure of business cycle fluctuation. Thus, this study uses it the same way.	Rolling window variance is used to find variance of output gap.	Dependent variable
Macroeconomic uncertainty	Industrial production volatility is used in literature to measure the macroeconomic uncertainty.	Rolling window variance is used to find volatility of industrial production.	Independent variable
Financial uncertainty	PSX index based on its market capitalization has been used in various papers to measure financial market uncertainty.	To measure PSX index volatility. Rolling window variance is used.	Independent variable

## CHAPTER: 4

### RESULTS AND DISCUSSION

The key objective of the present study is answering a question: whether business cycles in Pakistan economy are driven by financial uncertainty or macroeconomic uncertainty? And which kind uncertainty matter in causing business cycle in Pakistan economy. The above question is modeled using mediation and moderation analysis. Before we go for analysis it is necessary to talk about stationary and non-stationary of times series in order to draw meaningful conclusion from the data.

The variables used in the present study are variance of output gap representing business cycles and independent variables are industrial production volatility and PSX index volatility. Along with this there are some control variables final government purchases, trade openness measured using ratio exports to imports and consumption are taken keeping in view literature. Augmented dickey fuller results for all the above mentioned series are provided below.

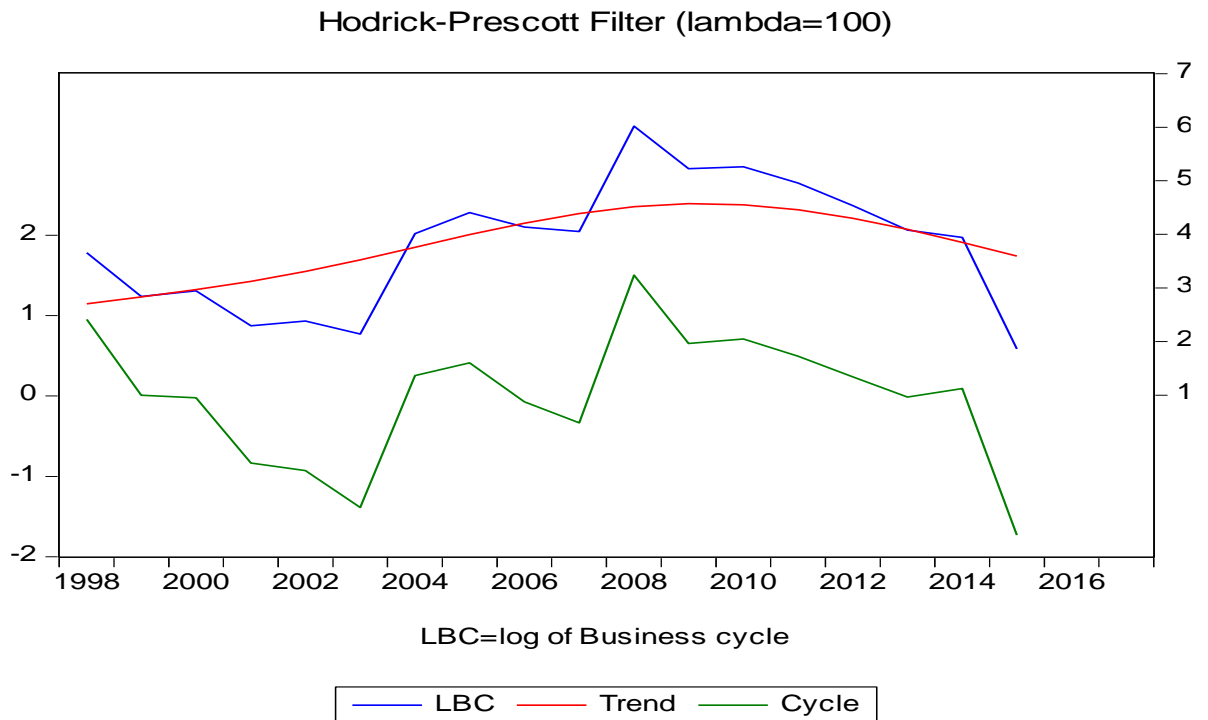
**Table 4.1 Augmented Dickey & Fuller test**

Variables	ADF-T-stat	ADF-critical value	Prob	Hypothesis
Bcyle	-4.93	-3.67	0.0046	Reject H0
MAUC	-4.91	-3.67	0.0048	Reject H0
FINCU	-3.79	-3.69	0.0009	Reject H0
Govt	-2.05	-3.69	0.5335	Do not Reject H0
CONS	3.75	-3.81	0.0456	Do not Reject H0
Trade	-4.46	-1.96	0.0003	Reject H0
INF	-4.76	-3.02	0.0013	Reject H0

Notes: The sample is based on time series data from 1998 to 2017. Because of the time series data stationary of series is necessary to be tested in order to have meaningful analysis. ADF test is used to check order of integration of series. The Bcyle represents business cycle variable measured as rolling window variance of output gap, Macu represents macroeconomic uncertainty measured using rolling window variance of industrial productivity and the fincu measures another main variable that is financial uncertainty. The control variables include TO, trade openness measured by ratio of exports to imports, Govt shows government spending on final goods and services, Cons depicts the total consumption expenditure and INF shows inflation rate.

The significance level used for testing stationary all variables is 5%. Output of ADF test suggests some variables are integrated of order one and others are integrated of order zero. Because dependent variable of study is integrated of order zero we are applying simple regression model to answer the research question. The result of stationarity test can be confirmed by comparing ADF calculated value with critical value, the decision rule is if critical value is greater than calculated value then we reject the null hypothesis that series is non-stationary. Where, Bcyle shows the variance of output gap and Cons represents final consumption expenditure, To represent trade openness, FINCU represent volatility PSX index and MACU represent volatility of industrial production.

The cyclical component in the output gap variance can be represented in order to account for deviation of actual output from potential output. The Hodrick Prescott filter is used in the present study to identify the deviation of Pakistan's GDP from its potential value. The Bcyle variable is the log of variance of output gap that is used as proxy of business cycle.



**Figure 4.1 Hodrick Prescott Filter**

This figure represents the increase or decrease in the variance of output. It can be observed that the first deviation in output was in 2003-04 after that recovery phase started and then a slight boom in 2005-06 was experienced afterwards a slow decline of actual output represents the variance of actual output from potential output increased. Again an increase in actual output was realized in 2008-09 and in later years a continuous decline was observed do be dominant till 2014. This filter gives us intuition that lack of productive capacities in Pakistan economy resulted in existence of hills and valleys in GDP pattern. There could be multiple reasons for this decline in output but this research will answer it with limited number of possible factors.

After testing for stationarity of variables now the mediation and moderation model are to be estimated to answer two research questions.

(1) Controlling for all other factors how or why business cycles are affected by macroeconomic uncertainty when financial uncertainty is taken as mediator. In addition, how or why the relationship between financial uncertainty and business cycles may be affected by taking macroeconomic uncertainty as mediator? Answering these questions will help us explaining why the variance of output gap of Pakistan economy seems to be rising over the time? This research will contribute methodologically in such a way it provides a different insight of testing causal relationship because outcome variable generally is affected by various possible predictors.

It is not logically justifiable to assume causation based on merely a correlation between two variables or only based on one pair or correlation relationship. Mediation analysis are used to answer above posed questions of how or why business cycles may be linked with financial uncertainty keeping macroeconomic uncertainty as a mediator which helps researcher to identify why the relationship may exist between above said variables and also provide a channel with which business cycles are affected by either macroeconomic uncertainty or financial uncertainty and both. Another objective of the study is to see whether the relationship between

financial uncertainty and business cycle is affected (strengthen, weakening or changing) by addition of macroeconomic uncertainty into the model and vice versa. For this moderation model is to be estimated. Seven models would be estimated and the results for each model are summarized below.

**Table 4.2: Estimated Models for Testing Mediation Effects**

<b>Relationship</b>	<b>Coefficient</b>	<b>T-value</b>	<b>P-value</b>
<b>FINCU → BCYLE</b>	<b>-0.137</b>	<b>0.390</b>	<b>0.697</b>
<b>MACU → BCYLE</b>	<b>0.805</b>	<b>1.805</b>	<b>0.075</b>
<b>FINCU → MACU</b>	<b>0.092</b>	<b>0.167</b>	<b>0.867</b>

The above table represent three estimated model used for testing mediation using simple OLS method. The financial uncertainty is taken as mediator variable for explaining the relationship between business cycles and macroeconomic uncertainty.

The first model is estimated by taking business cycle as a dependent variable and the main variable is macroeconomic uncertainty measured by industrial production volatility along with control variables of consumption, government purchases, trade openness, and inflation. The coefficient of macroeconomic uncertainty is negative but statistically insignificant as t-value in the second parenthesis is less than two. Similarly, all coefficients are insignificant except trade openness and

inflation rate. The negative coefficient of trade openness implies that increases in trade openness increases variation between actual and potential output because, Pakistan imports are more than exports which results in a decrease in ratio that will cause fluctuation in economic activity.

The second estimated model represents the impact of macroeconomic uncertainty on business cycle fluctuation by taking financial uncertainty as mediator and controlling for other factors. The second model shows that the relationship between business cycles fluctuations and macroeconomic uncertainty is mediated by financial uncertainty in Pakistan economy as is suggested by statistical significance of the two coefficients. The impact of macroeconomic uncertainty on variance of output gap is negative and the impact of financial uncertainty on variance of output gap is positive. Trade openness has again negative coefficient implying same as mentioned earlier. The third model is estimated for testing the impact of mediator variable which is financial uncertainty on macroeconomic uncertainty to confirm the mediation relationship between these two variables. There is positive relationship between financial uncertainty and macroeconomic uncertainty controlling for all other factors. All the diagnostic test and goodness of fit of the model is provided below the estimated models. Another three set of models would



be estimated in which macroeconomic uncertainty is taken as mediating variable between financial uncertainty and business cycle fluctuations.

**Table 4.3 Estimated Models for Testing Mediation Effects**

<b>Relationship</b>	<b>Coefficient</b>	<b>T-value</b>	<b>P-value</b>
MACU → BCYLE	0.794	1.767	0.078
FINCU → BCYLE	-0.133	0.407	0.684
FINCU → MACU	-0.053	0.167	0.867

For testing mediation again three equation models are estimated. The first model tests the impact of mediating variable, macroeconomic uncertainty on relationship between financial uncertainty and business cycle fluctuations controlling for all other factors. The results of model one which shows impact of financial uncertainty on business cycles controlling for other factors, suggest financial uncertainty coefficient is positive but is statistically insignificant keeping in view the t-value of less than 2. Separately financial uncertainty has no impact on business cycles in Pakistan economy it may be because of less sophisticated financial market.

All control variables are insignificant except inflation and trade openness. The second model is estimated to show the impact of financial uncertainty on business cycle keeping macroeconomic uncertainty as mediator and controlling for all other factors. Results depict that coefficient of

macroeconomic uncertainty is negative and coefficient of financial uncertainty is positive but former is statistically insignificant and later is significant. Implying that financial uncertainty along with macroeconomic uncertainty causes business cycle fluctuations. There is mediating relationship between financial and macroeconomic uncertainty on business cycles. All control variables except trade openness and inflation are significant. Similarly, third estimated model in above table shows the impact of macroeconomic uncertainty on financial uncertainty controlling for all other variables. The relationship between macroeconomic and financial uncertainty is positive and statistically significant implying causal relationship between two when controlling for all other factors

**Table 0.4: Estimated model for testing moderation effects**

<b>Relationship</b>	<b>Coefficient</b>	<b>T-value</b>	<b>P-value</b>
Moderator → BCYLE	-0.249	0.419	0.675
MACU → BCYLE	0.023	0.169	0.866
FINCU → BCYLE	0.703	0.644	0.519

The results of moderation model suggest that the relationship between business cycle fluctuations and financial, macroeconomic uncertainty is not moderated by adding a third variable as interaction into the model.

This finding is based on the insignificant coefficient of interaction term (product of financial and macroeconomic uncertainty). The other variables of above estimated model are insignificant except inflation and trade openness and macroeconomic uncertainty itself. But jointly all the coefficients are statistically significant as provided by probability of F-stat which is less than five percent suggesting the rejection of null hypothesis that all coefficients in above estimated model are jointly zero

**Table 0: Estimated Model for Testing Moderation Effects**

<b>Relationship</b>	<b>Coefficient</b>	<b>T-value</b>	<b>P-value</b>
MACU → BCYLE	0.665	0.700	0.484
Moderator → BCYLE	-0.239	0.456	0.648
FINCU → BCYLE	0.029	0.140	0.889

## **CHAPTER: 5**

### **DISCUSSION**

Financial market uncertainty has a significant role in causing business cycles. SecilYildirm *et al* (2018) Found that an increase in stock market volatility affects the future expectations of non-sophisticated agents about expected price of stocks which cause investment to fall and as a result aggregate demand and employment to fall. The above mentioned recent study showed how increase in financial market uncertainty caused macroeconomic uncertainty to rise and both uncertainties simultaneously affected business cycles. This finding is consistent with our finding that the relationship between financial uncertainty and business cycles in Pakistan economy is mediated by macroeconomic uncertainty.

HikaruSaiju (2017) found that there is the negative relationship between uncertainty and aggregate output. An increase in uncertainty will result in loss of investor's confidence which cause investment to fall and aggregate demand and output both will fall. The control variable of investment found to be negative in affecting output gap when uncertainty is increasing in the economy.

Uncertainty may also arise as a result of not having export competitiveness to country. If a country is importing more than it exports in most of the cases which will cause more international borrowing or

result in decrease in net foreign assets of the country Abel & Bernanke. This channel is generally ignored while discussing factors which may cause business cycles. Thus, the present study also included this channel by including a variable known as trade openness. The results found that trade openness adversely affect output gap in Pakistan economy.

### **5.1 Conclusion**

The purpose of this research is to understand the process or channel with which business cycle fluctuation takes place in response to changes in financial and macroeconomic uncertainty. To do this, yearly time series data has been taken from 1998 to 2017. Methodology used to answer the question is mediation and moderation which is generally used to develop theories related to variables having mix evidence in literature. This method is better than other because it helps researcher in identifying how or why two or more variables or observed to be correlated. A single regression may not be enough to conclude how or why dependent variable is affected by one or more independent variables.

In addition to this, the relationship between business cycle fluctuations and financial, macroeconomic uncertainty can be better explained by using mediation and moderation analysis because the channel with which two or more variables are related theoretically and empirically correlated is identified using this method. This study found that in Pakistan economy

relationship between business cycle fluctuations and macroeconomic uncertainty is mediated by financial uncertainty. Similarly, relationship between business cycle and financial uncertainty is mediated by macroeconomic uncertainty. These finding shows that business cycles are not driven by macroeconomic uncertainty only but when combined with financial uncertainty it cause business cycles in Pakistan economy. In addition, there is also a no effect of moderation because the relationship between business cycle fluctuations and financial uncertainty, macroeconomic uncertainty which is measured using interaction term found to be insignificant. The insignificance of interaction term implies that the direction of relationship between business cycle fluctuations and financial, macroeconomic uncertainty remain unchanged when an interaction between two uncertainties is included as a separate variable in model. The results of are provided in appendix (OLS results).

**Appendix: Estimated Models using OLS (Mediation effects:1)**

<b>Models</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>
	Yt=business cycles	Yt=Business cycles	Yt=Financial uncertainty
C	(-66.82) (3.75) (0.0024)	(-65.07) (-4.41) (0.0008)	(-21896688) (0.16) (0.8739)
MACU	(-0.014) (-0.36) (0.72)	(-0.06) (-1.76) (0.1027)	(672671.2) (2.22) (0.0446)
FINCU	—————	(8.00) (2.65) (0.0211)	—————
TO	(-1.87) (-11.92) (0.0000)	(-2.16) (-12.76) (0.0000)	(3603620) (3.02) (0.0098)
D(CONS)	(-1.09) (-0.707) (0.49)	(-2.70) (-1.90) (0.0804)	(0.000201) (1.70) (0.1110)
D(GOVT)	(-9.81) (-0.10) (0.9187)	(25.33) (12.83) (0.9772)	(-9.42) (-0.131) (0.89)
INF	(21.96) (11.99) (0.0000)	(25.33) (12.83) (0.0000)	(-42015345) (3.02) (0.0098)
R-square	0.84	0.91	0.631
LM Stat (prob)	0.997	0.34	0.410
F-statistic (prob)	0.000	0.00	0.0139

Notes: The table contains three estimated models to test mediation effects. The mediator in present study is financial uncertainty. Bcyle is dependent variable measuring business cycle fluctuations, Macu, measures macroeconomic uncertainty and Fincu measures financial uncertainty. Control variables are TO, trade openness, D(cons) first difference of consumption, D(GOVT) first difference of government spending, INF represents inflation rate. The first parenthesis is the value of estimated coefficient and the second parenthesis represent t-value and the third parenthesis represents shows the p-value of estimated coefficient. Decision rule of statistical significance is if t-value in second parenthesis is greater than plus or minus 2 then estimated coefficient is statistically significant.

## Estimated Models using OLS (Mediation effects:2)

Models	M1	M2	M3
	Yt=Business	Yt=Business	Yt=Macroeconomic
C	(-79.23) (-5.94) (0.0000)	(-65.07) (-4.41) (0.0008)	(207.25) (2.33) (0.03)
MACU	_____	(-0.06) (-1.76) (0.10)	_____
FINCU	(5.20) (1.87) (0.082)	(8.00) (2.65) (0.02)	(4.09) (2.22) (0.0446)
TO	(-2.02) (-12.46) (0.0000)	(-2.16) (-12.76) (0.0000)	(-1.99) (-1.84) (0.08)
D(CONS)	(-2.28) (-1.51) (0.153)	(2.70) (-1.90) (0.08)	(-6.17) (-0.61) (0.54)
D(GOVT)	(-3.55) (-0.43) (0.67)	(-2.28) (-0.02) (0.97)	(4.85) (0.89) (0.38)
INF	(23.73) (12.53) (0.0000)	(25.33) (12.83) (0.0000)	(23.30) (1.85) (0.08)
R-square	0.89	0.891	0.98
LM- statistic (prob)	0.799	0.343	0.173
F-statistic (prob)	0.00	0.00	0.00

Notes: The table contains three estimated models to test mediation effects. The mediator in present study is macroeconomic uncertainty. Bcyle is dependent variable measuring business cycle fluctuations, Macu, measures macroeconomic uncertainty and Fincu measures financial uncertainty. Control variables are TO, trade openness, D(cons) first difference of consumption, D(GOVT) first difference of government spending, INF represents inflation rate. The first parenthesis is the value of estimated coefficient and the second parenthesis represent t-value and the third parenthesis represents shows the p-value of estimated coefficient. Decision rule of statistical significance is if t-value in second parenthesis is greater than plus or minus 2 then estimated coefficient is statistically significant.



### Moderation Model Results (Using OLS)

Variables	Coefficient	t-stat	p-value
C	-57.11	-3.90	0.0025
MACU	-0.082	-2.222	0.0481
FINCU	-1.99	-1.15	0.2737
TO	-2.198	-13.72	0.0000
D(CONS)	-2.45	-1.83	0.0930
D(GOVT)	7.65	-0.104	0.9185
INF	25.75	13.79	0.0000
(MACU*FINCU)	3.84	1.63	0.1296
R-square	0.84		
LM-Stat (prob)	0.45		
F-stat prob	0.000		

Notes: The table contains three estimated model to test moderation effects. The moderator in present study is the product of financial and macroeconomic uncertainty (MACU\*FINCU). Bcyle is dependent variable measuring business cycle fluctuations, Macu, measures macroeconomic uncertainty and Fincu measures financial uncertainty. Control variables are TO, trade openness, D(cons) first difference of consumption, D(GOVT) first difference of government spending, INF represents inflation rate. The first parenthesis is the value of estimated coefficient and the second parenthesis represent t-value and the third parenthesis represents shows the p-value of estimated coefficient. Decision rule of statistical significance is if t-value in second parenthesis is greater than plus or minus 2 then estimated coefficient is statistically significant.

## REFERENCES

- Bachmann, R., and G. Moscarini (2011): “Business Cycles and Endogenous Uncertainty,” Discussion paper, Society for Economic Dynamics.
- Bachmann, R., S. Elstner, and E. R. Sims (2013): “Uncertainty and Economic Activity: Evidence from Business Survey Data,” *American Economic Journal: Macroeconomics*, 5(2), 217–49.
- Baker, S. R., and N. Bloom (2013): “Does Uncertainty Reduce Growth? Using Disasters as Natural Experiments,” National Bureau of Economic Research Working Paper 19475.
- Baker, S. R., N. Bloom, and S. J. Davis (2013): “Measuring Economic Policy Uncertainty,” <http://www.policyuncertainty.com/media/BakerBloomDavis.pdf>.
- Bansal, R., and A. Yaron (2004): “Risks for the Long-Run: A Potential Resolution of Asset Pricing Puzzles,” *Journal of Finance*, 59(4), 1481–1509.
- Bar-Ilan, A., and W. C. Strange (1996): “Investment lags,” *The American Economic Review*, 86(3), 610–622.
- Basu, S., and B. Bundick (2012): “Uncertainty Shocks in a Model of Effective Demand,” <http://fmwww.bc.edu/ec-p/wp774.pdf>.
- Bekaert, G., M. Hoerova, and M. L. Duca (2013): “Risk, Uncertainty and Monetary Policy,” *Journal of Monetary Economics*, 60(7), 771–88.
- Berger, D., I. Dew-Becker, and S. Giglio (2016): “Contractionary volatility or volatile contractions?,” Unpublished paper, Northwestern University.
- Bernanke, B. S. (1983): “Irreversibility, Uncertainty, and Cyclical Investment,” *The Quarterly Journal of Economics*, 98(1), 85–106.
- Bianchi, F., C. Ilut, and M. Schneider (2014): “Uncertainty Shocks, Asset Supply and Pricing Over the Business Cycle,” Unpublished paper, Duke University.
- Bloom, N. (2009): “The Impact of Uncertainty Shocks,” *Econometrica*, 77(3), 623–85.
- Bloom, N., M. Floetotto, N. Jaimovich, I. Saporta-Eksten, and S. J. Terry (2012): “Really Uncertain Business Cycles,” National Bureau of Economic Research Working Paper 18245.

- Boncianni, D., & Van Roye, B. (2016). Uncertainty shocks, banking frictions and economic activity. *Journal of Economic Dynamics and Control*, 73, 200-219.
- Fairchild, A. J., & MacKinnon, D. P. (2009). A general model for testing mediation and moderation effects. *Prevention Science*, 10(2), 87-99.
- Fajgelbaum, P., E. Schaal, and M. Taschereau-Dumouchel (2014): "Uncertainty traps," Discussion paper, National Bureau of Economic Research Working Paper No. W19973.
- Favilukis, J., S. C. Ludvigson, and S. Van Nieuwerburgh (2015): "The Macroeconomic Effects of Housing Wealth, Housing Finance and Limited Risk Sharing in General Equilibrium," *Journal of Political Economy*, forthcoming.
- Fernández-Villaverde, J., J. F. R.-R. Pablo Guerrón-Quintana, and M. Uribe (2011): "Risk Matters: The Real Effects of Volatility Shocks," *American Economic Review*, 6(101), 2530–61.
- Fluctuations in Uncertainty," *The Journal of Economic Perspectives*, pp. 153–175.
- Ludvigson, S. C., Ma, S., & Ng, S. (2015). Uncertainty and business cycles: exogenous impulse or endogenous response? (No. w21803). National Bureau of Economic Research.
- Saijo, H. (2017). The uncertainty multiplier and business cycles. *Journal of Economic Dynamics and Control*, 78, 1-25
- Silvia, J. E., Iqbal, A., Swankoski, K., Watt, S., & Bullard, S. (2014). *Economic and business forecasting: Analyzing and interpreting econometric results*. John Wiley & Sons.
- Yıldırım-Karaman, S. (2018). Uncertainty in financial markets and business cycles. *Economic Modelling*, 68, 329-339.