© *The Pakistan Development Review*
58:3 (2019) pp. 307–331
DOI: 10.30541/v58i3pp.307-331

Political and Economic Uncertainty and Investment Behaviour in Pakistan

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This study analyses the effect of political stability and macroeconomic uncertainty on aggregate investment behaviour in Pakistan over the period 1960–2015. The Auto-Regressive Distributed Lags (ARDL) methodology is applied to explore both the long-run equilibrium relationship and short-run behaviour of investment. The macroeconomic uncertainty variable is derived from real exchange rate and is computed by the best-fitted GARCH model. The results reveal robust effects of political stability and macroeconomic uncertainty on overall investment activity in Pakistan. The government nationalisation policy, GDP growth, user cost of capital, credit availability and degree of openness are found to be the other key determining factors for investment both in long- and short-run. However, the favourable impact of physical infrastructure on investment holds in long-run only, while its effect is adverse though insignificantly in short-run. The findings support the neoclassical flexible accelerator principle and are consistent with economic theory. The volume of available funds is the binding constraint for investment and the McKinnon-Shaw hypothesis is validated in the short-run.

Keywords: Aggregate Investment, Irreversibility, Macroeconomic Uncertainty, Political Stability, GARCH, ARDL, Bound Testing Approach, Pakistan

1. INTRODUCTION

The existing theoretical and empirical literature suggest that investment is influenced by three categories of factors, which are anticipated future demand, past decisions and current market opportunities [Lucas and Prescott (1971)]. In the perspective of anticipated future demand, Jorgenson (1971, p. 1142) claimed that consideration of uncertainty in modelling and empirical analysis is the most important challenge. Uncertainty is classified into macroeconomic uncertainty, which could be the outcome of fluctuations in macro variables like GDP, CPI, exchange rate, etc. and political instability like civil conflicts, bad governance; unstable governments, etc. [see Knight (1921); Feng (2001); Le (2004)].

It is generally presumed that uncertainty (both macroeconomic and political) may have adverse effects on investment. Abdelkader (2017) postulates that investors are averse towards investing in a country characterised by economic uncertainty and political

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Authors' Note: The paper is based on PhD thesis of principal author.

instability. The phenomenon of uncertainty is even more pronounced in developing countries like Pakistan due to the vulnerable economic conditions and political upheavals. The effect of political instability may be more visible because most investment decisions in a country like Pakistan are not taken on economic grounds but on an opportunistic and public choice basis [Haque (2007)].

Investment is irreversible in nature and thus involves an inherent delaying factor [Dixit and Pindyck (1994)]. Once capital is installed, it has little or no value unless used for the intended production and this makes investment sensitive to risk or uncertainty [Pindyck (1993)]. Irreversibility coupled with uncertainty makes potential investors reluctant to invest, which results in sub-optimal levels of investment. Hence, irreversible investment (that generates sunk cost) and delaying (wait and see) policy are linked with uncertainty, which consequently leads to inefficiency because of high cost of doing business. Furthermore, investors delay their investment decisions in the wake of unstable political environment and prefer to wait for improved and stable political conditions.

At the micro level, firms' investment decisions can be delayed in the presence of sunk costs, political instability and uncertainty about future cash-flows and unprofitable business opportunities. However, at macro level, 'raised business costs' are the channel of uncertainty. The issue of investment-uncertainty nexus is, therefore, a realistic phenomenon in modelling investment behaviour at macro level too, especially in the context of developing economies. Macroeconomic uncertainty matters a lot in investment decisions because if economic conditions are uncertain, potential investors do not have expectations of growth in demand and, hence tend to shy away from taking the risk of incurring huge sunk costs in case demand does not grow. Similarly, political instability/uncertainty also imposes unexpected costs on investment because it creates the risk of unexpected changes in economic policies, especially the structure of taxation and other fiscal and monetary policy measures that can directly or indirectly affect cost-benefit aspects of investment decisions.

The current body of evidence suggests various measures of uncertainty and irreversibility depending upon the data type, nature of the analysis (such as aggregated vs. disaggregated and macro vs. micro analysis etc.) and size of the economy. Macroeconomic uncertainty has been measured using inflation, real exchange rate and interest rate proxies, which have an adverse effect on capital formation [see Aryeetey (1994); Pattillo (1998)]. Moreover, different measures have been employed for quantifying uncertainty, such as unconditional variance, standard deviation, standard deviation of residuals of AR process and conditional volatility generated through an estimated GARCH model. In some cases, the percentage rate of change in inflation has also been used as a measure of uncertainty.[1] Unconditional variance or standard deviation may be used as a proxy for risk but not for uncertainty. Notably GARCH process seems more relevant and it is considered to be relatively more reliable proxy for uncertainty [see Darrat and Hakim (2000); Arize, *et al*. (2000)].

Investment activity in Pakistan has gone through various phases over the past sixty years as the country has a long history of macroeconomic and political uncertainty. Economic uncertainty has been partially caused by global factors like oil price shocks (during 1970s and 1990s) and commodity price shocks (2007-09). Another source of

[1]See Ahmad, *et al*. (2008); Ahmad and Qayyum (2008, 2009).

economic instability has been internal factors like debt crisis of 1990s, when rupee continued to lose its value against US dollar, and major variations in monetary and fiscal policy stances and structural reforms under the IMF adjustment programmes. Pakistan also faced spells of political instability. For example, four democratically elected governments between 1988-99 were dislodged prematurely, on one pretext or the other. During this period investment activity mostly remained sluggish. In the context of this background it is important to explore to what extent economic and political uncertainties have hampered investment activity in Pakistan, while accounting for other (conventionally considered) determinants of investment behaviour.

A few studies have probed the aggregate investment and uncertainty nexus by making use of different measures of uncertainty. However, to our knowledge, no study has captured the effect of uncertainty (measured through conditional variance, i.e., GARCH) coupled with political instability on aggregate gross fixed investment for the Pakistan economy. The present study attempts to fill this gap by analysing the effect of macroeconomic uncertainty and political stability and investment in Pakistan over the period 1960–2015. The study uses a GARCH model to calculate macroeconomic uncertainty variable through real exchange rate, while polity score is used as a proxy for political instability. ARDL technique is employed to estimate the investment behaviour under uncertainty. Figure 1 (a and b) shows that investment growth and the proposed measure of macroeconomic uncertainty tend to move over time more-or-less in opposite directions indicating negative relationship of investment with macroeconomic uncertainty. On the other hand, the relationship between investment growth and political stability (opposite of uncertainty) is positive but weak.

The paper is comprised of six sections. Section 2 presents a review of literature, while theoretical background of the model is discussed in Section 3. Section 4 outlines the data used, construction of variables, research methodologies and models. Moreover, estimates of the parameters are discussed in this section. The main results and finding of the empirical analysis are presented in Section 5. The final section gives concluding remarks and outlines the policy implications of this analysis.

2. REVIEW OF LITERATURE

The recent strand of literature on investment behaviour mainly focuses on the issues of risk, irreversibility and uncertainty. The issue of irreversibility of investment and role of risk/uncertainty in determination of investment has gained attention in the literature from the late 1980s [for example, see Bernanke (1983); McDonald and Siegel (1986); Bertola and Caballero (1994); Belanová (2014)]. The classical theory of real options postulates that uncertainty dampens investment activity [Antoshin (2006)]. The literature, in general, demonstrates negative impact of irreversibility and uncertainty on investment [Lee and Shin (2000); Carruth, *et al.* (2000)]. It is pertinent to note that evidence about the impact of uncertainty has been found positive as well and so investment-uncertainty relationship is inconclusive in terms of its impact and intensity [Abel, *et al.* (1996); Patnaik (2016); Lee (2016)].

The micro or firm-level studies mostly analyse issues of irreversibility, option value and delays in investment decisions. In the context of irreversibility, Majd and Pindyck (1987) demonstrate that uncertainly may possibly increase the required return to a great extent due to considerable delays in delivery and installation of new capital. The literature on the issue has examined the implications of irreversibility for investment-uncertainty relationship [see Caballero and Pindyck (1992); Pindyck and Solimano (1993)]. It is argued that the threshold level of required profit increases along-with uncertainty; hence less is invested at higher levels of uncertainty.

In their pioneering work on investment in an uncertain world, Dixit and Pindyck (1994) explain how option pricing theory can be utilised to gain insights into the irreversible investment behaviour facing demand and price uncertainty. The study indicates that investors use the ‘wait and see’ policy prior to undertaking investment in the presence of uncertainty. This implies that a higher level of uncertainty leads to lower levels of investment. Using panel data of 772 US manufacturing firms Leahy and Whited (1996) examine the linkages between investment and uncertainty during the period 1981–1987 and find that uncertainty negatively causes investment. However, Parker (2010) points out that even in micro-level surveys of investment, the impacts of irreversibility are hard to observe. The study further elaborates that it can be implied from testable effect of irreversibility that the increase in uncertainty affects investment negatively through raised option cost of investment.

In a recent analysis of business investment, Belanová (2014) explore the impacts of uncertainty and irreversibility as determining factors of investment. The study finds that interaction between these variables may create opportunity costs and application of corresponding (real) option and the prevalent conditions pertaining to market structure and institutional setup in volatile economies of developing countries are more prone to the issue of uncertainty. The study concludes that the inverse relationship between uncertainty and investment persists in the presence of irreversibility. According to Pindyck and Solimano (1993), uncertainty has robust negative influence on investment in the case of developing economies, but for the OECD countries the negative impact is not considerable. However, Ferderer (1993) finds that uncertainty negatively influences aggregate investment activity in the USA. Levine and Renelt (1992) reveal that even though inflation itself and its uncertainty do not have significant effect on investment, yet when linked with political uncertainty it may affect investment adversely.

Employing data of 14 African countries over the time span of 1980–1995, Bleaney and Greenway (2001) find that investment is significantly affected by exchange rate uncertainty, but not by terms of trade uncertainty. In a more comprehensive study based on data for 46 developing countries, Aizenman and Marion (1993) explore the effect of uncertainty on investment using a composite uncertainty index derived from the nominal money growth, ratio of government expenditures to GDP, and real effective exchange rate. The findings show a strong negative effect of volatility on private investment, a positive effect on public investment and no significant impact when private and public investments are analysed jointly. Similarly, Rozeei, *et al.* (2014) in the case of Iran finds that macroeconomic uncertainty affects the private investment negatively both in the short-run and the long-run; when macroeconomic uncertainty is proxied by inflation rate, nominal interest rate and real exchange rate.

Sioum (2002) identifies terms of trade volatility as the only macroeconomic uncertainty proxy out of four other measures that negatively and significantly influences private investment. However, Serven (1998) and Clausen (2008) find significant direct relationship of investment with volatility of exchange rate. Aysan, *et al.* (2006) while analysing the traditional reasons of low investment for a panel of 39 countries of Middle East and North Africa region along-with economic uncertainty using several measures of volatility, conclude that deficient economic environment and the lack of economic reforms significantly erode private entrepreneurs' decision to invest.

The uncertainty measures used in both micro and macro level studies include variance, standard deviation and coefficient of variation of key variables in investment decision making. GARCH conditional variance, residuals of AR processes and future perception measures of variables of interest are often used as proxies of uncertainty [Pindyck (1986); Episcopos (1995); Price (1996); Ghosal and Loungani (1996); Pattillo (1998); Guiso and Parigi (1999); Bloom, *et al.* (2007); Belanová (2014)]. The variation in results across different studies are mostly due to use of the different measures and estimation techniques. Keeping in mind the Knightian and Keynesian viewpoints, risk is distinguished from uncertainty on the basis of unconditional or objective method versus conditional variances or subjective approach. In this context simple variance/standard deviation and residuals of AR processes (unconditional volatility) may be closely related measure of the risk whereas the GARCH based conditional volatility can be the relevant measure of uncertainty.

Coupled with (macro) economic uncertainty, volatile and unstable social and political situations may also hamper investment flows. In macroeconomic context Rodrik (1991) and Pindyck and Solimano (1993) show that political uncertainty tends to reduce the level of investment. The factors like weak institutions, fragile political structure, disobedience of rule of law, poor law and order conditions, corruption, riots, strikes, crime and frequent changes in political regimes are expected to affect the investment decisions [see Stewart and Venieris (1985); Sjaastad and Bromley (1997)]. Basically, socio-political uncertainty adversely affects investment due to a gloomy investment climate. It shatters business confidence and raises cost of doing business because property rights cannot be properly enforced. In particular, corruption results in inefficiencies, transaction costs and levy of new taxes, which all reduce investment activity in the economy [Mauro (1995); Murshed (2002)].

Using data of 60 countries, Brunetti and Weder (1997) study the effects of various measures of institutional uncertainty on investment over the period 1974–89. The study finds that different uncertainty measures are inversely related to investment and investment irreversibility magnifies the impact of uncertainty on investment decisions. In another major study using data of 48 countries, for the period 1980–2005, Julio and Yook (2012) analyse the influence of political uncertainty on corporate investment. The study finds that investment is reduced by 4.8 percent on average during election years when compared to nonelection years.

The existing empirical evidence supports the notion that political instability/uncertainty can adversely affect the aggregate investment level. The studies like Barro (1991) and Alesina and Perotti (1996) find correlation between cross-country differences in rates of investment and measures of violence and political instability. Moreover, the literature shows that aggregate investment expenditures are inversely related to political uncertainty as well as corruption and bribery [Pindyck and Solimano (1993); Mauro (1995)].

3. THEORETICAL UNDERPINNING OF THE ECONOMETRIC MODEL

Investment behaviour is inherently uncertain and should be modelled accordingly. Along-with conventional determining factors of investment like profitability, monetary and fiscal policy measures, etc., investment analysis incorporates the phenomena of animal spirits,[2] (business) expectations, timing of investment decisions and risk/uncertainty [Chirinko (1993); Temple, *et al.* (2001); Le (2004); Aysan, *et al.* (2006)]. The effects of uncertainty can be viewed in terms of uncertainties about future profitability and discount factors; lumpy and irreversible investment; linked and fixed adjustment costs; political instability; property rights problem, corruption, rent-seeking and opportunistic behaviour [Caballero (1999); Romer (2001); Le (2004)]. Caballero (1999) states the concept of 'reluctance to invest', which states that capital's marginal profitability should considerably outweigh its cost for the investment to take place. Reluctance reflects the value of 'option to wait'. In this case positive simple net present value (NPV) will not be the exclusive criterion to invest because of the pending decision for tomorrow and uncertain future. Therefore, in the context of value-maximising, simple NPV rule is not optimal in the presence of irreversibility and uncertainty [Ingersoll and Ross (1992)].

The present study uses the model of Le (2004) to construct an econometric model of aggregate investment behaviour for Pakistan under macroeconomic uncertainty and political instability. The model assumes a large number of economic agents with infinite life spans. They consume an amount (C) from the return on income allocated to investment in one period. For simplicity, investors are assumed to allocate their resources in a single (domestic) market. Additionally, there is no labour income. A single homogeneous good in the country is assumed. Finally, population is assumed to be constant and normalised to unity. Assuming that the representative agent maximises lifetime utility subject to the budget constraint, Le (2004) concludes that in spirit the investment decision under irreversibility and uncertainty are based on expected return and risk or uncertainty measured by (conditional or unconditional) variance of returns.

In the generalised aggregate model, aggregate investment is taken as dependent variable and expected return and measures of uncertainty (both political and economic) are the explanatory variables. Other control variables could also be included to effectively investigate the investment behaviour. In the presence of control variables the econometric model assumes the following form:

$$I = \alpha + Z\beta + X\gamma + \varepsilon \qquad \ldots \qquad (1)$$

where I is the aggregate fixed investment,[3] X is Vector of macroeconomic uncertainty and political instability and Vector Z includes the variables suggested by theoretical and empirical studies such as GDP growth (accelerator theory/principle),[4] user cost of capital (neoclassical investment model of Jorgenson), financial development (credit availability),

[2] The Keynesian notion of 'animal spirit' describes the state of inability of economic agents to perceive the future outcomes who are unable to attach probabilities to the possible outcomes.

[3] Many studies have used the real (private/total or aggregate/domestic) investment level rather than its ratio to output (GDP) or capital stock [for example, see Serven (1998); Bleaney and Greenway (2001); Badawi (2003); Ajide and Lawanson (2012); Hamuda, *et al.* (2013); Rozeei, *et al.* (2014); Akanbi (2016)]. However, Le (2004) has taken this variable as private investment to output ratio.

[4] Sakr (1993) and Suhendra and Anwar (2014) have also used GDP growth (as a proxy) to empirically test the accelerator theory/model.

physical infrastructure and trade openness [for details, see Aysan, *et al*. (2006)]. Notably the literature suggests that investors' expectations about economic environment can be captured through one-year lagged GDP growth rate [Aysan, *et al*. (2006)].

Variation in the investment spending with changes in output can be referred to as the 'accelerator principle' and it indicates changes in demand [Naa-Idar, *et al*. (2012)]. The neoclassical model also suggests that increase in cost of capital/doing business makes some of the investment projects economically unfeasible and as a result overall investment expenditure declines [Hall and Jorgenson (1969); Akkina and Celebi (2002)]. The neoliberal framework of investment behaviour emphasises on the importance of financial deepening in encouraging investment [McKinnon (1973) and Shaw (1973)]. Contrary to neoclassical theory of investment, McKinnon and Shaw hypothesis suggests a positive impact of real rate of interest on the level of investment as higher interest rates can lead to an increase in savings and thus domestic credit available as investible funds. Similarly, financial development (bank credit) is also considered as the key determinant of investment. In developing countries due to underdeveloped financial markets, interest rate does not reflect the true cost of capital and the availability of financial resources rather than cost is a binding constraint. Availability of financial resources is captured by credit availability [Akkina and Celebi (2002)].

Trade openness means access to the latest technology [Hamuda, *et al*. (2013)]. Trade liberalisation reduces trade barriers and thus stimulates the export sector, resulting in improvement in the current account balance and increased investment incentives [Balassa (1988); Asante (2000); Naa-Idar, *et al*. (2012)]. Infrastructural development increases productivity of capital [Looney (1997)]; reduces the external (transaction) costs and hence boosts the rate of return [Asiedu (2002)]; and enlarges the market [Badawi (2003); Suhendra and Anwar (2014)].

The econometric model in its simple form to represent the relationship between investment and its determinants is given by:

$$I = \propto_0 + \propto_1 G = \propto_2 UC + \propto_3 FD + \propto_4 OP + \propto_5 PI + \propto_6 GSD + \propto_7 POL + \propto_8 ND + \mu \quad \ldots \quad (2)$$

where *I, G, UC, FD, OP, PI, GSD, POL, ND* denote aggregate fixed investment, real GDP growth rate, user cost of capital, financial development, trade openness, physical infrastructure, GARCH conditional standard deviation of real exchange rate, polity score and nationalisation dummy respectively.

4. DATA AND ESTIMATION METHODOLOGY

4.1. Data Description

The study analysis encompasses the time period 1960–2015. All the variables are extracted from *Pakistan Economic Survey* (*PES*), *International Financial Statistics* (*IFS*), *World Development Indicators* (*WDI*) online version, *Polity IV dataset* and *Penn World Table.* Real gross fixed capital formation i.e. aggregate fixed investment (I) is the dependent variable while real GDP growth (G), user cost of capital (UC), financial development (proxied by real domestic credit availability) (FD), trade openness (OP) and physical infrastructure (PI) are the major explanatory variables employed in the study. GARCH standard deviation of real exchange rate[5] represents macroeconomic uncertainty (GSD).[6] Political stability (POL) is proxied by polity IV score. The lower value represents political instability and *vice versa*. To calculate polity score autocracy score is subtracted from the democracy score; with the resulting unified polity scale ranging from –10 (strongly autocratic) to +10 (strongly democratic). To capture the effect of nationalisation, dummy variable (DN) is used. The value of it is set equal to one for the years 1972-1974 and zero otherwise.

4.2. Construction of Variables

Data on all variables used in the analysis are expressed at constant 1999-2000 million Pakistan Rupees except user cost of capital, physical infrastructure and polity IV score. Monthly real exchange rate data are used to estimate GARCH standard deviations series. It is then converted into annual series by taking twelve month average for each year. Financial development variable (FD) is proxied by using total domestic credit availability. Physical infrastructure (PI) variable is proxied by road density (length of roads per square kilometer or area). Trade openness (OP) is computed by dividing the sum of exports and imports by GDP.

Hall and Jorgenson (1967) argue that decision of investment relies upon cost and benefit analysis. Benefit side largely depends upon demand, while cost relies on (change in) price of capital (the implicit investment deflator)/inflation rate,[7] (nominal) interest rate and depreciation rate. According to Jorgenson, user cost (UC) of capital is represented by the following formula.

$$UC = P_k\left(i + \delta - \frac{\Delta P_k}{P_k}\right), \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

where the capital price P_k is approximated by (implicit) investment price deflator, i is average of three different nominal interest rates (call money rate, government bond yield and discount rate), δ is the depreciation rate,[8] and last term $\Delta P_k/P_k$ shows the growth rate of capital price/inflation rate.[9]

4.3. Estimation Technique

Majority of macroeconomic time series variables, i.e., GDP, credit availability and road density are non-stationary; while some series may be stationary.[10] The standard

[5]Real effective exchange rate (REER), in most cases, is a better indicator of actual competitive exchange rate. However, for developing countries this indicator has not been much of a help. In Pakistan's case during the fixed exchange rate regime the data on exchange rate was flat before 1982 with a few steps representing planned devaluation, rendering itself non-viable for econometric usage.

[6]The movements in real exchange rate occur due to inflation, government policies, country competitiveness and real variables of the economy. So, it captures the uncertainty originating from inflation uncertainty, and all other sorts of uncertainty [see Dornbusch (1976); Van Foreest and De Vries (2003)].

[7]See Akkina and Celebi (2002).

[8]The series is taken from *Penn World Table*.

[9]Capital has three costs to the firm namely forgone interest (iP_k), depreciation capital cost (δP_k), and change in the price of capital over time (ΔP_k). Note that probable change in the price of capital ΔP_k causes the increase in cost of using the capital due to the fall in price and vice versa. So, the corresponding cost is $-\Delta P_k$. The forgone interest and negative growth in the price of capital (inflation) i.e. real interest rate $r = \left(\mathrm{i} - \frac{\Delta P_k}{P_k}\right) => i - \pi$ is opportunity cost (of capital).

[10] Note that if all the variables in the analysis are non-stationary/integrated of order one (or same order) and their linear combination is stationary/error-correction i.e. co-integrated (existence of long-run relationship) then the *r* Engle and Granger (1987) or Johansen-Juselius (JJ) (1990) approach method can be applied. In case of small data and differing or mix order of integration, the ARDL technique of co-integration is used.

estimation techniques like OLS can, therefore, possible produce spurious results.[11] Furthermore, endogeneity is another important issue present in many macroeconomic relationships, such as output and investment behaviour because of interdependence and inertia factor. In such a scenario, the OLS would yield biased and inconsistent estimates. The present study addresses these issues by employing the Auto-Regressive Distributed Lag (ARDL) approach outlined by Pesaran, *et al.* (2001). The advantage of ARDL approach is that it not only takes into account the endogeneity issue [Alam and Quazi (2003); Rehman, *et al.* (2009)], but it also does not require all variables to be stationary in first differences, allowing some of them to be stationary at level as well.

Pesaran and Shin (1999) show that in an ARDL model free of residual correlation, endogeneity is less of an issue and, therefore, choice of appropriate lags in the ARDL model is vital to ensure absence of residual correlation and tackling of endogeneity. Another advantage of ARDL method is that it estimates both the long-run and short-run responses in the variable under consideration, thereby addressing issues related with omitted variables and autocorrelation. Therefore, estimates provided by ARDL method are unbiased and efficient because of avoiding the problems caused by endogeneity and autocorrelation [Siddiki (2000)].

The main disadvantage of ARDL model is that it only allows for one-way relationship from all the regressors towards the focused variable (investment in our case). Given that investment is, by definition, a part of GDP, one wonders how GDP could be considered as exogenous in the system. However, we can justify the use of ARDL framework, keeping in view its advantages, on two grounds. First, the GDP variable is not represented in level form, rather in the form of year to year growth rate. Therefore, even though GDP itself cannot be treated as an exogenous variable, its growth rate could still be exogenous with respect to current investment expenditure. Second, preliminary data analysis (Granger causality tests) shows that causality from investment to GDP growth rate is rather weak, insignificant even at 20 percent level of significance, whereas causality from GDP growth rate to investment is statistically significant.

Using the standard ARDL framework, Equation (2) is generalised as follows.

$$\Delta I_t = \alpha + \sum_{i=1}^{p1} a_i \Delta I_{t-i} + \sum_{i=0}^{p2} b_i \Delta G_{t-i} + \sum_{i=0}^{p3} c_i \Delta UC_{t-i} + \sum_{i=0}^{p4} d_i \Delta FD_{t-i} + \sum_{i=0}^{p5} e_i \Delta OP_{t-i} + \sum_{i=0}^{p6} f_i \Delta PI_{t-i} + \sum_{i=0}^{p7} g_i \Delta GSD_{t-i} + \sum_{i=0}^{p8} h_i \Delta POL_{t-i} + \gamma ND_t + \beta_1 I_{t-1} + \beta_2 G_{t-1} + \beta_3 UC_{t-1} + \beta_4 FD_{t-1} + \beta_5 OP_{t-1} + \beta_6 PI_{t-1} + \beta_7 GSD_{t-1} + \beta_8 POL_{t-1} + v_t \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

The null hypothesis of joint restriction that all the parameters β_is are equal to zero means non-existence of co-integrating relationship among the variables considered. This hypothesis is tested using F-statistic, wherein rejection of the null hypothesis would indicate existence of a co-integrating (long-run) relationship. The parameters *a*'*s*, *b*'*s*, *c*'*s*, *d*'*s*, *e*'s, *f*'s, *g*'s and h's describe the short-run dynamics of the variables. Finally, v_t the residual term and it is assumed as white noise process. The estimates are subject to many econometric issues if the assumptions regarding the residual are violated. The diagnostic tests, therefore, consist of checking for autocorrelation, normality and heteroscedasticity of errors, Ramsey Reset test and the tests for stability of parameters based on CUSUM and CUSUMSQ test.

[11] Granger and Newbold (1974) have suggested the rule of thumb that estimated results are spurious when the coefficient of determination (R^2) is larger than the Durbin Watson (DW) statistic of autocorrelation.

Multiple lag selection criteria such as Hannan Quinn Criterion (HQC), Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and adjusted R-square are used in ARDL approach. However, the present study mainly focuses on Schwarz Bayesian Criterion (SBC) as it selects the most parsimonious model [Quinn (1988); Morimune and Mantani (1995); Pesaran and Shin (1999)].

The ARCH and the GARCH models formulated by Engle (1982) and Bollerslev (1986), respectively are used to study volatility clustering and model uncertainty accordingly. Generally the GARCH model is specified in terms of two equations namely the conditional mean equation (ARMA), and conditional variance equation. For diagnostics of lag structure of both the mean and variance equations besides the study of autocorrelation structure of residuals and squared residuals, performance criteria like AIC, SBC, etc. are also employed.

It is important to note that besides ARDL and GARCH, to analyse the investment behaviour under uncertainty over time, Dynamic Conditional Correlation (DCC) and/or Copula models and Extreme Value Theory (EVT) methodology are also used in the studies to observe co-movement between uncertainty and investment behaviour [for details, see Nguyen and Bhatti (2012); Bhatti and Nguyen (2012); Al Rahahleh, *et al.* (2017)]. But Copula approach to study co-movement between uncertainty and investment (dependence between two random variables) does not seem to be feasible for the present study. The approach is usually applied to high frequency data [see Palaro and Hotta (2006); Righi and Ceretta (2012); Bob (2013); Al Rahahleh and Bhatti (2017)]. Various studies have also noted that the approach is hard/cumbersome and tricky and requires large samples [Palaro and Hotta (2006); Alexander (2008); Bob (2013)]. For example, Alexander (2008) and Bob (2013) suggest that historic sample should be sufficiently large to yield enough observations in the tail of the data distribution.

5. ESTIMATION RESULTS AND DISCUSSION

Firstly, macroeconomic uncertainty is measured by real exchange rate volatility through GARCH model. Appendix shows that according to unit root tests results the log of real exchange rate series is integrated of order one. Therefore GARCH model is considered with first difference of the log of real exchange rate (growth rate of real exchange rate). Before fitting the GARCH process, we have tested the presence of ARCH process (volatility clusters) using Lagrange Multiplier (LM) ARCH test [Engle (1982)] and serial correlation in using Ljung-Box Q-Stat. The results presented in Appendix confirm the presence of significant ARCH effects and serial correlation in data. For final model selection alternative specifications of GARCH model are run and the results are presented in Table 1. Based on the results of these specifications, GARCH (1,3) specification for variance equation along-with ARMA (2,3) specification for mean equation are considered to be appropriate using AIC, SBC and significant coefficient technique.

The effectiveness and efficiency of the selected GARCH process is verified by testing the residual term, which should follow the white noise process. If the residual term shows the properties of white noise then the selected model is appropriate. To test the residuals, two tests are applied i.e. LM ARCH test and serial correlation using Ljung-Box Q-Stat. The results presented in Appendix reveal that there is no ARCH and serial correlation left in the residual at 5 percent level of significance, so residuals are white noise. After passing the diagnostic test the conditional variances are estimated and using 12 period averages they are converted into annual time series to be used in our main model as a measure of macroeconomic uncertainty.

Table 1

Estimates of Alternative GARCH Model

	ARMA(2,3)				ARMA(2,2)		
	GARCH (1,1)	GARCH (1,2)	GARCH (1,3)	GARCH (2,3)	GARCH (1,1)	GARCH (1,2)	GARCH (1,3)
ARCH(1)	0.001	0.002***	0.001*	0.02**	0.006	0.003**	0.01**
	(0.17)	(0.06)	(0.00)	(0.04)	(0.15)	(0.03)	(0.03)
ARCH(2)				–0.01			
				(0.53)			
GARCH(1)	0.968*	0.001	–0.80*	0.41	0.89*	0.004	–0.31*
	(0.00)	(0.98)	(0.00)	(0.68)	(0.00)	(0.93)	(0.00)
GARCH(2)		0.93*	–0.39*	0.02		0.925*	0.31*
		(0.00)	(0.00)	(0.97)		(0.00)	(0.00)
GARCH(3)			0.47*	0.01			0.88*
			(0.00)	(0.98)			(0.00)
AIC	–4.536	–4.540	–4.798	–4.503	–4.530	–4.537	–4.55
SBC	–4.483	–4.480	–4.732	–4.430	–4.484	–4.484	–4.494
Adj R^2	0.178	0.174	0.168	0.013	0.163	0.168	0.14

P-values are provided in the brackets.
The coefficients significant at 1 percent, 5 percent and 10 percent are indicated by *, ** and *** respectively.

Before presenting the results of ARDL model, it will be informative to observe the descriptive relationship of investment growth with the two uncertainty variables. Figure 1 shows that investment growth forms negative relationship with macroeconomic uncertainty and positive relationship with political stability (opposite to political instability or uncertainty).

Fig. 1.a. Investment Growth and Political Stability

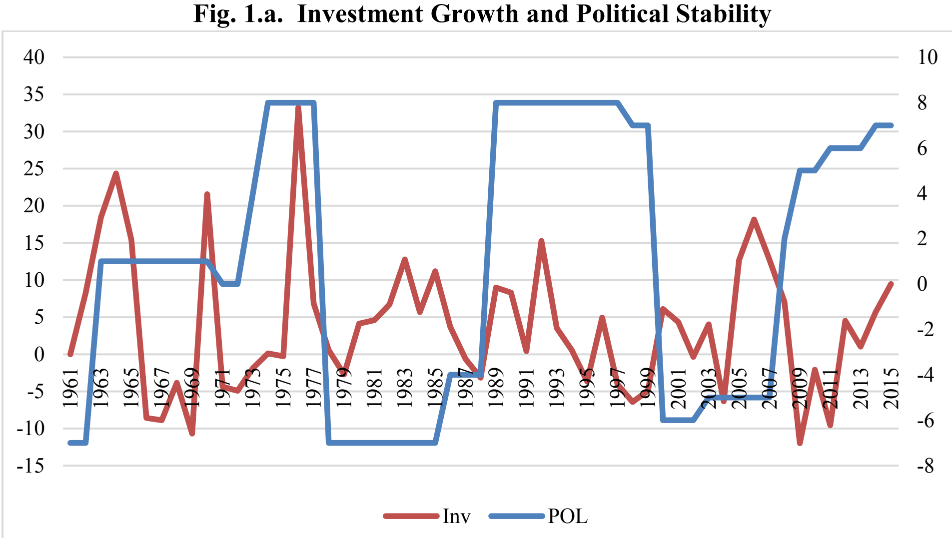
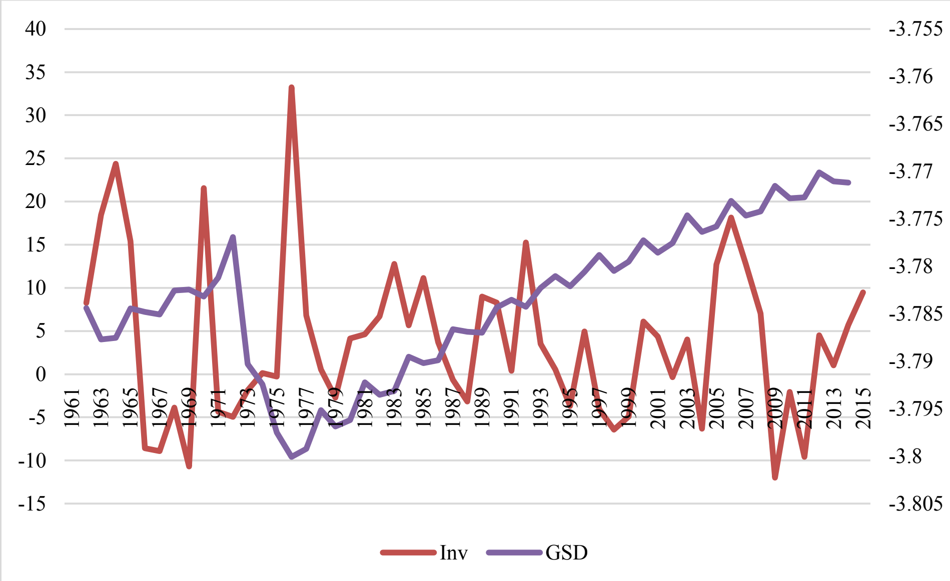


Fig. 1.b. Investment Growth and Economic Uncertainty



Moving now to the ARDL model, Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests are applied to check the stationarity of the variables that enters into the model. The results presented in Appendix indicate that GDP growth rate, user-cost of capital, and trade openness are stationary at level whereas investment, real credit, economic uncertainty and political stability are integrated (process) of order one. Physical infrastructure variable has a very strong inertia, therefor it is de-trended before applying the tests. Based on Schwarz Bayesian Criterion (SBC) lag lengths of 4,0,3,4,0,2,3 and 0 are selected for investment, GDP growth, user cost, financial development, trade openness, physical infrastructure, GARCH conditional standard deviation and polity score respectively.

Since reliability of the estimated model depends on outcomes of diagnostic test, firstly discussion on these issues is provided and the results are reported in Appendix. To confirm whether residuals follow white noise process and normality assumptions, serial correlation LM test for Autocorrelation, ARCH LM test for conditional heteroscedasticity, Jarque-Bera (JB) test for normality and Ramsey Reset test for model specification are applied. The test results presented in Appendix indicate that there is no serious econometric problem in regression residuals and model specification is appropriate. Finally, stability of parameters is assessed using CUSUM and CUSUMSQ tests. The corresponding graphs shown in Appendix indicate that parameter estimates are stable. The Adjusted R^2 is 0.993. Our model is, therefore, explaining 99.3 percent variations of the aggregate investment.

While fitting ARDL model, first of all, presence of long-run relationship is tested by "Bounds Test" and F-stat confirms presence of long-run relationship at 2.5 percent level of significance. The long-run and short-run relationships can also be confirmed through coefficient of error-correction (ECM) term. Table 2 indicates that the estimated value of this coefficient is –1.065, which is almost in the middle of the desired range of –2 to 0 [Rafindadi and Yosuf (2013)]. The estimated value implies that on average investment shock in any year are adjusting within the next year by slight overshooting. For example, if investment exceeds (falls short of) the equilibrium level by 100 billion rupees in any year then in the very next year investment expenditure will decrease (increase) by 106.5 billion rupees.

The results of the ARDL model are presented in Tables 2 and 3. The findings reveal that coefficients of majority of variables are significant in both long-run and short-run and are consistent with theory. Both the short-run and long-run coefficients of real GDP growth variable (G) are positive and highly significant, indicating that economic growth is a major factor in stimulating investment. This confirms the validity of accelerator principle. The result justifies the argument that conducive economic environment enhances investment activity in the economy. Better economic condition through increase in income is a signal of optimism and leads to high rates of investment [DeLong and Summers (1992); Blomstrom, *et al.* (1996); Booth (1999); Ghura and Goodwin (2000); Krishnaa, *et al.* (2003)].

The long run coefficient of user cost of capital (UC) shows negative sign and it is statistically significant. The result is consistent with neoclassical investment model which theorises that increase in cost of doing business leads to reduction in investment [Hall and Jorgensen (1967); Akkina and Celebi (2002)]. In the short-run, the coefficient of UC is positive and statistically significant. The neoclassical investment model treats real interest rate as an important and significant component of cost of doing business/capital and it generally effects investment negatively. However, real interest rate may have positive impact on investment in developing countries according to complementarity hypothesis of McKinnon (1973) and Shaw (1973).

It is postulated that a high rate of interest will increase the flow of supply of bank credit and by complementing the saving, result in facilitating investment [Luintel and Mavrotas (2005)]. This behaviour signifies the role of imperfect capital markets and credit constraints prevailing in developing countries. Positive sign supports the complementarity hypothesis postulated by neo-liberal approach accentuates the conduit/channel effect of saving to investment in the developing countries. According to findings, complimentary hypothesis holds in short-run only due to credit constraints, whereas in long-run investment is discouraged when the user cost of capital increases.

Table 2

Long-run Parameter Estimates

	Dependent Variable is Investment SBC Selected Model (4,0,3,4,0,2,3,0)	
Independent Variables	Coefficient	t-statistics
G	1.897961	4.11*
UC	–0.0037	–2.63*
FD	0.4909	38.21*
OP	0.7345	2.06**
PI	1.6844	4.61*
GSD	–3.8496	–2.02***
POL	0.0098	5.56*
ND	–0.1820	–5.38*
C	–8.4683	–1.15

Note: The coefficients significant at 1 percent, 5 percent and 10 percent levels are indicated by *, ** and *** respectively.

Table 3

Short-run Parameter Estimates

	Short-run Dynamics	
Independent Variables	Coefficient	T-stats
ΔI(-1)	0.608	5.79*
ΔG	2.022	5.08*
ΔUC	0.001	3.04*
ΔFD	0.299	3.17*
ΔOP	0.783	2.32**
ΔPI	–2.164	–1.21
ΔGSD	–3.102	–2.43**
ΔPOL	0.010	5.01*
ΔND	–0.193	–4.42*
EC coefficient	–1.065	–6.99*

Note: The confidents significant at 1 percent and 5 percent levels are indicated by * and ** respectively.

In developing countries due to underdeveloped financial markets, interest rate does not reflect the true cost of capital and the availability of financial resources could be a more binding constraint rather than user cost. Thus the principal constraint on investment could be the quantity, rather than the cost, of financial resources and this justifies the inclusion of financial development variable (FD) proxied by domestic credit availability in the model [Akkina and Celebi (2002)]. Both the short-run and long-run estimated coefficients of financial development (FD) are positive and statistically significant as suggested by literature [Akanbi (2016)]. The estimates indicate that improvement of financial sector boosts aggregate investment by reducing the financial constraints. This finding is consistent with the hypothesis that financial intermediaries bridge the financial and the real sectors [also see Fry (1998); Agrawal (2000)].

Empirical research shows that more open economies attract more capital and financial flows than protected economies and provide the justification of including the trade openness variable (OP) in the analysis. In our empirical results, trade openness (OP) enters with a positive and statistically significant coefficient both in short-run and long-run. It indicates to possible boost in export-oriented sector which may in turn improve current account balance and induce investment [also see Asante (2000); Naa-Idar, *et al.* (2012)].

A well-developed physical infrastructure supports investment activities through many channels. Firstly it enhances the productivity of capital [Looney (1997)], secondly it reduces the transportation and transaction costs and ultimately increases the rate of return on investment [Barro (1990); Asiedu (2002)] and finally it provides better access to production resources and end good markets [Blejer and Khan (1984); Aschauer (1989); Badawi (2003); Suhendra and Anwar (2014)]. In line with empirical research, in the long-run contribution of physical infrastructure is positive and significant. But the effect of physical infrastructure on investment is negative in the short-run. The obvious reason is that advantages that physical infrastructure provides for investment occur in long-run, while physical infrastructure development in short run may disrupt transportation channels for the time being.

Macroeconomic uncertainty renders the adverse effects on investment decisions and discourages investment activities. As expected, macroeconomic uncertainty (captured through GARCH conditional standard deviation) has significantly negative effects both in long-run and short-run. Uncertainty causes sluggishness in investment through creating passive expectation about future. It hampers the investment decision by creating ambiguity about future cash-flows and expected raised business cost. The impact of uncertainty will be more pronounced in the presence of large sunk cost.

As already mentioned, political stability is captured through polity IV score, where higher score represents more democratic environment. The coefficient of political stability variable (POL) is positive and statistically significant both in long-run and short-run, indicating that improvement in political environment leads to higher level of investment activities. At first sight, the small magnitude of the estimated slope coefficient may indicate that the effect of political uncertainty on investment is not substantial. However, since the investment variable is in natural log form, the estimated slope coefficient indicates that increase in political stability score by one unit on the scale of –10 to +10 results in increase in investment by 0.98 percent in long-run and 1 percent in short-run. Or equivalently, we can say that five percentage points increase in political stability score results in about one percent increase in investment, which does not seem to be negligible.

Conversely, political instability (deterioration of political climate) shatters the investors' confidence and, hence, lowers the level of overall investment in the economy. The worsening political situations are associated with inconsistent and frequently changing economic policies and make investment climate unfriendly. In such situations, firms are much conscious about taxation and regulation policies. In such uncertain climate firms adopt wait and see strategy and tend to postpone their investment decisions.

Government policies in Pakistan shifted drastically during 1970s in the form of nationalisation of banking and large-scale manufacturing sectors. To capture the impact of this factor, a dummy variable (ND) is included and its coefficient is observed to be negative and highly significant. There would be many possible reasons of it. Firstly, shift in the government policy created an uncertain environment that shattered the confidence of the investors. Secondly it crowded the private investment out and shook the roots of the private investment structure. Further, inefficiency arising due to the government's control over banking system erupted financial backbone of the economy and investment level declined.

6. CONCLUSION AND POLICY IMPLICATIONS

The study has examined the effects of macroeconomic uncertainty calculated through real exchange rate volatility and political (in)stability captured by polity IV index on the aggregate investment in Pakistan, while controlling for other economic and government policy variables. The model, devised in the light of theoretical and empirical literature, is estimated by employing the ARDL approach using annual time series data from 1960 to 2015.

The results reveal that both accelerator theory and neoclassical investment model explain the aggregate investment behaviour quite significantly that is the output and user costs both are important in influencing capital formation/investment. Political stability, government nationalisation policy and macroeconomic uncertainty are found to have adversely affected the overall investment in Pakistan. The 1970s nationalisation policy of government, especially for banking and manufacturing sectors, had discouraged investment activity in Pakistan. The positive indicators of economic performance like GDP growth rate, financial development, physical infrastructure and trade openness are all found to be important factors in promoting investment activity. High user cost of capital is found to be a binding constraint on investment in long-run only but it tends to promote investment in short-run by relaxing the credit supply constraint.

The study concludes that investment activity flourishes under stable political and economic conditions while uncertainty on either front is detrimental to investment climate. In addition, positive and sustained development in key economic indicators like economic growth, infrastructure and financial development and international trade is also essential to promote investment activity.

A number of lessons for investment policy can be drawn from the study. First, in order to make investment an economically viable activity in long-run, investment funds have to be committed for a sufficiently long duration. For realisation of such commitment consistency of economic conditions and political environment is crucial. A stable political/democratic environment not only ensures consistency of economic policies in long-run, but it also provides a milieu in which economic policies, especially fiscal and monetary policies, are guided by political economic considerations rather than pure political compulsions.

Second, even though financial sector of Pakistan has grown both in terms of size and efficiency over the past few decades, credit availability is still constrained by distortions mainly because of large scale crowding out of funds due to excessive public borrowing and loan defaults. These distortions can be eased by granting further autonomy to the entire financial sector of the country. Third, nationalisation of businesses has adversely affected investment climate in Pakistan. Although banking, telecommunication and education sectors and quite a few manufacturing industries have been privatised, certain industries like airlines and steel production also need to be privatised on priority basis in order to ease the drain on investable funds and to encourage profitable investment in these areas as well. Once the loss-making entities are no more a drain on government budget, funds would be easily diverted to infrastructure development, which is crucial to reduce the cost of doing business.

APPENDIX

Table A1

Unit Root Tests for Real Exchange Rate

	Augmented Dickey Fuller (ADF)Test		Phillips Perron (PP)Test	
Variables	Intercept	Intercept and Trend	Intercept	Intercept and Trend
RER	–1.452	–2.240	–1.430	–2.045
	(0.557)	(0.465)	(0.568)	(0.574)
ΔRER	–13.05*	–13.06*	–17.44*	–17.44*
	(0.000)	(0.000)	(0.000)	(0.000)

P-values are provided in the brackets.
The statistics significant at 1 percent are indicated by *.

Table A2

ARCH and Serial Correlation Tests for Real Exchange Rate

	ARCH LM TEST		
	ARCH(1)	ARCH(2)	ARCH(3)
Obs*R^2	79.17*	89.88*	91.16*
	(0.00)	(0.00)	(0.00)
	Ljung-Box Q-Stat		
	Q(8)	**Q(16)**	**Q(32)**
Q-stat	102.7*	126.8*	134.4*
	(0.00)	(0.00)	(0.00)

Table A3

Autocorrelation and Heteroscedasticity Tests on the Residuals of Selected GARCH Model

	ARCH LM TEST		
	ARCH(1)	ARCH(2)	ARCH(3)
Obs*R^2	3.36	3.48	3.49
	(0.18)	(0.47)	(0.74)
	Ljung-Box Q-Stat		
	Q(8)	**Q(16)**	**Q(32)**
Q-stat	3.90	18.7	38.8
	(0.272)	(0.06)	(0.11)

P-values are provided in the brackets.

Table A4

Unit Root Tests Results for Variables of ARDL Model

Variables	Augmented Dickey Fuller (ADF) Test		Phillips Perron (PP) Test	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
I	–1.523	–3.391***	–1.515	–2.824
	(0.514)	(0.063)	(0.518)	(0.195)
ΔI	–5.64*	–5.626*	–5.472*	–5.418*
	(0.000)	(0.000)	(0.000)	(0.000)
G	–5.194*	–5.715*	–5.207*	–5.646*
	(0.000)	(0.000)	(0.000)	(0.000)
UC	–2.88*	–3.929**	–6.72*	–6.801*
	(0.055)	(0.018)	(0.000)	(0.000)
FD	–1.750	–2.314	–2.776***	–2.659
	(0.400)	(0.420)	(0.068)	(0.257)
ΔFD	–4.854*	–4.986*	–4.847*	–4.996*
	(0.000)	(0.000)	(0.000)	(0.000)
PI[1]	–2.269**		–1.24	
	(0.0238)		(0.1947)	
ΔPI			–3.794*	
			(0.000)	
OP	–3.354**	–3.931**	–3.420**	–3.923**
	(0.017)	(0.017)	(0.014)	(0.017)
POL	–2.391	–2.384	–2.661***	–2.666
	(0.149)	(0.384)	(0.087)	(0.254)
ΔPOL	–6.810*	–6.746*	–6.810*	–6.747*
	(0.000)	(0.000)	(0.000)	(0.000)
GSD	–1.013	–2.190	–9.429*	–10.55*
	(0.741)	(0.484)	(0.000)	(0.000)
ΔGSD	–62.57*	–62.85*		
	(0.000)	(0.000)		

P-values are provided in the brackets. The statistics significant at 1 percent, 5 percent and 10 percent are indicated by *, ** and *** respectively. In the test equation for PI there is no constant as it is de-trended variable.

Table A5

Diagnostic Tests of ARDL Model

Test	Statistic	P-value
AR(1) LM Test (1)	$n*R^2 = 0.384$	0.535
ARCH (1) LM Test	$n*R^2 = 1.106$	0.292
Normality teat	JB-statistic =2.39	0.302
Ramsey RESET Test	t-statistic = 0.78	0.4408
	F-statistic = 0.61	0.4408
Number of Observations	55 (1960-2015)	
R^2	0.996	
Adjusted R^2	0.993	

Fig. A1. CUSUM and CUSUMSQ Tests for Parameters Stability

CUSUM Statistics CUSUMSQ Statistics

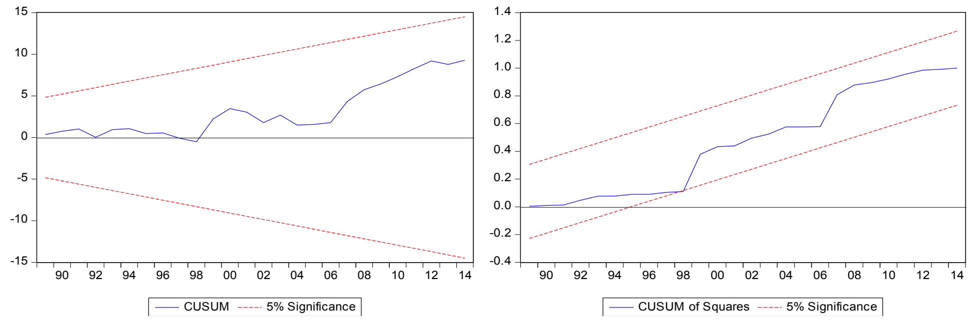


Table A6

Results of Bounds Test

Test Statistic	Calculated Value	Level of Significance	Lower bound Critical Value	Upper bound Critical Value
F-statistic	3.935	5%	2.32	3.50
		2.5%	2.6	3.84
		1%	2.96	4.26

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