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MACROECONOMIC UNCERTAINTY AND DOMESTIC INVESTMENT: Evidence from Developing Countries

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Abstract

Macroeconomic uncertainty and instability is predominantly and pervasively faced by developing countries, despite application and adoption of varying adjustment policies. Its implications are many and far reaching. This research is conducted to empirically analyze the impact of macroeconomic uncertainty in both the internal and external sectors, on domestic investment in the selected developing countries. For this purpose, a panel of 63 developing countries for the time period 1970 to 2013 has been selected. The uncertainty of selected macroeconomics indicators; namely, the output, inflation, RER and TOT are computed by using the AR (1) models, whereas, instrumental variable approach is employed for empirical estimation. The results show that all types of macroeconomic uncertainty, adversely affect the level of investment. Moreover, the adverse impact of external sector uncertainty is dominant relative to the internal sector uncertainty. It is, therefore, suggested that appropriate policy actions are needed to ensure macroeconomic stability in order to increase domestic investment.

Key Words: Investment, Uncertainty, Exchange Rate, TOT, Inflation, GDP.
JEL Classification: D81; E22; E31.

I. Introduction

The debate on links between macroeconomic uncertainty and investment has gained considerable attention among researchers and policy makers in the recent past. Theoretically, the impact of uncertainty on investment is conditional on various factors. For instance, the investment decisions are sensitive towards uncertainty attached to future profitability, interest rate, expected price level, and the currency over- and undervaluation, mainly due to the irreversible nature of investment and risk-averse behavior of investors. In particular, the irreversibility reduces investment in the face of uncertainty due to huge operational costs attached as investment plans; namely the sunk cost. The risk aversion, on the other hand, induces investors to delay the investment plans while encountering with instability in the economy. The Prospect Theory or the Loss Aversion Theory proposed by Tversky and Kahneman (1992) portrayed that in-

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vestors always choose the less risky scenario. Therefore, the uncertainty of expected future profitability discourages investment. Moreover, market structure is also one of the important factor determining the uncertainty-investment relationship [Caballero (1991)]. Similarly, Dixit and Pindyck (1994) stated that investment decisions can be delayed in the short run in order to spread the risk, but this risk diversification cannot be inferred in the long-run.

The preliminary empirical work in this regard has focused on the impact of internal sector uncertainty on investment, and reports an adverse impact on it. For instance, output volatility hampers investment by reducing predictability and the anticipated future profitability of demand [Bekoe and Adom (2013), Mohey-ud-Din and Siddiqui (2014), among others]. On the other hand, high inflation uncertainty increases the risk associated with anticipated marginal revenue and profit; and consequently postpones investment [Able (1980), Servén (1998), and Fischer (2013), among others]. Similarly, interest rate uncertainty also exerts an adverse impact on the investment behavior [Federer (1993)]. The studies have also empirically analyzed the impact of uncertainty attached to external sector variables, such as real exchange rate (RER) and terms of trade (TOT). The RER volatility is mostly experienced by weaker currencies which increases the likelihood of loss associated with new investment and consequently deters the investment level [Bekoe and Adom (2013), Escaleras and Kottaridi (2014), and Diallo (2015)]. In addition, the TOT shocks lead to an increase in the volatility of GDP and inflation, which in turn, adversely affects the investment level [Bleaney and Greenaway (2001)].

Despite the abundance of literature discussing the impact of macroeconomic uncertainty on investment, there is a dearth of literature for comparing the impact of internal and external sector's uncertainty on investment. Therefore, this study aims to fill this gap by comparing the impact of both the internal and external sectors' uncertainty on domestic investment. The former is captured by using the uncertainty of inflation rate and the output growth, while the latter is examined through the uncertainty in exchange rate and terms of trade. The empirical analysis is conducted by using instrumental variable technique on the sample of 63 developing countries for the period 1970-2013. Findings of the study explain that all types of uncertainties, adversely affect the domestic investment. However, the impact of external sector uncertainty is dominant over the internal sector uncertainty. This implies that a more careful policy formulation should be devised to neutralize the impact of internal and external sector uncertainty.

The organization of the study is as follows: Section II presents a brief overview of the theoretical and empirical literature concerning the impact of macroeconomic uncertainty on the level of investment. Section III delineates the methodology, data, data sources, and estimation technique used for empirical examination, whereas the discussion of empirical results is carried out in section IV. Finally, Section V concludes the study.

II. Literature Review

The theoretical literature linking uncertainty and investment has been pioneered by Hartmans (1972) and Abel (1983) who documented that there exist a positive relationship between economic uncertainty and the investment level. However, Zeira (1990) reported that in presence of risk-averse behavior of shareholders relationship between uncertainty and investment, is not unambiguous along with the market imperfections. Moreover, Caballero (1991) suggested that uncertainty-investment relationship completely depends on market structure. In case of perfect competition, the anticipated future profit and price of capital influence investment decisions of firms; whereas, under the imperfect competition in presence of asymmetric adjustment costs, a rational investor decreases the level of investment in presence of uncertainty. Subsequently, Dixit and Pindyck (1994) explained that in case of economic insecurity, the investment decisions can be delayed due to irreversible nature of investment, in order to get more information. Furthermore, Fischer (2013) extended the Dixit and Pindyck (1994) theory, reflecting that in presence of uncertainty, the firms can spread the risk by delaying investment; but this cannot be implied for the long-run. Recently, the Real Options Theory by Kellogg (2014) stated that in presence of irreversibility and economic insecurity, firms consider it better to postpone investment unless the estimated benefits are considerably higher than the anticipated cost of investment.

Given the theoretical background a large body of empirical literature has examined the impact of macroeconomic uncertainty on investment level. The empirical literature explicates different channels through which the investment level is being affected by the uncertainty of key macroeconomic variables [Bernanke (1983), Aizenman (1993), Aizenman and Marion (1993), Bleaney and Greenaway (2001), Byrne and Davis (2004) and Diallo (2015)]. In particular, Able (1980) provided an empirical evidence for negative impact of the inflation uncertainty on business fixed investment. He presents the adverse impact of inflation uncertainty on effectiveness of tax policies that are designed to increase and encourage the business fixed investment. By assuming that investment is not reversible, Bernanke (1983) presents an investment theory in order to explain the short-run variations in investment associated with the business cycle. He argues that uncertainty negatively affects the level of investment; however, by taking into account the possibility of 'learning by doing', this relationship may become positive. Another important contribution in the empirical literature was done by Byrne and Davis (2004). They estimated the impact of permanent and temporary inflation uncertainty on non-residential fixed investment in the United States. Their study concludes that both the permanent and temporary inflation uncertainty have a negative impact on investment; however, the later has a stronger effect. Recently, Fischer (2013) explained the mechanism through which uncertainty regarding future inflation may affect the investment behavior of the firms. The study states that the inflation uncertainty shifts away the investment from fixed assets towards more flexible factors of production; thus, affecting

economy-wide investment and growth negatively. On the other hand, an increase in GDP, volatility decreases the predictability of demand which in turn, decreases the anticipated future profitability of demand. Thus, the investors are hesitant to make the investment [Serven (1998), Bekoe and Adom (2013), Mohey-ud-Din and Siddiqui (2014)].

Among the external sector uncertainty, the empirical studies largely focus on RER volatility and TOT volatility. Aizenman (1993) analyzed the factors which play an important role in determining the impact of exchange rate regimes on behavior of domestic investment and the FDI. The study concludes that if shocks are nominal then the exchange rate volatility and investment would be negatively related. However, these are positively correlated in case of real shocks. Servén (1995) reexamined the consequences of permanent and transitory changes in TOT for inter temporal-optimizing consumption and investment decisions. The study reported that a permanent improvement in TOT increases profitability of capital stock; and thus both the investment and GDP will increase. On the other hand, the impact of a temporary improvement in TOT is ambiguous for both the investment and GDP. A comparative analysis by Servén (1997) suggested that poor investment performance is mainly due to political and economic uncertainty and the instability. Similarly, Bleaney and Greenaway (2001) reported that TOT instability and RER volatility, negatively affect the growth and investment expenditures. Moreover, they empirically prove that an improvement in TOT leads to an increase in output growth and investment, and eliminates the over valuation of RER. Gomez (2000) explained that RER volatility affects the investment level directly through changes in prices and profits; and indirectly through substitution between domestic and foreign products, changes in direct investment decisions and increase in risk of international trade. In contrast, Lafrance and Tessier (2000) reported that the excessive RER volatility or the pronounced misalignment of Canadian dollar does not reduce the level of domestic investment and do not affect the degree of FDI inflow in Canada. Bahmani-Oskooee and Hajilee (2013) infers that exchange rate has significant effect on domestic investment in short run; however, in long-run, the effect is only significant for a limited number of countries. Recently, Chowdhury and Wheeler (2015) concluded that neither the GDP uncertainty nor the RER volatility have a significant impact the fixed private investment in developed countries. A new dimension in the uncertainty-investment relationship is introduced by Diallo (2015) which asserts that the relationship between RER volatility and investment is nonlinear. The study concludes that RER volatility has a strong negative impact on investment, and this finding is robust in low and middle-income countries. Moreover, this impact is large in countries where large trade openness is associated with low financial development.

The review of literature suggests that empirical findings regarding the impact of uncertainty on investment is inconclusive. Furthermore, there is no such study which tests the comparative impact of internal and external sectors' uncertainty on the domestic investment. Therefore, this study intends to abridge this gap in the existing literature by carrying out the comparative analysis of internal and external sectors' uncertainty for domestic investment.

III. Methodology and Data

The following dynamic panel model is estimated as under:

$$I_{it} = \beta_0 + \beta_1 I_{it-1} + \beta_2 \sigma^2_{it} + \beta_3 LRGDP_{it} + \beta_4 LRER_{it} + \beta_5 LCPI_{it} + \beta_6 LTOT_{it} + \beta_7 RIR_{it} + \beta_8 TO_{it} + \mu_{it} \quad (1)$$

where, *'i'* refers to i^{th} country (i = 1,2,3….63) and *'t'* to the time period (1970-2013). I_{it} refers to domestic investment captured through log of gross fixed capital formation; $LRGDP_{it}$ shows log of real gross domestic product; $LRER_{it}$ is log of real exchange rate; $LCPI_{it}$ indicates log of consumer price index; $LTOT_{it}$ denotes log of terms of trade; RIR_{it} refers to real interest rate; TO_{it} is trade openness measured through the sum of exports and imports as percentage of GDP; σ^2_{it} shows internal sector and external sectors' uncertainty. The former is measured by computing volatility of inflation (LCPI) and output growth (LRGDP), while the later is captured by computing the volatility of real exchange rate (LRER) and terms of trade (LTOT); μ_{it} is the error term.

In order to study the empirical relationship between the domestic investment and macroeconomic uncertainty, a panel of 63 developing countries was constructed for the time period 1970 to 2013. The data has been accessed from the database of World Development Indicators [WDI (2014)]. All variables are in log form except real interest rate and TO. The estimation is based on two steps; first, computing the volatility of selected macroeconomic indicators, and then, empirically estimating the impact of macroeconomic uncertainty on domestic investment.

1. Computation of Volatility

To measures the macroeconomic uncertainty, the AR(1) model is estimated to generate residuals for the underlying series across each country for the time period 1970 to 2013.[1] One-period ahead, residuals are saved for each country. Later, using one period ahead, residuals, the cumulative volatility of the underlying series were computed. In particular, the cumulative volatility for the year 1972 is computed by calculating the standard deviation of residuals from the AR(1) model of the respective series that used data for the years 1972 and 1971. This process was repeated to construct the cumulative volatility for all years, see, [Aizenman and Marion (1999) and Turnovsky and Chattopadhyay (2003)] for further detail.

[1] The authors preferred using AR(1) process to generate the residuals, and did not run a family of autoregressive series to select the appropriate model as for the annual data with a limited time series observations a higher order AR process may not generate consistent measure of uncertainty. Similar practice is adopted by Aizenman and Marion (1999).

2. Estimation Technique

The GMM instrumental variable approach is taken for empirical estimation of the model presented in Equation (1). This technique allows consistent estimation if there is a problem of endogeniety; as in such cases instrumental variable approach can give unbiased and consistent estimates [Anderson and Hsiao (1982), and Imbens and Angrist (1994)].

IV. Discussion of Results

Before discussing the empirical results, the descriptive statistics of macroeconomic variables used in the analysis is presented. The descriptive statistics are presented in Table A-1 of Appendix. These statistics indicate that selected variables do not exhibit huge variations except the trade openness. The lowest variation is observed in TOT. Among the types of uncertainties, the average value and standard deviation is higher in internal sector uncertainties relative to external sector uncertainties. For empirical analysis, the investment model presented in Equation (1) is presented first, without uncertainty. The estimates are presented in Table 1. Later, the model of investment is estimated for each measure of macroeconomic uncertainty, separately. Table 2 reports the findings of internal sector uncertainty, whereas Table 3 displays the impact of external sector uncertainty, on domestic investment level. Panel A of each table shows the empirical estimates and panel B shows the diagnostic tests. Prior to discussing the empirical findings, the diagnostic test of each model is reported. The diagnostic tests reflect that all models are correctly specified. Particularly, all models estimated by the study are tested for: under identification, weak identification and over-identification. The LM statistic of under-identification test is significant at 1 per cent level which means that null hypothesis is not accepted; hence, the model is not under-identified. The F-statistic of weak identification test indicates the acceptance of null hypothesis, i.e., the excluded instruments are valid but are only weakly correlated with the endogenous regressors. Finally, Sargan-Hansen test is of over-identifying restrictions with null hypothesis confirming the absence of endogeneity; thereby, ensuring the validity of instruments. The p-value of the test substantiates orthogonality of instruments.

Moving towards empirical estimates, it is observed that investment shows inertia as 1 per cent increase in lagged investment level which increases the current investment level. This relationship is proved as statistically significant in all models. Higher investment leads to higher GDP growth through multiplier effects which further increases the investment level in the next time period due to accelerator effect [Westerhoff (2006)]. This finding is consistent with the one of Bleaney and Greenaway (2001), Bekoe and Adom (2013), and Escalerasand Kottaridi (2014). Keynes Multiplier-Accelerator theory states that there exists a bidirectional and positive relationship

between GDP and the investment. This is also verified by this study as all models confirm that an increase in GDP leads to a higher investment level. The results are in line with those of Servén (1998), Bleaney and Greenaway (2001), Westerhoff (2006), Diallo (2015), Bekoe and Adom (2013), Escaleras and Kottaridi (2014).

TABLE 1

Estimates Without Uncertainty

Panel A: Estimates	Dependent Variable: Domestic Investment
Variables	Coeff.(S.E)
I_{t-1}	0.828***
	(0.031)
LRGDP	0.072**
	(0.036)
LCPI	0.093**
	(0.029)
LRER	0.055**
	(0.027)
LTOT	0.045*
	(0.027)
TO	0.001***
	(0.0003)
RIR	(0.0004)
	(0.0005)
Panel B: Diagnostics	
No. of observations	974
F-stat	1041.35
Under identification test	229.322***
Chi-sq-p-value	(0.000)
Weak identification test	75.379
[Critical Value @ 5%]	[16.85]
Over identification test	4.585
{p-value}	{0.205}
Endogeniety test	5.908***
	(0.015)

Note: In panel A, values in parenthesis are standard errors. In Panel B, the diagnostics are presented with their respected critical/p-values. The models are estimated by using 1-4 lags of some endogenous and exogenous variables. ***, **, * represent significance at 1%, 5%, and 10% level of significance, respectively.

Source: Authors' calculations.

TABLE 2

Internal Sector Volatility and Domestic Investment

Panel A: Estimates	Dependent Variable: Domestic Investment	
Variables	GDP Uncertainty Coeff. (S.E)	Inflation Uncertainty Coeff. (S.E)
I_{t-1}	0.830***	0.831***
	(0.026)	(0.029)
σ^2_{LRGDP}	-0.147**	-
	(0.074)	
σ^2_{LCPI}	-	-0.164**
		(0.084)
LRGDP	0.058**	0.051*
	(0.030)	(0.028)
LCPI	0.081***	0.068***
	(0.025)	(0.025)
LRER	0.057**	0.044*
	(0.026)	(0.026)
LTOT	0.047*	0.045*
	(0.027)	(0.027)
TO	0.002***	0.002***
	(0.0003)	(0.0003)
RIR	(0.0003)	0.0001
	(0.0005)	(0.0005)
B: Diagnostics Test		
No. of observations	975	975
F-stat	909.16***	909.16***
Under identification test	339.683***	394.944***
{Chi-sq-p-value}	{0.000}	{0.000}
Weak identification test	105.841	68.645
[Critical Value @ 5%]	[18.31]	[20.74]
Over identification test	5.441	10.973
{Chi-sq-p-value}	{0.245}	{0.278}
Endogeniety test	12.951***	13.595***
{Chi-sq-p-value}	{0.000}	{0.000}

Note: In panel A, values in parenthesis are standard errors. In Panel B, the diagnostics are presented with their respected critical/p-values. The models are estimated by using 1-4 lags of some endogenous and exogenous variables. ***, **, * represent significance at 1%, 5% and 10% level of significance, respectively.

Source: Authors' calculations.

TABLE 3

External Sector Volatility and Domestic Investment

Panel A: Estimates	Dependent Variable: Domestic Investment	
Variables	RER Uncertainty Coeff. (S.E)	TOT Uncertainty Coeff. (S.E)
I_{t-1}	0.623***	0.618***
	(0.031)	(0.038)
σ^2_{tRER}	-1.441***	
	(0.451)	-
σ^2_{TOT}		-0.767**
	-	(0.391)
LRGDP	0.189***	0.178***
	(0.033)	(0.053)
LCPI	0.206***	0.187***
	(0.028)	(0.042)
LRER	0.148***	0.085*
	(0.039)	(0.046)
LTOT	0.068*	0.088*
	(0.041)	(0.050)
TO	0.003***	0.175***
	(0.0005)	(0.029)
RIR	-0.0001	-0.0001
	(0.0007)	(0.0009)
B: Diagnostics Test		
F-stat	368.26***	276.16***
No. of observations	959	811
Under identification test	566.165***	279.048***
{Chi-sq- P-val}	{0.000}	{0.000}
Weak identification test	368.756	39.023
[Critical Value @ 5%]	[16.85]	[20.90]
Over identification test	1.668	12.987
Endogeniety test	0.644	{0.224}
{Chi-sq- P-val}	15.937***	9.072***
	{0.000}	{0.003}

Note: In Panel A, values in parenthesis are standard errors. In Panel B, the diagnostics are presented with their respected critical/p-values. The models are estimated by using 1-4 lags of some endogenous and exogenous variables. ***, **, * represent significance at 1%, 5% and 10% level of significance, respectively.

Source: Authors' calculations.

The output volatility, in contrast, exerts an adverse impact on investment level. This finding is consistent with that of Servén (1998), Bekoe and Adom (2013), and Mohey-ud-Din and Siddiqui (2014). Keynes explains that the effective demand and financial conditions are the primary determinants of investment. This implies that investment decisions are affected by output volatility through the channel of aggregate demand. In particular, Servén (1998) explains that an increase in output volatility increases the unpredictability of demand. In addition, output uncertainty leads to a decline in the expected future profitability, which in turn, has a negative impact on domestic investment [Bekoe and Adom (2013)]. Furthermore, Fischer (2013) reports that investment is made till the point where the expected marginal revenue and the opportunity cost of capital becomes equal. In the presence of output uncertainty, the expected revenues becomes uncertain, therefore, reducing the level of investment.

Another important macroeconomic variable that affects the level of investment is inflation. The findings suggest a favorable impact of inflation on the level of investment, in all models. This is consistent with Iqbal and Nawaz (2009), and Ahmad and Joyia (2012). Specifically, Iqbal and Nawaz (2009) describe that a positive relationship between inflation rate and investment level is expected as long as the inflation rate remains below a threshold level of 6 per cent, where as Ahmad and Joyia (2012) recommend 13 per cent threshold level of inflation below which the relationship between inflation and investment remains positive. For inflation uncertainty, the results illustrate that an increase in inflation volatility hampers the investment level with a statistical significance at conventional level. This result is in accordance with Able (1980), Servén (1998), Bekoe and Adom (2013), and Fischer (2013). Inflation uncertainty increases the risk associated with the expected future profitability. In order to avoid this risk, and to minimize the probability of losses, investors delay their investment decisions. Thus, the uncertainty regarding future inflation lowers the level of investment and hampers the economic growth [Fischer (2013)]. According to the Neo-Classical Theory and the Tobins' q Theory of Investment, profit maximization is one of the major determinants of investment.

To estimate the impact of external sector variables, the real exchange rate and TOT is used. The findings portray that an increase in RER (depreciation of domestic currency) has a favorable impact on the domestic investment level. RER depreciation encourages exports by making domestic goods cheaper in the international market. Thus, the expected future profit increases due to high international demand and producers exploit this opportunity by investing more. This result is in harmony with that of Goldberg (1993), and Nucci and Pozzolo (2001). Moreover, RER affects the investment level through the channel of revenues. An increase in RER increases the expected marginal revenue which serves as an incentive for higher investment, thus, the investment level increases [Nucci and Pozzolo (2001)]. In contrast the RER volatility increases the probability of losses associated with new investment. Therefore, it affects the investment level adversely. The findings suggest a decline in do-

mestic investment with respect to an increase in the volatility of RER. This result is consistent with the findings of Aizenman (1993), Servén (1998), Bleaney and Greenaway (2001), Diallo (2015), Bekoe and Adom (2013), and Escaleras and Kottaridi (2014). RER volatility is mostly faced by weaker currencies, such as of the developing countries. In the presence of RER volatility, the investors are hesitant to make investment because they are uncertain about their expected profits. Moreover, the probability of loss is also high in the presence of exchange rate volatility. Consequently, the investment level declines.

Moving towards the impact of TOT, a statistically significant and favorable impact of TOT improvement is observed on domestic investment level. An improvement in TOT reflects higher prices of exports relative to imports therefore, an increase in future revenues is expected. The producers exploit this incentive by producing more in order to earn higher profits. Hence, the level of investment increases in a country [Spatafora and Warner (1999), Bleaney and Greenaway (2001), and Diallo (2015)]. Conversely, TOT uncertainty has detrimental consequences for investment level through the channel of inflation and GDP volatility. The findings show a deleterious impact of TOT volatility on investment level and is consistent to Bleaney and Greenaway (2001). In particular, Andrews and Rees (2009) explain that shocks to TOT increase the volatility of GDP and inflation, which in turn proliferates the risk associated with the expected future profitability and therefore, it reduces the investment level. The results illustrate that all measures of macroeconomic uncertainty affects the level of investment, negatively. It is reported that external economic shocks affect the investment level more strongly as compared to the internal economic shocks. In the internal sector, inflation uncertainty has dominant role in affecting the level of investment adversely, while in the external sector, the size of RER volatility is higher than the TOT volatility.

This study also observes the impact of other variables on investment level. For instance, trade openness exerts a favorable impact on domestic investment in all models. The finding is consistent with that of Dowrick and Golley (2004), Cuadros, et al. (2004), and Andrews and Rees (2009). These studies illustrate that openness may help investors to maximize their profits by diversifying the production and investment in different projects within and outside the country. Moreover, openness encourages competitive environment, and the chance of profit maximization increases which leads to higher investment level. Keynesian theory of interest rate states that interest rate serves as a cost of capital; and thus, higher interest rate results in low level of investment. According to Keynes, investment is carried out only up to the point where expected rate of profit is greater than the interest rate. The findings report is an insignificant impact of interest rate on investment. This finding is in contrast to Servén (2003), Diallo (2015), Bekoe and Adom (2013), Escaleras and Kottaridi (2014) who prove a significant negative impact of interest rate on domestic investment in their studies.

V. Conclusions and Policy Recommendations

As compared to the developed countries, the macroeconomic uncertainty and instability is much higher in developing countries. This uncertainty is due to the internal and external factors such as output, inflation, RER, and TOT, among others. The theoretical literature regarding investment-uncertainty relationship is ambiguous and suggests that uncertainty can either have a positive or a negative impact on investment level. According to Abel (1983) and Hartman (1972), this relationship is positive if profit function and capital adjustment costs of firm are convex to prices. Moreover, the argument of Jensen's inequality is also in favor of positive relationship between investment and uncertainty. Caballero (1991) suggests that uncertain-investment relationship is positive in presence of perfect competition; whereas, it is negative in presence of imperfect competition. But, in presence of incomplete markets, the impact of uncertainty on investment level is ambiguous [Zeira (1990)]. Dixit and Pindyck (1994) point out the negative relationship between uncertainty and investment by arguing that uncertainty makes the investors to delay their investment decisions, but only in the short-run. Thus, theoretical literature fails to solve ambiguity regarding the impact of uncertainty on investment, consequently leaving it for empirical testing.

This empirical research has been conducted to test the impact of internal economic shocks (i.e., output volatility and inflation volatility) and the external economic shocks (i.e., RER volatility and TOT volatility) on the domestic investment level in 63 developing countries from 1970 to 2013. The data is collected from the database of the World Development Indicators [WDI (2014)]. This study used the GARCH (1,1) models for computing the volatility of GDP, inflation rate, RER and TOT, where as the empirical estimation is done by using instrumental variable approach. The empirical findings suggest that both internal and external sectors' uncertainty impart an adverse impact on domestic investment of developing countries. However, the impact of external sector uncertainty is dominant. Particularly, among the internal sector, inflation uncertainty has a stronger impact than output uncertainty whereas among the external sector, RER uncertainty portrays relatively stronger impact than TOT uncertainty.

Thus, findings of the study suggest that investment level in developing countries is more sensitive towards external economic shocks as compared to internal economic uncertainty. Therefore, it is suggested that policies may be directed to ensure macroeconomic stability which may provide conducive environment for domestic investment. Specifically, for internal sector, inflation volatility can be monitored meticulously by improving the efficiency of transmission channels. On the other hand, external sector stability may be ensured by improving external sector competitiveness; for instance, diversification may help reducing the intense impact of exchange rate uncertainty on investment.

The study suggests that future research can be conducted to investigate uncertain-investment relationship with respect to different income levels of countries. Moreover, the role of institutions can be tested in the uncertain-investment relationship in order to check whether institutions play any role in mitigating the adverse impact of uncertainty on investment.

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APPENDIX

TABLE A-1

Descriptive Statistics

Variables	Mean	Std. Dev	Minimum	Maximum
I	21.235	1.785	14.978	26.897
LRGDP	19.574	4.675	14.151	54.122
LCPI	2.103	4.417	-30.983	5.384
LRER	4.351	2.233	-2.577	9.964
LTOT	4.682	0.332	3.054	6.58
TO	61.572	34.87	0.308	280.361
RIR	2.039	1.007	-3.521	5.529
σ^2_{LRGDP}	0.542	0.939	0.001	12.538
σ^2_{LCPI}	0.747	0.905	0.035	12.77
σ^2_{LRER}	0.143	0.087	0.006	1.037
σ^2_{LTOT}	0.145	0.078	0.004	0.83

Source: Authors' calculations.