EFFECTIVENESS OF THE INTEREST RATE CHANNEL AS A MEAN OF MONETARY TRANSMISSION IN SRI LANKA

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Abstract

This study investigates whether the interest rate has a significant negative impact on investment. For an interest rate channel to support the achievement of monetary policy objectives, the prevalent interest elasticity of investment should be high and assume a negative value. The present study applies the co-integration and vector error correction tests to estimate the long run model and the short run dynamics of investment and independent variables; using interest rate, income, exchange rate and price level. Results show that the interest rate is negatively related to investment, with a coefficient value of 0.06. This negative relationship proves that low interest rates can negatively influence investment to achieve monetary policy objectives. A marginal effect on investment (based on the magnitude of coefficient) is not enough to maintain the efficiency of monetary policy.

According to Sri Lankan experience, price level and income are positively related to investment in the long run, while the nominal exchange rate is negatively related to investment. According to short run dynamics, (-71%) of the disequilibrium in investment will be adjusted towards equilibrium within a one year period.

Key Words: *Interest Rate Coefficient, Long Run Investment Model, Interest Rate Channel, Vector Error Correction Method, Co-integration Method*

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INTRODUCTION

Many Central Banks use interest rate as an instrument in conducting monetary policy. The interest rate mechanism is used to achieve monetary policy objectives, and for the Central Bank of Sri Lanka (CBSL), these objectives are to maintain economic and price stability.

If the interest rate elasticity of investment is negative, expansionary monetary policy can achieve higher economic growth and higher employment performance through higher aggregate demand. During a recession, policymakers consider adopting expansionary monetary policies to increase investment and aggregate demand, thereby securing higher economic growth.

LITERATURE REVIEW

If the interest rate channel[1] in the transmission mechanism is effective, a central bank can achieve its monetary policy targets (thus exerting the expected effect on inflation and economic growth) through this channel (Ireland, 2005). Higher interest rates raise the cost of financing and discourage investments occurring through bank financing. On the other hand, such rates enable firms holding interest bearing instruments to earn more: thus encouraging higher investment on their part (Elmendorf, 1996). In the meantime, higher interest rates encourage savings, since returns on savings would have risen even as investment is discouraged (Harbaugh, 2004).

Economists such as Taylor (1995) have empirically proved the existence of a strong interest rate channel working through consumption and investment decisions. Makers of monetary policy consider the role of investment in the monetary transmission mechanism to achieve the goals of price stability and of maximum sustainable employment. By changing interest rates, monetary policy influences investment through the interest rate channel (Mishkin, 2007).

[1]When the central bank decides to decrease the policy rate, adjustments in short-term money market rates occur. Given that prices are sticky, real interest rates (i.e. inflation adjusted nominal interest rates) decline first in the short-run and then in the long-run, in line with the term structure. A part of these adjustments can be explained through the portfolio management of financial institutions which strives to maintain competitiveness and generate profit; ultimately resulting in a decline in deposit and lending rates. From above, a decline in real interest rate lowers the opportunity cost in consumption and investment, causing private domestic demand to expand. This channel of transmission can also be explained through price level expectations since an accommodative monetary policy stance also leads to higher a price level and to expectations of inflation. As a result, real interest rates decline and higher economic growth is achieved as above.

Investment in residential buildings (residential investments) have a major effect on economic activity. Changes in interest rates transmit to aggregate demand through housing demand related to the cost of capital. Improvements in the housing market lead to increased economic activity. By changing interest rates, monetary policy influences the housing market through at least six channels (Mishkin, 2007). According to Mishkin (2007), housing construction is relatively quick, and short term interest rates affect the cost of financing such construction. Higher short term interest rates reduce housing construction activity.

According to Romer and Romer (1994), monetary policy moves affect credit flows in two ways. First, the tightening of monetary policy increases interest rates, with the result that borrowers may reduce borrowings and lenders may share funds with certain types of borrowers according to ability. This, they show, is the ‘interest rate side’ of the transmission mechanism. Second, monetary policy moves directly affect the ability of certain types of lenders to obtain funds. Banks obtain funds subject to open market operations and reserve requirements, which may in turn affect the opportunity cost of funds. Therefore, monetary policy affects firms and households which depend on banks to obtain loans. This effect on the ability of particular lenders to obtain funds is the ‘credit side’ of the transmission mechanism. This study found that monetary tightening without credit moves was adequate to achieve the desired slowdown in economic activity and inflation.

Angeloni et al. (2003) provide a comprehensive description of how monetary policy affects the Eurozone. According to their study, the interest rate channel is a prominent channel in monetary policy transmission for the Euro area.

Muhammad et al. (2013), using data for the 1964-2012 period, confirm the existing economic theory that investment has a significantly inverse association with the real interest rate in Pakistan, a developing country. Bader & Malawi, (2010), Christopher and Tuzel (2010), Sharpe and Suarez (2014), and Wuhan, Suyuan and Khurshid (2015) all suggest that interest rate has a negative impact on investment expenditure in the long run. According to the study by Wuhan, Suyuan and Khurshid (2015), a positive relationship appears to exist between investment and the interest rate in the short run. According to the findings of Christopher and Tuzel (2010), the cost of capital (represented by risk premium rather than real interest rate) is strongly negatively related to future inventory growth. Sharpe and Suarez (2014) say that investment is also less interest sensitive among firms expecting greater revenue growth.

According to Hemachandra (2011) interest rates do not influence total investment in Sri Lanka. The study by Amarasekara and Chandranath (2008) suggests a negative relationship between interest rate and GDP growth. Following a positive innovation in interest rate, GDP growth and inflation decrease while the exchange rate appreciates.

Research Problem

This study investigates the effectiveness of the interest rate channel as a means of monetary transmission mechanism of Sri Lanka. It is anticipated its findings would contribute to the pool of empirical literature on the interest rate channel and the transmission of monetary policy in the Sri Lankan context.

In order for monetary policy to be successful and for the interest channel to be sound, there should be a negative relationship between interest rate and investment (Mishkin, 2007). If the interest rate transmission channel is efficient, investment expenditure should increase with each negative change in interest rate, and such increase should take place at a level which satisfactorily aids economic growth.

There are few empirical studies which focus on the effectiveness of the interest rate channel in the monetary transmission mechanism in Sri Lanka. Hemachandra in 2011 revealed that, as a policy instrument, the interest rate is not a significant variable in determining investment, aggregate demand, or inflation. This shows the ineffectiveness of interest rate channel in the transmission of monetary policy within the Sri Lankan context.

Objectives of the Study

This analysis seeks, as its main objectives:

- to investigate the interest rate elasticity (coefficient) of investment, and its magnitude, and
- to investigate the effectiveness of the interest rate channel in the monetary transmission mechanism in Sri Lanka

Its other objectives are**:**

- to investigate the income elasticity of investment.
- to examine the exchange rate elasticity and price elasticity of investment.

Hypothesis

The main hypothesis tested in this study is whether there is empirical evidence corresponding to existing theoretical explanations with respect to the effectiveness of the interest rate transmission channel in maintaining investment targets to achieve economic growth in Sri Lanka.

The study mainly tests:

a) whether investment increases following an expansionary monetary policy shock such as a fall in interest rate – i.e.,

$$H_0;\ \beta_1 = 0$$
$$H_1;\ \beta_1 < 0$$

where β_1 is the interest elasticity of investment; and

b) whether the income elasticity of investment is positive

$$H_0; \beta_4 = 0$$
$$H_1; \beta_4 > 0$$

where β_4 is the income elasticity of investment.

METHODOLOGY

This study uses macroeconomic data from 1978-2014 period for its regression analysis.

The first step of a regression analysis is the testing of the stationarity[2] of all the variables used in the model. The unit root test tests whether the series are stationary or non-stationary and how many times it is to be differenced to make the series stationary[3]. Thereafter, the Dickey-Fuller test (DF test) is employed for unit root testing.

The DF test proved that all variables used for the present study: i.e., investment on construction (CONSTR), fixed deposit rate (FDR), consumer price index (CCPI), real GDP (RGDP) and exchange rate (ER) are non-stationary (I (1)) variables (See Equation 1 and Table 1).

The non-stationary nature of most economic time series makes it necessary to employ co-integration and error correction models rather than applying conventional econometric techniques such as OLS. If multiple time-series variables are non-stationary and integrated of the same order, the co-integration test is appropriate to determine whether there is a long term relationship among the variables.

[2]Stationarity is used as a tool in time series analysis, where the raw data are often transformed to become stationary.

[3]In mathematics, a stationary process (or strict stationary process or strong stationary process) is a stochastic process whose joint probability distribution does not change when shifted in time or space.

Johansen (1988) developed maximum likelihood estimators of co-integrating vectors and the Johansen co-integration method was applied to test whether there are any long run relationships among the set of non-stationary variables. If the time series data used in the analysis are non-stationary, then the VAR framework should be modified to allow consistent estimation of the co-efficient of the variables. The vector error correction (VEC) model is just a special representation of VAR for variables that are stationary in their difference (I(1)) (Weliwita and Ekanayake, 1998).

Table 1: Variables used for the Study and the Transformation Form of the Variables

Time Series of	Denotation	Units	Data Span	Transformation Form
Log of Investment on Construction	LCONSTR	LKR Mn. 2005 as Base year	1978 - 2014	Log(CONSTR)
Fixed Deposit Rate	FDR	Percentage	1978 - 2014	FDR
Log of Real Gross Domestic Product (GDP at Constant Price)	LRGDP	LKR Mn. 2005 as Base year	1978 - 2014	Log(RGDP)
Log of Colombo Consumer Price Index	LCCPI	Index	1978 -2014	Log(CCPI)
Log of Exchange Rate	LER	LKR/USD	1978 -2014	Log(ER)

Source: Authors' preparation.

The vector error correction (VEC) model through co-integration is employed to estimate the dynamics of both the long and short run relationships among the variables in the investment model, during the 1978-2014 period. The VAR method does not capture non-linear elements, and each series were linearised by taking the logs of the level variables. Original data series except FDR were transformed as LCONSTR, LCCPI, LRGDP and LER. The form of the data series is presented in Table 1.

The Expected Model

According to the theoretical and empirical discussion presented in the literature survey, the long run investment function for Sri Lanka can be specified in the following manner:

$$LCONSTR = \beta_0 - \beta_1 FDR + \beta_2 LCCPI - \beta_3 LER + \beta_4 LRGDP + \mu_{t-1}$$
(Equation 01)

where,

LCONSTR- log of investment on construction (base year 2005)

FDR - fixed deposit rate

LCCPI – log of Colombo consumer price index (base year 2005)

LER – log of exchange rate

LRGDP - log of real GDP (base year 2005)

β_0 -constant of investment function

β_1 - interest rate elasticity of investment (expected to be negative)

β_2 - price level elasticity of investment (expected to be positive)

β_3 - exchange rate elasticity of investment (expected to be negative)

β_4 - income elasticity of investment (expected to be positive)

μ_{t-1} - deviation of investment from the long run equilibrium in the previous year.

The estimated error correction form equation can be represented as;

$$\Delta LCONSTR_t = \gamma_0 - \alpha_1(LCONSTR - \beta_0 + \beta_1 FDR - \beta_2 LCCPI + \beta_3 LER - \beta_4 LRGDP) + \gamma_1 \Delta LCONSTR_{t-1} + \gamma_2 \Delta FDR_{t-1} + \gamma_3 \Delta LCCPI_{t-1} + \gamma_4 \Delta LER_{t-1} + \gamma_5 \Delta LRGDP_{t-1} + \upsilon_t$$
(Equation 02)

where,

α - speed of adjustment to disequilibrium of Investment equation

β ‘s - coefficients of long run model of investment.

γ’s - short term adjustment coefficients of the VEC model

υ_t - error term of VECM of investment.

Limitations

Structural breaks have not been considered in the analysis. The study has used annual data due to the absence of quarterly data for some variables.

RESULTS

Results of the Unit Root Test

The plotting of the levels and differences of the five series suggest that the data are non-stationary in levels, but stationary in differences (See Table 2 and 3). The unit root test was done using the Augmented Dickey Fuller (ADF) unit root test, including a constant. Unit root tests were conducted for each variable; LCONSTR, FDR, LCCPI, LER and LRGDP that are used for the analysis are identified as I(1) variables (non-stationary variables), and Tables 2 and 3 report the results of the ADF test at 1%, 5% and 10% significance levels. The results of the ADF test for all variables in level show that the null hypothesis (series contains unit root) is accepted. The ADF test statistics for all data is smaller than critical value at 5% significance level (See Table 2). The results of the ADF test of differenced data show that the null hypothesis is rejected. This means that the alternative hypothesis (series does not contain unit root) is accepted. The ADF test statistics for all the series are greater than the critical value in 1% significance level (See Table 3).

The null hypothesis that there is a unit root of the first difference for all variables has been rejected at 1% significance level, indicating that differenced variables are stationary. Therefore, the ADF unit root test indicates that these variables are integrated in the order one [I (1)], and those are suitable for co-integration and VEC tests to examine both long run relationship and short run dynamics.

Figure 1: Behaviour of Level Variables in the Investment Model

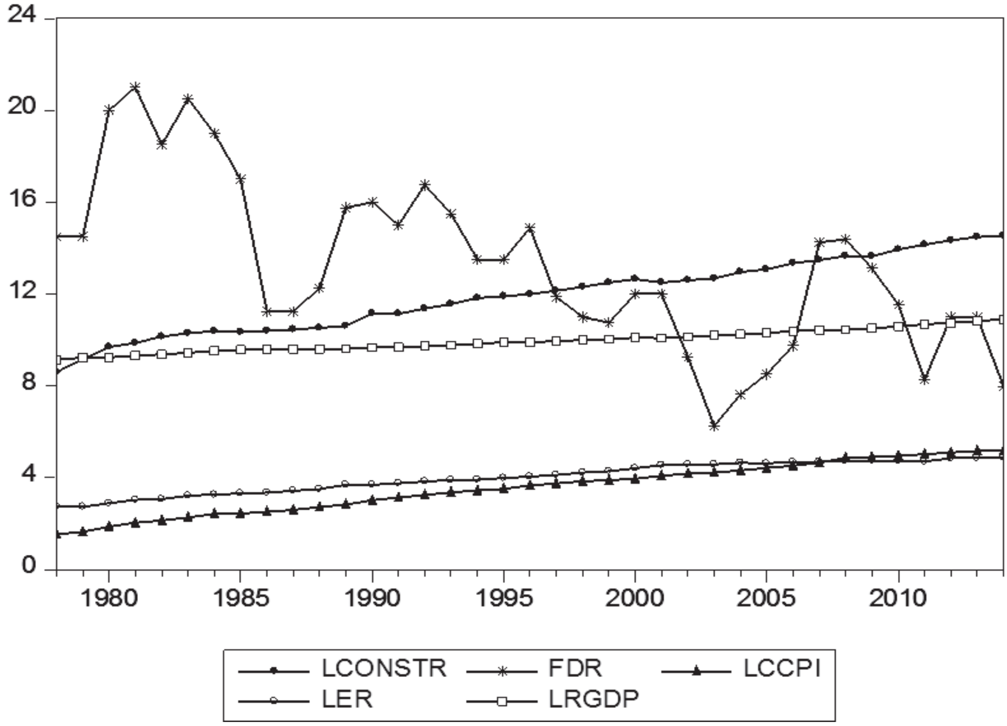

Table 2: ADF Test Results (Level-Intercept)

Variable	ADF Test Statistics	Critical Values 1%	Critical Values 5%	Critical Values 10%
LCONSTR	-1.798200	-3.626784	-2.945842	-2.611531
LCCPI	-2.582279	-3.626784	-2.945842	-2.611531
FDR	-1.639716	-3.626784	-2.945842	-2.611531
LRGDP	1.245097	-3.626784	-2.945842	-2.611531
LER	-2.370693	-3.626784	-2.945842	-2.611531

Source: Authors' findings.

Table 3: ADF Test Results (1st Difference-Intercept)

Variable	ADF Test Statistics	Critical Values 1%
LCONSTR	-5.633005*	-3.632900
LCCPI	-4.430292*	-3.632900
FDR	-5.000489*	-3.632900
LRGDP	-5.394482*	-3.632900
LER	-6.140805*	-3.632900

Note: Sign * for rejecting at 1% significance level.
Source: Authors' findings.

Co-integration Test

The non-stationary nature of most economic time series makes it necessary to employ co-integration and error correction models, rather than applying conventional econometric techniques such as OLS. Johansson co-integration methodology (maximum likelihood estimators developed by Johansen in 1988) is conducted using E-views 07 to test whether there are any long run relationships among a set of non-stationary variables.

This test was applied in relation to LCONSTRU, LFDR, LCCPI, LER and LRGDP. At the beginning, the null hypothesis (that these non-stationary variables are not co-integrated) was tested by the Engle and Granger methodology. This test proved that these variables were co-integrated.

The co-integration vector $\prod$, is solved with maximum Eigen value statistics and trace statistics. The number of co-integrating relations is calculated assuming that there is no linear time trend. Tables 4 and 5 below report the values of Johansen λ_{trace} and λ_{max} test statistics. To test the null hypothesis that the number of co-integrating vectors is zero $(r = 0)$ the λ_{trace} statistics were used against the alternative $= 1,\ 2, 3\ or\ 4$. Since the null hypothesis is than $\text{r} = 0$ and there are five variables, the test equation runs from 1 to 4. Since λ_{trace} statistic of $\text{r} = 0$ is 108.2 and is larger than the critical value of 69.81, the null hypothesis is rejected at the 5% significance level. Accordingly, this test confirmed that the variables are co-integrated (See Table 4).

Table 4: Trace Statistics of Co-integration Test

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	5% Critical Value	Probability
None *	0.803355	108.2466	69.81889	0.0000
At most 1 *	0.475268	52.95055	47.85613	0.0154
At most 2 *	0.393024	31.02504	29.79707	0.0359
At most 3	0.338487	14.04999	15.49471	0.0816
At most 4	9.69E-06	0.000329	3.841466	0.9876

Note: Sign * denotes rejection of the hypothesis at 0.05 significance level.
Source: Authors' findings.

Table 5: Maximum Egan Statistics of Co-integration Test

Hypothesized No. of CE(s)	Eigen Value	Maximum Egan Statistics	5% Critical Value	Probability
None *	0.803355	55.29606	33.87687	0.0000
At most 1	0.475268	21.92551	27.58434	0.2242
At most 2	0.393024	16.97506	21.13162	0.1732
At most 3	0.338487	14.04966	14.26460	0.0540
At most 4	9.69E-06	0.000329	3.841466	0.9876

Note: Sign * denotes rejection of the hypothesis at the 0.05 significance level.
Source: Authors' findings.

In contrast to the λ_{trace} statistic, the λ_{max}statistic test was used to test the specific null hypothesis $\text{r} = 1$ against the specific alternative $\text{r} = 2$. According to the λ_{max} test, λ_{max} statistic of the null hypothesis $\text{r} = 1$ is 21.93 and as it is less than the critical value of 27.58, null hypothesis is accepted at 5% significance level and the alternative hypothesis is rejected (See Table 5). The maximum Egan value test indicates that there is one co-integrating equation (at 5% significance level).The presence of one co-integration vector implies that Granger-causality should exist in one direction among the variables.

Long Run Model for Investment Expenditure

In the long run, only one co-integration relationship is there among the set of series. The long run equilibrium equation of investment which was estimated by the co-integration test is written below.

$$\text{LCONSTR} = 18.87 - 0.06\text{FDR} + 2.69\text{LCCPI} - 1.64\text{LER} + 0.92\text{LRGDP} + \mu_{t-1}$$

(-6.06212) (12.2097) (-7.02469) (+3.47529)

Investment on construction (CONSTR) is used as an investment variable, and examines the effect of interest rate on investment. In the long run model of investment, interest rate (FDR) is negatively related with investment. According to theories of investment, the interest rate sensitivity of investment should be negative. The estimated coefficient has taken the expected sign and is significant. Higher nominal interest rates lead to higher real interest rates, and investments would be discouraged. Prices will not adjust quickly and real interest rate would increase. This negative significance coefficient (0.06) of FDR in the investment model shows that the impact of a 1% increase in FDR would be (*ceteris paribus*) a decrease in investment by 0.06%. The negative relationship proves that low interest rates can negatively influence investment to achieve monetary policy objectives and the magnitude of coefficient shows the marginal effect of interest rate on investment. Several reasons may be behind this results. Larger investment projects and government investments are not determined by the interest rates and these larger components are included in investments on total construction. Similarly, some part of private investment is also not influenced by interest rate changes.

The price elasticity of investment has taken expected positive sign, and is highly statistically significant. According to theories of investment, price sensitivity of investment should be positive. In an inflationary period, individuals are encouraged to invest in constructions to minimize the cost of inflation. Higher price levels lead to higher investment on construction. Currently public and private construction are the largest recipients of investment in Sri Lanka. This positive significant coefficient (2.69) of LCCPI in the investment model shows that the impact of a 1% increase in FDR would be an increase in investment by 2.7% *ceteris paribus*.

Meanwhile, movements in exchange rate can influence price level and investment directly and indirectly, through changes in the pattern of spending. The coefficient of Nominal Exchange Rate (ER) in the long run investment model also is statistically significant. Estimated results show that the exchange rate has a negative impact on investment. The coefficient of ER variable in the long run investment model is -1.64 and negative coefficient of ER of investment is consistent with the expected models. Investment declines with a higher exchange rate due to higher prices of imported materials used in the construction field. In recent decades, 60 percent of gross domestic capital formation has been investment on constructions. The exchange rate elasticity of investment represents the impact of a 1% increase in ER to be a decrease in investment by 1.64% *ceteris paribus*. In contrast, a 1% decrease in ER will increase investment by 1.64%. The effect of exchange rate innovations on investment is greater than the effects of interest rate.

The coefficient of Real Gross Domestic Product is highly significant but inconsistent with the hypothesis that investment rises with the increase in income level according to the accelerator effect. The estimated result shows a higher positive impact of RGDP on investment. RGDP is used as the indicator for national income. The income elasticity of investment represents the impact of a 1% increase in income that would increase investment by 0.92% *ceteris paribus*.

Short Run Dynamics of Investment

This section presents the results of Vector Error Correction model, which was done to analyse the short run dynamics of the system. As all the above five variables are co-integrated and stationary in their first differences, the causality test was carried out using a model estimated in VECM form. Each error correction model (ECM) obtains an error correction coefficient (α) called the speed of adjustment in which the system moves towards its equilibrium. ECM captures the long run relationships among the set of variables. One co-integration equation established in the previous co-integration test is presented below, and vector error correction results are presented in the Table 6. Each column in Table 6 includes the error correction model for each variable in the model. The first row of the table presents the target model and estimated error correction parameters for each variable (See Table 6).

Co-integration Equation for Investment which was estimated by the Co-integration Test

$$\mu_{t-1} = LCONSTR_{(-1)} + 0.06FDR_{(-1)} - 2.7LRGDP_{(-1)} + 1.64LER_{(-1)} + 0.92LRGDP_{(-1)} - 18.87$$

Estimated Error Correction Model

D(LONSTR) = - $0.71(LCONSTR_{(-1)} + 0.06FDR_{(-1)} - \ 2.7LRGDP_{(-1)}$

$+1.64LER_{(-1)} + 0.92LRGDP_{(-1)}$ – 18.87) + 0.03D(FDR (-1)) – 1.47D(LCCPI (-1))

+ 1.34 D(LER(-1)) - 0.079

Coefficients of μ_{t-1} called α represent the error correction term of long run investment model in the VECM which is known as error correction coefficient. The magnitude of the error correction term shows how quickly the deviation of each variable from the long run equilibrium is corrected towards the equilibrium level through a series of partial short run adjustments. According to the estimation of target model the error correction term of LCONSTR (investment in construction) is –0.71 which is significant at 5% level. The interpretation of this error correction term is that 71% of the disequilibrium (μ_{t-1}) in investment will adjust itself towards equilibrium within a one year period. 71% is the adjustment rate of the investment and it is called the speed of adjustment of investment towards its long run equilibrium. This is a high rate of adjustment.

According to the same equation, it can be observed that lag one values of FDR, and ER each have a positive influence on the change of current investment and that the lag one value of CCPI has a negative impact on the change of current investment (See Table 6). The impacts are 0.03, 1.34 and -1.47 respectively. According to the Wald test for Joint significance of lag variables, Lag one and lag two values of FDR and CCPI jointly influence investment (See Annexure B). R-squared of the model is satisfied, and 53% of the change in investment is explained by the variables included in the model. According to the F-test, joint significance is high (See Appendix A). There is no serial correlation according to the results of Breusch-Godfrey serial correlation LM test (See Appendix B). There is no heteroskedasticity, and homoscedasticity is accepted by ARCH test (See Appendix C). Normality and stability tests were done and satisfied (See Appendix D and E).

Table 6: Vector Error Correction Estimates for Investment Model

	D(LIRB)	D(FDR)	D(LCCPI)	D(LER)	D(LRGDP)
μ_{t-1}	-0.709823	-4.666255	0.083217	0.013064	-0.032194
	[-3.39880]	[-1.07164]	[1.02524]	[0.12436]	[-0.49325]
D(LCONSTR(-1))	0.083865	3.729928	0.010764	0.155618	0.074397
	[0.46912]	[1.00071]	[0.15493]	[1.73056]	[1.33160]
D(LCONSTR(-2))	0.037547	5.108294	0.073919	0.193276	-0.013268
	[0.20344]	[1.32755]	[1.03054]	[2.08194]	[-0.23003]
D(FDR(-1))	0.033414*	0.142176	0.008178	-0.008503	0.000540
	[2.72400]	[0.55591]	[1.71540]	[-1.37802]	[0.14095]
D(FDR(-2))	0.020017	-0.070653	-0.006110	-0.005180	0.004758
	[1.43067]	[-0.24221]	[-1.12363]	[-0.73605]	[1.08826]
D(LCCPI(-1))	-1.473197*	-2.478731	0.094270	-0.230310	-0.204227
	[-2.07393]	[-0.16737]	[0.34147]	[-0.64457]	[-0.91994]
D(LCCPI(-2))	0.783837	-9.063326	-0.053638	-0.133439	0.110583
	[1.47292]	[-0.81686]	[-0.25934]	[-0.49849]	[0.66490]
D(LER(-1))	1.343218*	1.200419	-0.191277	-0.029338	0.057595
	[2.08558]	[0.08940]	[-0.76416]	[-0.09056]	[0.28614]
D(LER(-2))	0.540845	-5.010232	-0.178459	0.218367	0.019014
	[1.11175]	[-0.49397]	[-0.94388]	[0.89237]	[0.12506]
D(LRGDP(-1))	1.751495	8.447428	-0.381106	-1.088787	0.068804
	[1.49274]	[0.34531]	[-0.83572]	[-1.84476]	[0.18763]
D(LRGDP(-2))	1.679504	-3.106457	-0.716901	-0.068433	0.363777
	[1.39442]	[-0.12370]	[-1.53149]	[-0.11296]	[0.96641]
C	-0.079934	-0.597810	0.154602	0.080018	0.024410
	[-0.51162]	[-0.18352]	[2.54610]	[1.01819]	[0.49991]
R-squared	0.535624	0.349358	0.458425	0.369406	0.192492

Note: Sign * denotes the statistically significant coefficients at 5% significance level. Corresponding t-values are in parentheses.
Source: Authors' findings.

CONCLUSION

Interest elasticity of investment should be a higher, negative value for monetary policy objectives to be achieved via a sound interest rate channel. The Interest rate (FDR) is negatively related with Investment (investment on construction) in the Sri Lankan context during the sample period. Higher nominal interest rates lead to higher real interest rates, and investments are discouraged. Prices will not adjust quickly and the real interest rate would be increase. The negative relationship proves that low interest rates can negatively influence investment to achieve monetary policy objectives. Marginal effect on investment (magnitude of coefficient) is not enough to maintain the efficiency of monetary policy.

Price level and income are positively related to investment, and in an inflationary period, individuals are encouraged to invest on constructions to minimise the cost of inflation. In an economically healthy period, individuals are encourage to invest in private construction.

The Nominal Exchange Rate is also negatively related to investment expenditure in Sri Lanka. Investment declines with higher exchange rate due to higher prices of imported materials used in the construction field. All the estimated coefficients of the investment model are highly significant and theoretically consistent.

According to short run dynamics, -71% of the disequilibrium (μ_(t-1)) in investment on construction will be adjusted towards equilibrium within a one year period.

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Appendix A: Testing the Goodness of Investment Function

Dependent Variable: D(LCONSTR)
Method: Least Squares
Date: 09/07/15 Time: 18:05
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments
D(LCONSTR) = C(1)*(LCONSTR(-1) + 0.0570853825274*FDR(-1) - 2.69158481853*LCCPI(-1) + 1.63948664028*LER(-1) + 0.922672174646*LRGDP(-1) - 18.8749701683) + C(2)*D(LCONSTR(-1)) + C(3)*D(LCONSTR(-2)) + C(4)*D(FDR(-1)) + C(5)*D(FDR(-2)) + C(6)*D(LCCPI(-1)) + C(7)*D(LCCPI(-2)) + C(8)*D(LER(-1)) + C(9) *D(LER(-2)) + C(10)*D(LRGDP(-1)) + C(11)*D(LRGDP(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.709823	0.208845	-3.398799	0.0026
C(2)	0.083865	0.178771	0.469121	0.6436
C(3)	0.037547	0.184558	0.203444	0.8407
C(4)	0.033414	0.012267	2.723995	0.0124
C(5)	0.020017	0.013991	1.430672	0.1666
C(6)	-1.473197	0.710340	-2.073931	0.0500
C(7)	0.783837	0.532166	1.472918	0.1549
C(8)	1.343218	0.644051	2.085578	0.0488
C(9)	0.540845	0.486480	1.111751	0.2782
C(10)	1.751495	1.173345	1.492737	0.1497
C(11)	1.679504	1.204442	1.394425	0.1771
C(12)	-0.079934	0.156236	-0.511622	0.6140

R-squared	0.535624	Mean dependent var	0.142442
Adjusted R-squared	0.303436	S.D. dependent var	0.122987
S.E. of regression	0.102645	Akaike info criterion	-1.444507
Sum squared resid	0.231794	Schwarz criterion	-0.905792
Log likelihood	36.55663	Hannan-Quinn criter.	-1.260790
F-statistic	2.306855	Durbin-Watson stat	2.427493
Prob(F-statistic)	0.045812		

Appendix B: Serial Correlation Test for Investment Function

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.555858	Prob. F(2,26)	0.0970
Obs*R-squared	5.750568	Prob. Chi-Square(2)	0.0564

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/06/15 Time: 01:57
Sample: 1980 2014
Included observations: 35
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.196457	0.157009	1.251243	0.2220
C(2)	0.364192	0.233817	1.557592	0.1314
C(3)	-0.016717	0.013319	-1.255138	0.2206
C(4)	0.147741	0.557487	0.265013	0.7931
C(5)	0.224822	0.421859	0.532931	0.5986
C(6)	0.358200	1.007052	0.355691	0.7249
C(7)	-0.110449	0.098764	-1.118305	0.2737
RESID(-1)	-0.821995	0.380154	-2.162266	0.0400
RESID(-2)	-0.021323	0.230318	-0.092579	0.9269

R-squared	0.164302	Mean dependent var	1.07E-15
Adjusted R-squared	-0.092836	S.D. dependent var	0.100876
S.E. of regression	0.105455	Akaike info criterion	-1.444030
Sum squared resid	0.289140	Schwarz criterion	-1.044083
Log likelihood	34.27052	Hannan-Quinn criter.	-1.305968
F-statistic	0.638964	Durbin-Watson stat	2.163903
Prob(F-statistic)	0.738005		

Appendix C: Test for Heteroskedasticity of Investment Function

Heteroskedasticity Test: ARCH

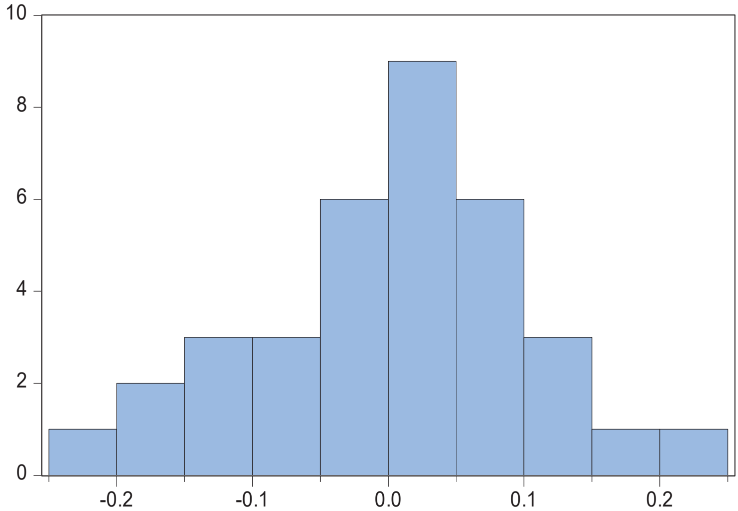
F-statistic	2.602950	Prob. F(1,32)	0.1165
Obs*R-squared	2.557594	Prob. Chi-Square(1)	0.1098

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/06/15 Time: 01:58
Sample (adjusted): 1981 2014
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007175	0.002890	2.482735	0.0185
RESID^2(-1)	0.275108	0.170518	1.613366	0.1165

R-squared	0.075223	Mean dependent var	0.009947
Adjusted R-squared	0.046324	S.D. dependent var	0.013874
S.E. of regression	0.013549	Akaike info criterion	-5.707989
Sum squared resid	0.005874	Schwarz criterion	-5.618203
Log likelihood	99.03582	Hannan-Quinn criter.	-5.677370
F-statistic	2.602950	Durbin-Watson stat	1.969135
Prob(F-statistic)	0.116485		

Appendix D: Normality Test for Investment Function



Series: Residuals	
Sample 1980 2014	
Observations 35	
Mean	1.07e-15
Median	0.011012
Maximum	0.205009
Minimum	-0.230284
Std. Dev.	0.100876
Skewness	-0.377000
Kurtosis	2.858582
Jarque-Bera	0.858253
Probability	0.651078

Appendix E: Stability Test for Investment Function