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Effect of Foreign Multilateral Aid and Foreign Bilateral Aid on Capital Formation in Kenya

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Abstract

Low capital formation in Kenya, averaging rate 20.13% of GDP over the period 2006-2017 has kept unemployment rate above 39% with more than 65 per cent of people living on less than $ 2 a day. Yet previous studies do not have a clear answer to the question of whether increasing bilateral aid/multilateral aidenhances capital formation or not. This study's purpose was to investigate the effect of multilateral aid and bilateral aid on capital formation in Kenya. The study was anchored by Solow (1956) model. Autoregressive distributed lag estimates for data over 1974-2017 suggested that multilateral aid has positive insignificant effect on capital formation while bilateral aid has negative significant effect after one year. Error correction mechanism model estimates suggest that bilateral aid has positive significant effect on capital formation in the short-run during the programme year but becomes negative thereafter. The results were robust for impulse response analyses. The study concluded that bilateral aid retards capital formation in the long run but enhances it in the short-run during the first year.Soliciting for more bilateral aid was recommended in order accelerate capital formation in Kenya in the short-run.

Keywords: Kenya, Capital Formation, Multilateral Aid, Bilateral Aid

1. Introduction

Insufficient capital formation in developing countries and the need for a big-push has been a central theme in academic and policy discussions for decades.Defined as the accumulation of production stock and inventories and expenditure on human capacity building (Kuznets, 1955), capital fundamentalists from the classical school (Smith, 1776; Malthus,1836; Ricardo, 1817; Mill & Laughlin,1848), neoclassical growth school (Solow-Swan, 1956), the new endogenous growth school (Lucas, 1988; Romer, 1990) and the big-push school (Sachs, 2008) demonstrate that capital formation imposes positive effect on gross domestic product (GDP) in the long run. Big-push school holds that high capital formation is the sufficient condition for breaking the poverty trap (Rosenstein-Rodan, 1943; Nurkse, 1953; Sachs, 2005; Collier, 2007; Sachs, 2008) and economic take-off to self-sustainable development (Lewis, 1954; Rostow, 1960). These views resonate with the March 2005 Blair Commission for Africa report (Commission for Africa, 2005), the 2005 World Bank report (World Bank, 2005) and UN Millennium Project (2005) which argued that Africa needs a big-push in public capital formation in order for her to realize growth that breaks the poverty trap.Conversely, one can deduce that high capital formation engineers growth which eliminates poverty. Thus, any country that seeks to eliminate poverty among her citizenry should prioritize enhancing capital formation in her poverty reduction strategy paper (PRSP).

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Table 1.1: Evolution of Kenya's gross capital formation (% of GDP) within the context of Sub-Saharan Africa, 2006-2017.

	CAR	CIV	KEN	RWA	CMR	UGA	COR	GAB	TZA	BWA	NER
2006	10.23	10.59	18.63	16.07	20.95	21.13	21.63	24.05	26.04	25.90	23.58
2007	10.69	12.67	20.46	18.17	20.84	22.08	21.81	24.88	32.85	30.79	22.90
2008	12.73	12.07	19.61	23.25	24.11	22.98	18.30	25.09	32.08	36.19	32.24
2009	13.17	8.70	19.33	22.63	23.66	25.00	22.51	27.98	25.13	38.93	34.89
2010	14.27	13.44	20.84	22.25	23.21	25.56	20.52	29.70	27.30	41.41	39.95
2011	14.98	4.70	21.70	22.52	24.14	27.46	25.27	26.64	33.24	38.58	38.39
2012	14.76	16.09	21.48	24.80	22.77	27.30	26.00	26.97	28.50	38.84	36.18
2013	8.69	20.71	20.11	25.44	23.05	28.35	30.94	29.18	30.32	29.41	36.15
2014	10.20	19.74	22.43	24.38	24.06	27.28	41.3	35.14	30.13	27.86	37.43
2015	13.92	20.10	21.47	25.82	22.40	24.62	40.87	29.23	27.20	32.11	38.71
2016	13.63	17.69	17.29	25.33	22.61	25.46	27.76	26.98	25.05	28.57	31.90
2017	17.67	17.64	18.22	22.91	22.93	23.68	22.56	21.47	26.14	28.10	33.69
AVE	12.91	14.51	20.13	22.80	22.89	25.07	26.62	27.28	28.66	33.06	33.83

Source: World Development Indicators, January 2019

Key: BWA: Botswana, CAR: Central Africa Republic, CIV: Cote d'Ivoire, CMR: Cameroon, COR: Congo Republic, GAB: Gabon, KEN: Kenya, NER: Niger, RWA: Rwanda, TZA: Tanzania, UGA: Uganda

Table 1.1 shows that Kenya's average rate of gross capital formation (% of GDP) outperformed Central Africa Republic and Cote d'Ivoire over the sub-sample period. However, it substantially lags behind SSA low income countries such as Uganda, Tanzania and Niger over the same sub-sample period. It underperforms fellow lower middle income country (LLMICs) such as Cameroon and Congo Republic.

This study was alarmed that Kenya's gross capital formation of 20.13% of GDP over the period 2006-2017 is below the threshold of 25 per cent of GDP necessary for developing countries to grow at self-sustainable rate (Geiger, 1990). The situation has depressed GDP growth to below 10 per cent per annum, kept unemployment rate above 39% line and condemned more than 65 per cent of Kenyans to living on less than $ 2 a day (World Bank, 2016a; World Bank, 2016b). The statistics suggest the need for an urgent policy intervention aimed at jumpstarting capital formation process in Kenya. But debate on whether the government should respond by appealing for more multilateral aid or bilateral aid still remains.

This is because a plethora of studies that analyzed the effects of multilateral aid and bilateral aid on development outcomes do not provide clear answers. For instance, Rodrick (1995), Ratha (2001), Harms & Lutz (2006), Uneze (2012) and Quazi, Balentine, Bindu, & Blyden (2019) focused on the effect of bilateral aid and multilateral aid on FDI inflow to developing countries. Such studies best address the question of whether there is 'vanguard effect' in developing countries or not. That is, whether bilateral and multilateral donors are the ones who carry out foreign private investment. Findings based on such studies best explain whether or not public-private partnership (PPP) is the appropriate vehicle for driving capital formation in developing countries. Though Ojiambo (2013) tried to specify capital formation as a target variable, the aggregate foreign aid masked the effect of bilateral and multilateral aids. Massa, Mendez-Parra, & Willem te Velde (2016) improved on Ojiambo's work by disaggregating foreign aid into bilateral aid and multilateral aid. But their findings based on Uganda's and Ghana's capital formation experience cannot be generalized for the rest of the developing countries due to structural and institutional differences.

Thus, whether bilateral aid and multilateral aid have negative or positive effects on capital formation is not clear. The purpose of this study therefore was to investigate the effect of multilateral aid and bilateral aid on capital formation in Kenya. This study followed the footsteps of Massa, Mendez-Parra, & Willem te Velde (2016) but distinguished itself by focusing on Kenya and controlling for the effect of domestic saving, FDI, diaspora remittance, foreign debt, openness and monetary policy proxied by inflation. Moreover, unlike Massa, Mendez-Parra, & Willem te Velde (2016) who limited themselves to physical capital formation, this study broadened the target variable's scope by considering gross capital formation, which captures both physical and human capital. The broad scope was in line with the new endogenous theory which appreciates human capital as a key factor in the production process.

This study contributes to policy guidance by answering the policy question of whether the government of Kenya should jumpstart her capital formation process by deploying multilateral aid or bilateral aid. It contributes to advancing scholarship on aid effectiveness by filling the gaps in the literature. The rest of the paper is organized as follows: section two reviews literature, section three dissects the methodology, section four presents the results, interpretation and discussion while section five concludes the paper.

2. Literature Review

2.1 Theoretical Literature Review

The vicious circle of poverty by Nurkse (1953) demonstrates that a big-push to domestic capital formation through foreign aid and not just Keynesian fiscal and monetary policies will engineer growth that eliminates poverty in underdeveloped countries. The views of Nurkse (1953) were echoed by Lewis (1954) and Rostow (1960) who affirmed that a big-push to domestic capital formation is the necessary condition for economic take-off to self-sustainable level. Using Solow-Swan (1956) model, Sachs, McArthur, Schmidt-Traub, Kruk, Bahadur, Faye & McCord (2004) and Sachs (2008) demonstrate that foreign aid enters growth via capital formation channel.

2.2 Empirical Literature Review

Rodrick (1995) investigated the effect of multilateral and bilateral aids on private investment flow in developing countries. A dynamic model was specified with current year private capital to developing countries assumed to depend on its own lag and multilateral and bilateral concessional/non-concessional loans and their lags. A sample of net ODA multilateral and bilateral aids approximated as a ratio of GDP were collected over the period 1970 to 1993 and analysed on a six year interval basis. OLS estimation found bilateral aid to have statistically significant effect on private capital flows. On the other hand, multilateral aid was found to have negative significant effect. The author concluded that aid is more effective in enhancing private capital flow if delivered via bilateral channel. This study applauded the author's effortin disaggregating foreign aid into its components. However, it noted that linking private capital flow with bilateral and multilateral aids best addresses the question of whether there is 'vanguard effect' in developing countries or not. That is, bilateral and multilateral donors are the ones who carry out foreign direct investment. As such, findings based on this study would best explain whether or not public-private partnership (PPP) is the right vehicle for driving capital formation. The findings do not provide information about the effect of bilateral aid and multilateral aid on capital formation. Thus, the findings have limited relevance for application for policy in developing countries.

Ratha (2001) analysed the effect of multilateral and bilateral aids in promoting investment in 137 developing countries. The author specified a dynamic model in which private capital flow to a developing country was dependent on multilateral loans, International Monetary Fund loans, bilateral loans, and grants. The study controlled for fixed effects, population size, per capital gross national product and gross domestic product. Panel data of gross ODA multilateral and bilateral aids approximated as a ratio of GDP were collected at an interval of 4 years over the period 1970 to 1998. Using OLS estimation just like Rodrick (1995), Ratha (2001) found mixed results across low-income countries and lower middle-income countries in SSA. For instance IMF loans did not affect private flows to lower middle-income countries but had positive and significant effect on private flow in low income countries during the program year and beyond. Multilateral loans were found to have lagged effect on private flows. On the other hand, bilateral loans and grants yielded positive significant effects on private flow during the program year and after lags.

This study acknowledges the effort by Ratha (2001) especially by trying to address the lagged effects of aids. But like Rodrick (1995), linking private capital flow with bilateral and multilateral aids best explains the question of whether or not public-private partnership (PPP) is the appropriate vehicle for driving capital formation. These findings not provide information about the effects of bilateral and multilateral aids on capital formation channel of production. As such, they have limited relevance for application for policy in developing countries.

Harms & Lutz (2006) assessed the effect of multilateral aid and bilateral aid on private foreign investment in 92 countries. They specified a static model in which private foreign investment to population was assumed to be determined by multilateral aid and bilateral aid. Data was collected over the period of 1988 to 1999. Multilateral and bilateral aids were the independent variables. OLS estimation found multilateral aid to be more effective than bilateral aid accelerating capital formation.

But like Rodrik (1995) and Ratha (2001), Harms & Lutz (2006) approach does not provide the answer to the question of the effect of multilateral aid and bilateral aid on capital formation in developing countries. As such, they have limited relevance for application for policy in developing countries.

Ozturk (2011) analysed the effect of IMF concessional loans under Standby Agreement (SBA) and Extended Fund Facility (EFFF) on gross capital formation, gross domestic saving, foreign direct investment, inflation, imports, exports, current account balance, GDP growth and GDP per capita in six Middle East and North African (MENA) countries over a period of 1975 to 2005. The six MENA countries were Yemen, Jordan, Tunisia, Algeria, Morocco and Egypt. Using the before and after design and generalized evaluation estimator (GEE) approach, the study found that IMF program had negative effect gross capital formation during the program year but not in the post-program period. They concluded that IMF supported programs have worsened domestic investment in MENA countries. This study appreciates the effort by Ozturk (2011), especially by employing the before and after approach. It also lauds the author for focusing on individual multilateral aid/lending institutions such as IMF and for the paradigm shift from OLS to GEE estimation. This study is however concerned that the cross-country approach hides country-specific details which limits the application of the findings for policy.

Uneze (2012) investigated the effect of multilateral aid and bilateral aid on private investment in 14 West African countries. Eight WAEMU and six non-WAEMU member countries were included. The author specified unobserved panel model in the tradition of Wooldridge (2003). The model was specified with private investment as a percentage of GDP as the dependent variable. Independent variables were multilateral aid as a percentage of GDP and bilateral aid as a percentage of GDP. The study controlled for unobserved effects, real gross domestic product, real interest rate, broad money supply as a percentage of GDP, inflation rate, debt service as a percentage of exports and export growth. Data over 1975-2008 were collected. Fixed effect (FE) estimation found multilateral aid to be more effective in enhancing private investment than bilateral aid. This study acknowledges the effort by Uneze (2012) especially the introduction of broad money supply, debt service and controlling for unobserved effects. But like the work of Rodrick (1995), Ratha (2001), Harms & Lutz (2006), results from this study may have limited relevance for policy application in developing countries since it ignores the direct link of bilateral aid, multilateral aid and other sources of finance with capital formation.

Ojiambo (2013) investigated the effect of foreign aid on investment and economic growth in Kenya. The study used time series data for the period 1966 to 2010. The explanatory variables were real per capita income, private investment, foreign aid, tax revenue, policy index, index of aid predictability, foreign debt, interaction of aid and policy index and the interaction of policy index and aid predictability index. Using ARDL estimation procedure, the results indicated that foreign aid had positive but insignificant effect on investment in Kenya. This study acknowledges the effort by Ojiambo (2013), especially when he shifts the focus from private investment to capital formation as the target variable with private investment assuming the role of an explanatory variable. But the study was limited to aggregate foreign aid. The shortcoming of aggregate aid is that it masks the effect of bilateral aid and multilateral aid.

Jiranyakul (2014) studied the determinants of capital formation in Thailand. The study employed annual time series data for the period 1979 to 2012. The study specified ARDL and ECM models. The findings indicated that import to GDP ratio had positive but statistically insignificant impact on capital formation. Market capitalization had positive and significant effect on capital formation. The study concluded that market capitalization plays an important role in Thai's capital formation. Though the study did quite well by acknowledging foreign private capital flow (FDI) as one of the sources of financing capital formation, it however failed to consider diaspora remittance, another foreign private capital flow despite its recent surge. It also failed to consider the effect of foreign aids such as multilateral aid and bilateral aid.

Massa, Mendez-Parra, & Willem te Velde (2016) analysed macroeconomic effects of multilateral and bilateral Development Finance Institutions (DFIs) in SSA over the period 1994-2012. Using simple correlation graphs, they demonstrate how an increase in development finance by bilateral and multilateral institutions leads to increase in gross fixed capital formation (GFCF) in Uganda and private GFCF in Ghana.

They also apply simple regression model and the Generalised Method of Moments (GMM) to the panel data. After controlling for aid for humanitarian assistance and FDI, the study finds significant positive effects of multilateral institution finance from IFC and EIB on GFCF; it also finds positive significant effects of bilateral development finance from Overseas Private Investment Corporation (OPIC) and Norfund on GFCF.

The effect is however not significant when multilateral and bilateral aid finance are pooled. This study notes that like Ojiambo (2013), Massa et al (2016) focused on capital formation as the target variable. However, Massa et al (2016) distinguished themselves from Ojiambo's study by disaggregating foreign aid into bilateral and multilateral aids. They further disaggregated bilateral and multilateral aid by institutions that provide aid. This makes the study by Massa et al (2016) one of the most disaggregated studies. Nevertheless, the study's focus on Uganda and Ghana makes it difficult for one to generalise its findings for other developing countries due to structural and institutional differences.

Quaglia (2016) evaluated the impact of IMF concessional loan participation on real GDP, gross capital formation and unemployment using difference-in-differences regression of panel data for 1980-2014 from a sample of 177 countries. Within a framework of game theory, he finds a negligible overall impact on growth of real GDP and gross capital formation in countries that have taken IMF loans. In high-growth countries, IMF loan had an average positive effect on real GDP growth and gross capital formation. In low-growth countries, IMF loan assistance had a smaller average positive effect on real GDP growth and gross capital formation. This study notes that the introduction of IMF concessional loans by Quaglia (2016) into capital formation equation was an important development given the critical role of the Bretton Woods institution in financing the balance of payment (BoP) thus freeing tax revenue for capital formation. However, IMF aid is too disaggregated to provide broad-based policies for financing capital formation developing countries.

Quazi, Balentine, Bindu, & Blyden (2019) investigated the effect of multilateral aid and bilateral aid on FDI in 14 sample countries. They specified a static model. Time series data was collected over the sample period 1996-2017. Fixed generalized least squares (FGLS) estimation revealed that multilateral foreign aid significantly improves FDI in Latin America. On the other hand, bilateral foreign aid did not have statistically significant effect on FDI. Quazi et al (2019) did well by incorporating recent data which capture recent dynamics in capital formation landscape. But their model like earlier studies by Rodrick (1995), Ratha (2001), Harms & Lutz (2006) and Uneze (2012) fails to appreciate the direct link of multilateral and bilateral aids with capital formation. It also fails to acknowledge the dynamic behaviour of aid and capital formation.

3. Methodology of the Study

3.1 Data Source and Type

Annual time series data for the period 1974-2017 were used. Data on all variables were drawn from the World Bank. Obtaining data from one source ensures consistency.

3.2 Theoretical Model

The study was anchored by Solow (1956) model. The study's preference for Solow's model was informed by its flexibility which allows foreign aid to augment domestic saving. According to Solow (1956), physical capital accumulates as follows

$$\dot{k} = \frac{\partial \dot{K}}{\partial t} = sf(k_t) - (\mathrm{n} + \delta)k_t \quad (3.1)$$

Where $\dot{k}$ refers to capital deepening; n refers to the growth rate of population; s refers to the saving rate; δ refers to the rate of depreciation of reproducible capital; $sf(k_t)$ refers to saving per capita out of output per capita that is necessary to keep capital-labour ratio constant (steady-state); $(\mathrm{n} + \delta)k_t$ refers to effective depreciation per capita. It thus follows from equation (3.1) that overpopulation and depreciation of reproducible capital retards capital formation while higher rates of saving generate a higher rate of capital formation and a higher per capita capital in the long-run. Solow's model was approved for use by scholars and policy makers by Mankiw (1995) arguing that the model is parsimonious, rigorous and flexible.

3.3 Econometric Models

3.3.1 Autoregressive Distributed Lag (ARDL) Model

To investigate the effects of multilateral aid and bilateral aid on capital formation, this study specified an ARDL model in the tradition of Pesaran, Shin & Smith (1995, 1999).

The preference of the dynamic ARDL model over the static models was motivated by the existence of the lag between the time when aid is approved and the time when it is applied to capital formation due to bureaucratic hitches (Collier, 2007).

To test the hypothesis of whether the effectiveness of foreign aid in achieving development objectives is contingent on donor practice of allocating aid via multilateral or bilateral channels, saving per capita out of output per capita ($sf(k_t)$) in the basic model 3.1 was retained and approximated by lagged gross domestic saving ($\mathrm{GDS_{t-1}}$).

In tandem with the big-push theory, foreign aid was allowed to disaggregatively and additively enter model 3.1as lagged multilateral aid ($\mathrm{MAID_{t-1}}$) and bilateral aid ($\mathrm{BAID_t}$). To minimize omitted variables bias, foreign direct investment ($\mathrm{FDI_t}$), lagged diaspora remittance ($\mathrm{DR_{t-1}}$), lagged external debt ($\mathrm{ED_{t-1}}$) and lagged openness to trade ($\mathrm{OPEN_{t-1}}$) and monetary policy proxied by inflation ($\mathrm{INF_t}$), were allowed to additively enter model 3.1. Lagging of domestic saving, multilateral aid, diaspora remittance, external debt and openness was intended to minimize the severity of multicollinearity. In the custom of Koyck (1954) and Almon (1965) distributed lag modelling, lagged gross capital formation ($\mathrm{GCF_{t-1}}$) was included to capture inertia effect. Logarithmic transformation of the variables was aimed at improving the linearity of the model(Asteriou & Price, 2007).

It also played the role of enhancing normality and removal of heteroskedasticity from the residuals. The constant term (ρ_0) was included in order to explain the influence of the causes of capital formation that were beyond the researchers'understanding. By assuming that the population growth rate (n), the growth rate of technology (g) and the rate of depreciation (δ) have insignificant effect on capital formation in Kenya;and by expanding the scope of Solow's physical capital formation model to reflect human capital formation in the tradition of Mankiv, Romer & Well (1992), the ARDL(q, q_1, q_2, q_3,q_4, q_5, q_6, q_7, q_8) model was specified as follows:

$$\begin{aligned}\mathrm{LNGCF_t} = \varrho_0 &+ \sum_{i=1}^{q} \beta_{1i}\,\mathrm{LNGCF_{t-i}} + \sum_{i=1}^{q_1} \beta_{2i}\,\mathrm{LNGDS_{t-i}} + \sum_{i=1}^{q_2} \beta_{3i}\,\mathrm{LNMAID_{t-i}} + \sum_{i=0}^{q_3} \beta_{4i}\,\mathrm{LNBAID_{t-i}} \\ &+ \sum_{i=0}^{q_4} \beta_{5i}\,\mathrm{LNFDI_{t-i}} + \sum_{i=1}^{q_5} \beta_{6i}\,\mathrm{LNDR_{t-i}} + \sum_{i=1}^{q_6} \beta_{7i}\,\mathrm{LNED_{t-i}} + \sum_{i=1}^{q_7} \beta_{8i}\,\mathrm{LNOPEN_{t-i}} \\ &+ \sum_{i=0}^{q_8} \beta_{9i}\,\mathrm{LNINF_{t-i}} + u_t \qquad (3.2)\end{aligned}$$

Where ρ_0 is the drift component; β_{1i}, β_{2i}, β_{3i},β_{4i},β_{5i}, β_{6i}, β_{7i}, β_{8i} and β_{9i} represented long run elasticities; q, q_1, q_2, q_3,q_4,q_5,q_6,q_7 andq_8 were lag lengths such that the random error $u_t$was normally distributed, homoscedastic and serially uncorrelated while ensuring stable elasticities over time.

3.3.2 Error Correction Mechanism (ECM) Model

Since cointegrating relationship was found to exist among the study's variables, the ECM model was specified in order to determine the speed of error correction.ECM model is a specification that expresses the first difference of the dependent variable as a function of first difference(s) of dependent variable(s), lagged error term and the white noise process. ECM model was specified as

$$\begin{aligned}\Delta\mathrm{LNGCF_t} = \tau_0 &+ \sum_{i=1}^{r} \alpha_{1i}\,\Delta\mathrm{LNGCF_{t-i}} + \sum_{i=1}^{r_1} \alpha_{2i}\,\Delta\mathrm{LNGDS_{t-i}} + \sum_{i=1}^{r_2} \alpha_{3i}\Delta\,\mathrm{LNMAID_{t-i}} + \sum_{i=0}^{r_3} \alpha_{4i}\,\Delta\mathrm{LNBAID_{t-i}} \\ &+ \sum_{i=1}^{r_4} \alpha_{5i}\,\Delta\mathrm{LNFDI_{t-i}} + \sum_{i=1}^{r_5} \alpha_{6i}\,\Delta\mathrm{LNDR_{t-i}} + \sum_{i=1}^{r_6} \alpha_{7i}\,\Delta\mathrm{LNED_{t-i}} + \sum_{i=1}^{r_7} \alpha_{8i}\,\Delta\mathrm{LNOPEN_{t-i}} \\ &+ \sum_{i=1}^{r_8} \alpha_{9i}\,\Delta\mathrm{LNINF_{t-i}} - \mu\mathrm{ECM_{t-1}} + v_t \qquad (3.3)\end{aligned}$$

Where Δ denotes first difference operator;τ_0 denotes the drift component;α_1, α_2, α_3, α_4, α_5,α_6,α_7,α_8 anα_9 denote short-run elasticities;r, r_1, r_2, r_3,r_4,r_5,r_6,r_7 andr_8 represent lag lengths such that the random disturbance v_t is serially uncorrelated;$\mathrm{ECM_{t-i}}$ is the error correction term derived from the long-run equation, lagged one period;μ measures the speed of short-run adjustment to long-run equilibrium following a shock to the system.

The coefficient should take a value between -1 and 0 in order to avoid nonsensical correction speed. According to Engle &Granger (1987) representation theory, negative and significant error correction term is a necessary condition for the variables under investigation to be cointegrated.

3.3.3 Vector Auto-Regression (VAR) Model

To check the robustness of ARDL results, the analysis of the impulse response functions (IRFs) were used to trace the impact of shocks to multilateral aid and bilateral aid on capital formation. To achieve this objective, vector auto-regression (VAR) model was specified in the tradition of Sims (1980).Anine-variable VAR (1) model was specified in compact form as follows:

$$\begin{bmatrix} LNGCF_t \\ LNGDS_t \\ LNMAID_t \\ LNBAID_t \\ LNFDI_t \\ LNDR_t \\ LNED_t \\ LNOPEN_t \\ LNINF_t \end{bmatrix} = \begin{bmatrix} \Gamma_{10} \\ \Gamma_{20} \\ \Gamma_{30} \\ \Gamma_{40} \\ \Gamma_{50} \\ \Gamma_{60} \\ \Gamma_{70} \\ \Gamma_{80} \\ \Gamma_{90} \end{bmatrix} + \begin{bmatrix} \Gamma_{11}\Gamma_{12}\Gamma_{13}\Gamma_{14}\Gamma_{15}\Gamma_{16}\Gamma_{17}\Gamma_{18}\Gamma_{19} \\ \Gamma_{21}\Gamma_{22}\Gamma_{23}\Gamma_{24}\Gamma_{25}\Gamma_{26}\Gamma_{27}\Gamma_{28}\Gamma_{29} \\ \Gamma_{31}\Gamma_{32}\Gamma_{33}\Gamma_{34}\Gamma_{35}\Gamma_{36}\Gamma_{37}\Gamma_{38}\Gamma_{39} \\ \Gamma_{41}\Gamma_{42}\Gamma_{43}\Gamma_{44}\Gamma_{45}\Gamma_{46}\Gamma_{47}\Gamma_{48}\Gamma_{49} \\ \Gamma_{51}\Gamma_{52}\Gamma_{53}\Gamma_{54}\Gamma_{55}\Gamma_{56}\Gamma_{57}\Gamma_{58}\Gamma_{59} \\ \Gamma_{61}\Gamma_{62}\Gamma_{63}\Gamma_{64}\Gamma_{65}\Gamma_{66}\Gamma_{67}\Gamma_{68}\Gamma_{69} \\ \Gamma_{71}\Gamma_{72}\Gamma_{73}\Gamma_{74}\Gamma_{75}\Gamma_{76}\Gamma_{77}\Gamma_{78}\Gamma_{79} \\ \Gamma_{81}\Gamma_{82}\Gamma_{83}\Gamma_{84}\Gamma_{85}\Gamma_{86}\Gamma_{87}\Gamma_{88}\Gamma_{89} \\ \Gamma_{91}\Gamma_{92}\Gamma_{93}\Gamma_{94}\Gamma_{95}\Gamma_{96}\Gamma_{97}\Gamma_{98}\Gamma_{99} \end{bmatrix} \begin{bmatrix} LNGCF_{t-1} \\ LNGDS_{t-1} \\ LNMAID_{t-1} \\ LNBAID_{t-1} \\ LNFDI_{t-1} \\ LNDR_{t-1} \\ LNED_{t-1} \\ LNOPEN_{t-1} \\ LNINF_{t-1} \end{bmatrix} + \begin{bmatrix} \lambda_{1t} \\ \lambda_{2t} \\ \lambda_{3t} \\ \lambda_{4t} \\ \lambda_{5t} \\ \lambda_{6t} \\ \lambda_{7t} \\ \lambda_{8t} \\ \lambda_{9t} \end{bmatrix} \quad (3.4)$$

The vector autoregressive moving average (VARMA) representation of the above VAR is

$$\begin{bmatrix} LNGCF_t \\ LNGDS_t \\ LNMAID_t \\ LNBAID_t \\ LNFDI_t \\ LNDR_t \\ LNED_t \\ LNOPEN_t \\ LNINF_t \end{bmatrix} = \begin{bmatrix} \overline{LNGCF} \\ \overline{LNGDS} \\ \overline{LNMAID} \\ \overline{LNBAID} \\ \overline{LNFDI} \\ \overline{LNDR} \\ \overline{LNED} \\ \overline{LNOPEN} \\ \overline{LNINF} \end{bmatrix} + \sum_{i=1}^{\infty} \begin{bmatrix} \Gamma_{11}(i) & \cdots & \Gamma_{19}(i) \\ \vdots & \ddots & \vdots \\ \Gamma_{91}(i) & \cdots & \Gamma_{99}(i) \end{bmatrix} + \begin{bmatrix} \lambda LNGCF_{t-1} \\ \lambda LNGDS_{t-1} \\ \lambda LNMAID_{t-1} \\ \lambda LNBAID_{t-1} \\ \lambda LNFDI_{t-1} \\ \lambda LNDR_{t-1} \\ \lambda LNED_{t-1} \\ \lambda LNOPEN_{t-1} \\ \lambda LNINF_{t-1} \end{bmatrix} \quad (3.5)$$

More compactly, the condensed VARMA is given as

$$\Delta X_t = \sum_{j=0}^{\infty} \Theta_i \lambda_{t-i} \qquad i = 1, 2, \ldots \ldots \ldots, n \quad (3.6)$$

Where Γ_i is the impact multiplier denoting the response of each variable to innovations in each of the corresponding error terms on impact; λ_{t-i} are innovations; n is the number of variables in the system; $\Gamma_i(0)$, $\Gamma_i(1)$, $\Gamma_i(n)$ are the impulse responses plotted to trace the time path of the system variables as they respond to various shocks over time.

3.4 Estimation Procedure and Techniques

3.4.1 Pre-Estimation Procedures

This study conducted a correlation analysis in order to determine the magnitude and the direction of the correlationship among the variables. Determining the magnitude of correlationship was useful in establishing the degree of multicollinearity in the data. This was important given that under exact collinearity, the regressors' matrix does not have full column rank. This situation could lead to indeterminate coefficient estimates or infinitely large standard errors and small t-values even when the goodness of fit of the model was high.

Unit root tests were conducted in order to determine whether the time series were stationary or non-stationary. Stationarity or non-stationarity of a series determines its behaviour. For example, a shock to the series does not die with non-stationarity but with stationarity. It implies that the application of non-stationary time series data to analysis could produce spurious test statistics because of non-constant means and variances.

Although ARDL estimation technique does not require pre-testing for unit roots, to ensure that ARDL model did not collapse in the presence of integrated series of I(2), Augmented Dickey-Fuller (ADF) was used to test for unit roots because of the parametric nature of the data.

This study selected a maximum lag of 2 according to the recommendation by Pesaran & Shin (1999) for annual data. The choice of an appropriate lag length is important in the estimation of the ARDL model since the use of long lags lead to over-parametisation, serially correlated errors and unstable slopes/elasticities. The optimum lag for each variable was determined through an automatic selection criteria using Akaike information criteria (AIC) since the study's sample size was less than 60. According to Khim-Sen & Tai-leung Chong (2005) for sample sizes of 60 and below, AIC selects optimal lengths without prejudicing parsimony. Unlike the fixed selection criteria which imposes untested restriction to the model before estimation, the automatic selection generates information about the model's lag structure from the data itself during estimation once the maximum lag is picked. According to Nwachukwu & Egwaikhide (2007), fixing the lag structure before estimation is the main cause of misspecification and wrong forecasts.

3.4.2 Estimation Procedures

The study employed the ARDL estimation procedure which is implemented in in two steps (Pesaran & Pesaran, 1997). The first step involved testing of the null hypotheses of no cointegrating relationship. This study employed ARDL bounds testing approach to level relationship developed by Pesaran & Shin (2001). The preference of the ARDL bounds testing approach over the traditional cointegration testing procedures was informed by the fact that unlike the traditional approaches which require that series be integrated at the same order, Pesaran, Shin & Smith (2001) bounds test can be applied to series that are not integrated at the same order, provided the order does not exceed two. The choice was also informed by the fact that Pesaran, Shin & Smith (2001) bounds test procedure does not require re-parametisation of the model into corresponding VEC model. This makes it easier for one to interpret the results. The study used level elasticities in the conditional error correction (CEC) model to test the null hypotheses of no cointegration. The calculated F-statistic from Wald test for cointegration were compared to two asymptotic critical values corresponding to polar cases of all variables being purely I(0) or purely I(1). The conclusions about the test results were based on thresholds provided by Narayan (2004). The study preferred Narayan's thresholds over those provided by Pesaran & Shin (2001) due to their suitability for small samples (Boakye, 2008).

The second step in the estimation process involved the estimation of long run elasticities and short run elasticities in model 3.2 and 3.3 respectively. This study employed the ARDL method developed by Pesaran & Shin (1995, 1999) and Pesaran & Pesaran (1996) to estimate the ARDL model. The study's preference of ARDL method over the traditional OLS was informed by the fact that it produces accurate long run estimates and t-values even in the presence of endogeneity (Ojiambo, 2013).

3.4.3 Post-Estimation Procedures

To guarantee validity and reliability of the estimates, this study conducted one data and a battery of six residual diagnostic tests. The data test involved the Ramsey's RESET of functional form. Residual tests included serial correlation test (Breusch-Godfrey LM Test), heteroskedasticity test (Breusch-Pagan-Godfrey test), normality test (Jarque-Bera, histogram plus superimposed normal distribution density curve for residuals) and stability tests (CUSUM tests, CUSUM square tests and recursive coefficient tests).

4. Results, Interpretation and Discussion

4.1 Correlation Analysis

Table 4.1: Correlation Matrix of OLS Correlation Analysis

	GCF	GDS	MAID	BAID	FDI	DR	ED	OPEN	INF
GCF	[1.000]								

GDS	[0.916]	[1.000]							
	(14.78)	-----							
	{0.000}	-----							
MAID	[0.953]	[0.847]	[1.000]						
	(20.45)	(10.31)	-----						
	{0.000}	{0.000}	-----						
BAID	[0.672]	[0.554]	[0.761]	[1.000]					
	(5.876)	(4.317)	(7.597)	-----					
	{0.000}	{0.001}	{0.000}	-----					
FDI	[0.774]	[0.659]	[0.751]	[0.511]	[1.000]				
	(7.931)	5.678	(7.364)	(3.851)	-----				
	{0.000}	{0.001}	{0.000}	{0.000}	-----				
DR	[0.956]	[0.857]	[0.920]	[0.659]	[0.721]	[1.000]			
	(21.03)	(10.78)	(15.26)	(5.678)	(6.749)	-----			
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}	-----			
ED	[0.895]	[0.825]	[0.847]	[0.639]	[0.597]	[0.923]	[1.000]		
	(13.01)	(9.465)	(10.33)	(5.377)	(4.820)	(15.820)	-----		
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}	-----		
OPEN	[0.843]	[0.700]	[0.938]	[0.720]	[0.652]	[0.856]	[0.800]	[1.000]	
	(10.16)	(6.340)	(17.570)	(6.763)	(5.567)	(10.722)	(8.653)	-----	
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}	-----	
INF	[−0.293]	[−1.163]	[−0.298]	[−0.216]	[−0.179]	[−0.277]	[−0.217]	[−0.334]	[1.000]
	(−1.986)	(−1.072)	(−2.021)	(−1.431)	(−1.177)	(−1.871)	(−1.444)	(−2.300)	-----
	{0.054}	{0.290}	{0.050}	{0.160}	{0.246}	{0.068}	{0.156}	{0.027}	-----

KEY: Correlation coefficients are presented in square brackets [ ]; t-statistics are presented in parentheses ( ); the probabilities of the t-statistics are presented in curly brackets { }.

Table 4.1 provides the coefficients of correlationship estimated using ordinary least squares (OLS). The results suggest the existence of strong multicollinearity in the data. Econometrically, multicollinearity is said to be severe if the coefficient correlationship exceeds 0.8 (Gujarati, 2005). The high correlations among the study's variables was expected because of the complementary relationship among the sources of finance. The resultant problem of multicollinearity was sidestepped by logarithmic transformation of the data and lagging.

4.2 Unit Test Analysis

Table 4.2: Results of Augmented Dickey-Fuller (ADF) Unit Root Tests

	ADF Test Statistic (Intercept and Trend)		
Variable	Level	Fist Difference	Order of Integration
LnGCF	-1.63	-6.23***	I(1)
LnLGCF	-1.70	-6.38***	I(1)
LnGDS	-1.42	-6.03***	I(1)
LnMAID	-0.69	-10.6***	I(1)
LnBAID	-4.68***	-6.52***	I(0)
LnFDI	-4.99***	-7.73***	I(0)
LnDR	-4.46***	-6.09***	I(0)
LnED	-1.74	-4.10**	I(1)
LnOPEN	-1.15	-6.46***	I(1)
LnINF	-5.26***	-7.86***	I(0)
MacKinnon Critical Values for the Rejection of Unit Root			
	Level		First Difference
1 % level	-4.192		-4.199
5 % level	-3.521		-3.524
10 % level	-3.191		-3.193

Note: ***means the ADF statistic was significant at 1% level of significance. ** means the ADF statistic was significant at 5% level of significance. * means the ADF statistic was significant at 10% level of significance.

Table 4.2 shows Augmented Dickey Fuller (ADF) test statistics for the study's series and the MacKinnon critical values for the acceptance or rejection of the null hypotheses of unit roots. The results indicate that ADF test failed to reject the null hypothesis of unit root for LnGCF, LnLGCF, LnGDS, LnMAID, LnBAID, LnFDI, LnDR LnED, LnOPEN and LnINF at 5 per cent level of significance after first differencing. The indication by ADF unit root tests that some of the series follow a random walk justified the study's decision to prefer Pesaran, Shin & Smith (2001) ARDL bounds testing procedure over the traditional tests of cointegration.

4.3 Cointegration Analysis

Table 4.3: Results for ARDL bounds test for cointegration with gross capital formation as the dependent variable, 1974-2017

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	3.46	10%	1.85	2.85
K	8	5%	2.11	3.15
		2.5%	2.33	3.42
		1%	2.62	3.77

The results in table 4.3 show that the calculated F-statistic of 3.46 exceeds the I(1) upper bound critical value of 3.15 provided by Narayan (2004) at 5% level of significance. Therefore, the study rejected the null hypothesis of no level relationship and concluded that there exists cointegrating relationship between capital formation and its determinants. This study favored Narayan's thresholds over Pesaran, Shin & Smith (2001) due to their appropriateness for small samples (Boakye, 2008). The results paved the way for the estimation of ARDL model (long run relationship equation) and the determination of the speed of adjustment back to long run equilibrium following a shock to the system.

4.4 Long Run and Short Run Dynamics

Table 4.5A: ARDL(2, 0, 0, 2, 2, 1, 2, 1, 0) model estimation with lnGCF as the dependent variable

Variable	Elasticity	t-Stat.	Prob.
lnGCF(-1)	0.2744	1.3815	0.1810
lnGCF(-2)	0.3300	1.8969	0.0710
lnGDS	0.4235	3.1553	0.0046
lnMAID	0.0100	0.0776	0.9389
lnBAID	0.1009	1.2550	0.2227
lnBAID(-1)	-0.1628	-2.1049	0.0469
lnBAID(-2)	0.0910	1.4618	0.1579
lnFDI	-0.0065	-0.2454	0.8084
lnFDI(-1)	0.0488	1.4848	0.1518
lnFDI(-2)	-0.0675	-1.9768	0.0607
lnDR	0.1254	1.7722	0.0902
lnDR(-1)	-0.1505	-2.2121	0.0376
lnED	-0.4115	-0.9360	0.3594
lnED(-1)	1.1561	1.7717	0.0903
lnED(-2)	-1.2196	-2.3084	0.0308
lnOPEN	-0.1095	-0.3135	0.7568
lnOPEN(-1)	0.5054	1.7693	0.0907
lnINF	-0.1443	-2.6089	0.0160
C	9.4157	3.1301	0.0049

R-squared=0.979AdjRsquared=0.962

Table 4.5B: ECM model estimation with $\Delta \ln GCF$ as the dependent variable

Variable	Elasticity	t-Stat.	Prob.
Δ(lnGCF(-1))	-0.330	-2.603	0.016
Δ (lnBAID)	0.101	2.205	0.038
Δ (lnBAID(-1))	-0.091	-2.282	0.033
Δ (lnFDI)	-0.007	-0.421	0.678
Δ (lnFDI(-1))	0.068	4.032	0.001
Δ (lnDR)	0.125	2.909	0.008
Δ (lnED)	-0.412	-1.454	0.160
Δ (lnED(-1))	1.220	4.451	0.000
Δ (lnOPEN)	-0.110	-0.649	0.523
ECM(-1)	-0.396	-6.987	0.000

R-squared=0.644, AdjRsquared=0.541

Table 4.5C: Diagnostics

Test Stat	**F Version**	**χ^2 Version**
Functional Form (Ramsey RESET)	$F[1, 21] = 1.05\ (0.32)$	Not Applicable
Serial Correlation (Breusch-Godfrey LM)	$F[2, 20] = 0.556\ (0.582)$	$CHSQ[2] = 2.16\ \ (0.34)$
Heteroskedasticity (Breusch-Pagan-Godfrey)	$F[18, 20] = 0.868\ (0.616)$	$CHSQ[18] = 17.0(0.52)$
Normality (Jarque-Bera)	Not Applicable	$CHSQ[2] = 1.36\ (0.51)$

Note: p-values in parentheses

The results in table 4.5A presents results for long run ARDL(2, 0, 0, 2, 2, 1, 2, 1, 0) model. It indicate that 97.93% of the variations in gross capital formation are explained by multilateral aid, bilateral aid and the control variables before adjusting for the degrees of freedom. Only 2.07% of the variations are not explained. Since most of the variations are explained, the study concluded that the long run model has a good fit.

Table 4.5A further shows that in the long run, at 5 per cent level of significance, the elasticity of multilateral aid is not statistically different from zero. It suggests that in the long run, Kenya's capital formation process does not depend on multilateral aid. Similarly, the elasticity of bilateral aid is not statistically different from zero during the program year. However, the sign for bilateral aid becomes negative and statistically significant after 1 lag. The elasticity of -0.1628 implies that a 10 per cent increase in bilateral aid will lead to 1.628 per cent reduction in capital formation one year down the line other factors remaining constant. In other words, US $1 increase in bilateral aid leads to US$ 0.433 reduction in gross capital formation in the long run one year down the line, ceteris paribus.

Because of the high debt element in concessional multilateral development finance and concessional bilateral development finance which were used as proxies for multilateral aid and bilateral aid respectively, the effects of multilateral aid and bilateral aid can be explained by the debt overhang hypothesis. According to debt overhang theory, increasing debt has positive effect on capital formation up to some point beyond which further accumulation of debt exerts negative pressure on capital formation (Cohen, 1993). The theory postulates that huge debt accumulation signifies high tax rates in future. High tax rates signify low returns on future investments. This discourages both domestic and foreign investors, leading to reduction in capital formation. Thus according to debt overhang hypothesis, bilateral aid has reached maximum absorption limit and further receipts will undermine capital formation in Kenya. On the other hand, multilateral aid has not reached the absorption limit. That is, more multilateral aid will contribute to enhancing capital formation in Kenya.

The failure by multilateral aid to achieve statistical significance in the long run can also be explained by aid fungibility hypothesis (Easterly, 2006; Moyo, 2009; Riddell, 2014) and corruption hypothesis (Easterly, 2006; Moyo, 2009; Gulrajani, 2015).According to fungibility hypothesis, aid meant for investment leaks into consumption while according corruption hypothesis, aid meant for investment is stolen by those in authority. Table 4.5B results demonstrate that the ECM term was statistically significant at 5% level of significance. The slope of -0.396 had the a priori negative sign. It suggests that 39.6 per cent of deviations from long run equilibrium are corrected in one year. According to Engle-Granger (1987) representation theory, negative and significant ECM term signifies long run Granger causality running from explanatory variables to the explained variable. Moreover, table 4.5B indicates that there is positive significant relationship between change in the elasticity for bilateral aid and change for the elasticity for capital formation. It implies that although bilateral aid retards capital formation in the long run, it enhances it in the short run. Table 4.5C shows that ARDL(2, 0, 0, 2, 2, 1, 2, 1, 0) model passed the functional form, serial correlation, heteroskedasticity and normality tests at 5% level of significance given that the probabilities for corresponding F-statistics and Chi-square statistics exceed the p-value of 0.05.

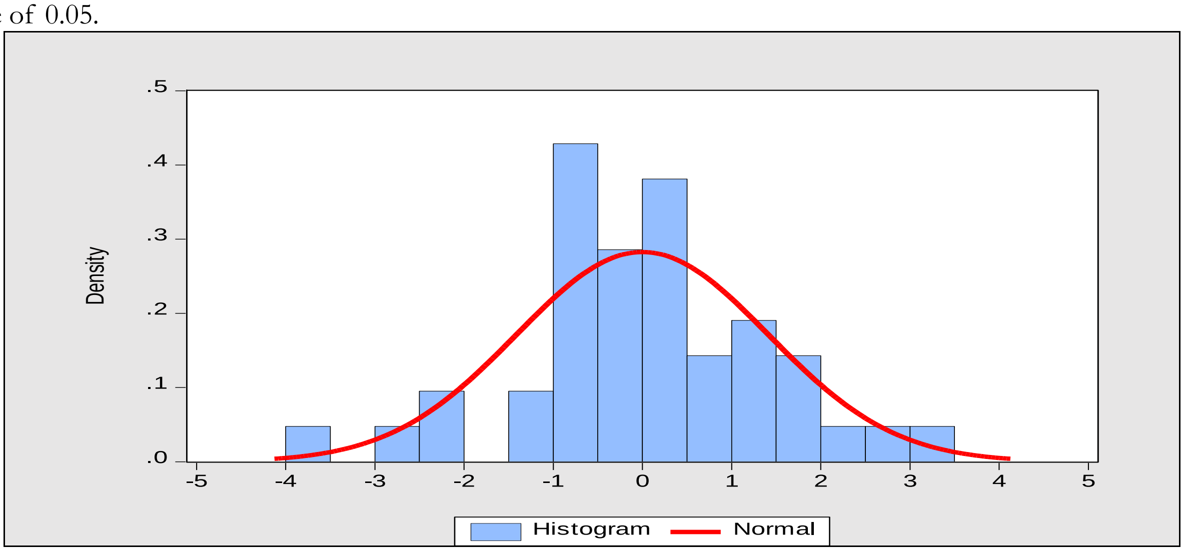

Figure 4.1: Histogram plus Superimposed Normal Distribution Density Curve for Residuals

The results of the Jarque-Bera normality test statistic were reinforced by a histogram plus superimposed normal distribution density curve for residuals in Figure 4.1.

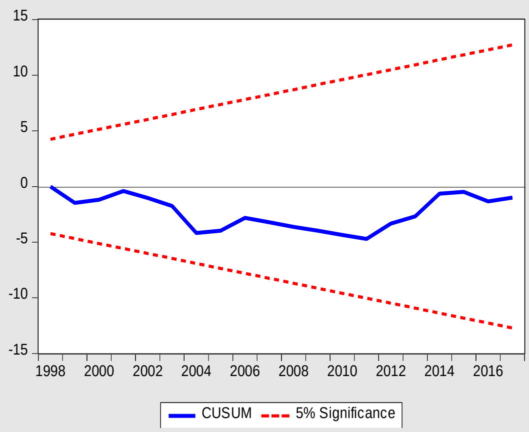

Figure 4.2: Recursive Residuals CUSUM

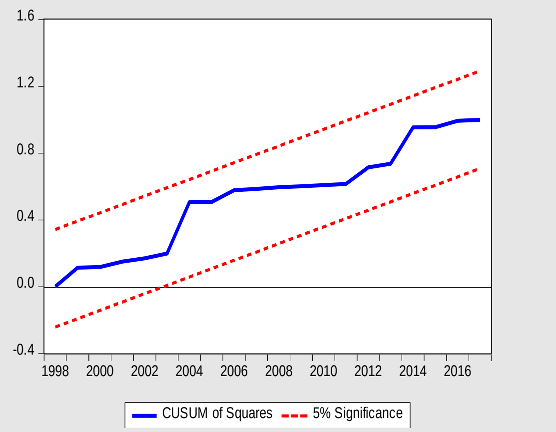

Figure 4.3: Recursive Residual Squares of CUSUM

Figure 4.2 and Figure 4.3 demonstrate that ARDL(2, 0, 0, 2, 2, 1, 2, 1, 0) model also passed stability tests. This is because the charts of residuals of cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) are within 5 per cent critical lines.

According to Brown, Durbin & Evans (1975), there is parameter and variance stability if the CUSUM and CUSUMSQ of recursive residuals remained within the region defined by the 5 per cent bound lines respectively.

4.6 Impulse Response Functions Analysis

To check the robustness of ARDL results, the study generated the response to Cholesky one standard deviation innovations.

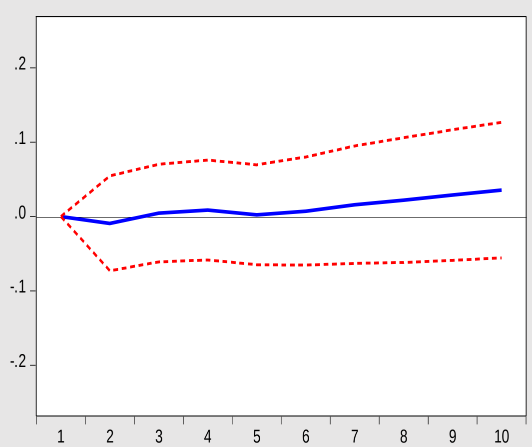

Figure 4.4: Response of capital formation to multilateral aid

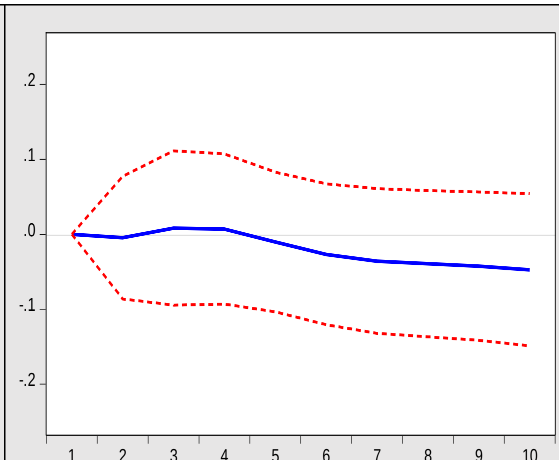

Figure 4.5: Response of gross capital formation to bilateral aid

Figure 4.4 indicates that the impact of one standard deviation innovation in multilateral aid on capital formation is positive since the effect is experienced in the positive territory seven and three quarter years out of ten years. However, the effect is statistically insignificant at 5% level of significance.Figure 4.5 shows that the impact of one standard deviation innovation in bilateral aid is experienced in the negative region seven and a half years out of the ten year period. The effect is statistically significant at 5% level of significance. The fact that the bilateral aid shock is statistically significant and does not die after ten years should be an issue of concern for the government of Kenya.

5. Conclusion and Recommendations

The purpose of this study was to investigate the effect of multilateral aid and bilateral aid on capital formation in Kenya. ARDL estimates suggest that in the long run, multilateral aid has positive but statistically insignificant effect on capital formation. The study concluded that Kenya's multilateral aid data does not support the big-push hypothesis that foreign aid enhances capital formation in developing countries. On the other hand, bilateral aid has negative and statistically significant effect on capital formation in the long run after one lag. ECM model estimates demonstrate that change in bilateral aid has positive significant effect on change in capital formation in the short run before the first lag; though the effect becomes negative and significant after one year. Therefore, Kenya's bilateral aid data supports the big-push hypothesis that foreign aid accelerates capital formation in developing countries but over the short-run horizon only. The results were robust for impulse functions analysis. The study recommended that to accelerate capital formation in Kenya in the short-run, the government should source for more foreign aid from bilateral donors.

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