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Impact of Capital Flow on Economic Growth: Empirical evidence from Ethiopia (1980-2010) using ARDL Approach

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Abstract
Evidence abound that some transitioning and developing countries are attracting large inflows of foreign capital that could engender economic growth or have destabilizing effects on their economies if not well managed. This has undoubtedly aroused anxiety over its potential effects on economic growth, the competitiveness of the export and external sectors viability. The study examines the impact of capital flow on economic growth in Ethiopia as well as the causal short-run and long-run relationship among the variables, using time series data from 1980 – 2010. Using the Autoregressive Distributed Lag (ARDL) approach, the result reveals that all the variables are statistically significant; which implies that the capital flow has an impact on economic growth in both short- and long-run dynamic equilibrium models. Additionally, Vector Autoregressive (VAR) and Innovative Accounting Techniques approach to Granger causality analysis shows that there exists bidirectional causality between gross capital flow, and economic growth. Consequently, these findings suggest that policy makers should critically understand, the nature, what drives the capital flows, and the impact of its sudden surge or reversal on economy. Moreover, it is also recommended that government should continue to pursue trade and foreign exchange policies that would ensure competitiveness of the export sector viability and economic growth.

Keywords: Economic growth; Capital flow; ARDL approach; Granger causality; Ethiopia.

Classification Code/JEL Code: C22, C32, D24, F32, F43, O11

Introduction
The issue of foreign capital flows to Africa as a whole including Ethiopia has become an important topic today among academic scholars. Capital flow is a controversial issue regarding to its impact on the economic development of one country. Several literatures might support or discourage the flow mode by considering the background of the consumer/recipient country because it has both negative and positive consequences on development. For example, Montiel argues that while developing economies tend to be capital-scarce, access to foreign capital should therefore normally be expected to be beneficial to them, in fact large capital inflows as well as sudden outflows have presented significant policy challenges [1].

As many studies confirm that the topic impact factor of huge capital flow is the “financial crisis or debit crisis” either on a single country and continent or on the world as a whole. Evidently, Musibau, Mahmood & Hammed confirm that global economies are severely affected from the debt crisis in 1980s till present especially an Africa, Latin America and few countries in Eastern Europe and Asia. consequently, the crises affected foreigners and domestic agents asymmetrically [2,3].

Capital flows are transactions involving financial assets between international entities either inflow or outflow. Capital outflow generally results from economic uncertainty in a country, whereas large amounts of capital inflow indicate a growing. The various form of inflow of foreign capital (loans, FDI, grant and portfolio) was welcome in developing countries to bridge the gap between domestic saving and domestic investment and therefore, to accelerate growth [4]. Unfortunately, an Africa economy is seriously affected by currency fluctuations, decay infrastructural development, high level of corruption, and political instability; consequently, these are situations discourage foreign investors [2]. Musibau and his colleagues further argue that the bottleneck of Ethiopian economy is the deficiency of finance (resource gaps) that it emanates from imbalances between __ exports and imports, debt payments and resource inflows, and domestic savings and domestic investments (ibid).

Consequently, the lack of adequate finance has reduced the ability of governments to embark on public expenditure in infrastructure and social services required to boost domestic demand, encourage private sector activity and sustain high level of growth for economic transformation [5]. Hence, Tasew suggest that poor countries like Ethiopia receive aid from foreign advanced countries to finance investment can directly fill this saving-investment gap, and aid can also indirectly fill the foreign exchange gap in the form of hard currency [6]. Thus, this makes the importance of foreign capital inflow unquestionable to a strong performance of the economy [4].

Empirical findings about the impact of capital flow on economic growth are rare: it is almost negligible, especially in Ethiopia. Many studies at the country level focus on the effect/impact of foreign capital inflow, foreign aid and foreign direct investment on economic growth, and the causality of saving, investment and economic growth. However, the study investigates how capital flow which includes both foreign capital inflow and domestic capital outflow affect economic growth in Ethiopia. Furthermore, it encompasses, implicitly the effect of capital flow/foreign capital inflow and domestic capital outflow/ on gross domestic saving and gross domestic investment; and hence on economic growth.

Thus, the study is believed to fill the gaps on studies which are limited only on one side flow of capital, foreign capital inflow effect on the economic growth of Ethiopia, by considering the two sides of capital flows, inflow and outflow effects. The main objective of the study is, therefore, to explore the macroeconomic impact of capital flow on economic growth in Ethiopia using data from 1980 to 2010. Moreover, the study tries to analyze the magnitude and direction of an impact of capital flow on (domestic) saving and economic growth in both short run and long run, and also to examine the causal relationship between capital flow and economic growth in Ethiopia.

Literature Review

Capital Flow and Economic Growth: Controversy Issue

International capital flows not only offer a great deal of benefits to financially integrated countries but they also pose numerous macroeconomic challenges [7]. Alley further found that the impact of capital flows on the economy depends on the level of financial market development - capital inflows have positive (negative) effect on growth when the country is financially developed (underdeveloped) (ibid).

Most scholars support the positive impact of foreign capital on economic growth. For example, Musibau et al. Found a strong, robust relationship between FDI (both inflows and outflows) and growth. Chen and Quang confirm that the growth effect of international capital flows is contingent on the levels of economic, institutional and financial development and government spending [8]. Moreover, moving capital flows from developed to developing countries would create employment opportunities and promote economic growth [9]. In contrary however, Musibau with his colleagues argue that FDI has negative impact on Domestic Investment in the short run but positive effect in the long run in the Sub-Sahara African economies and a net crowding the out effect [2]. Generally, for making negotiation these two views of controversial issues [2]; capital flows in the global market should be focused in the analyses of the effects of investment and savings on economic growth [10]. Hence, Hideaki further pointed out the fact that capital inflows in developing and emerging economies has not always contributed to increase GDP growth, and that those countries which are not dependent on external capital are likely to have higher growth (ibid).

Capital Flow, Saving, Investment and Economic Growth: Nexus

Hideaki explained that domestic savings have not been effectively utilized for domestic investment in the real economy, but mobilized for other non-productive sectors of economies (e.g. financial sectors and real states) in both domestic and foreign markets [10]. However, he also noted that capital inflows had positive effect on the domestic growth examines (ibid).

According to findings of Admasu on the nexus of foreign capital inflows and economic growth in Ethiopia over the period 1981–2014 by using ARDL approach examines:

"The long run and short run effect of explanatory variables on the dependent variable. Thus, the result reveals that the flow of foreign aid has a negative effect on economic growth both in long run and short run [5]. This is mainly because the existence of poor institutional arrangement and the funds are not always connected to the productive sectors. Similarly, the long run relationship between the flow of foreign direct investment and the economic growth is negative. The possible explanation for this negative effect is due to inadequate basic infrastructures and poor institutional quality in the country. However, the long run and short run effect of other foreign capital inflows and the short run effect of foreign direct investment are found to be insignificant in affecting real GDP per capita" [9].

Methodology

Sources and Types of Data

The study used annual time series (secondary)data ranging from 1980 to 2010 obtained from different publications of National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED), Statistical data base of Ethiopian Economic Association (EEA), African Development Indicator (ADI), IMF and, WB _CD-ROMs.

Description of Research Variables

The study treated two types of variables, dependent and explanatory variables. That is, one dependent variable, Real Gross Domestic Product (RGDP), and five different explanatory variables, Gross Domestic Saving (GDS), Gross Domestic Investment (GDI), Gross Capita Flow (GCF), Human Capital (HC) and Openness of Trade (OT).

Model Specification:

Mathematical Model

In line with the theoretical propositions reviewed in the literature, the impacts of capital flows on saving and investment implicitly, and on economic growth explicitly is examined by specifying equation.

Growth Function

"The relationship between productivity growth and private capital flows appears to have strengthened over time. The productivity benefits of capital flows—through the transfer of technology and management techniques and the stimulation of financial sector development are significant in countries where a developed physical infrastructure, a strong business environment, and open trade regimes have facilitated the absorption of those flows, but not otherwise".

Additionally, saving and investment have been considered as two macro-economic variables for achieving price stability and promoting employment opportunities thereby contributing to sustainable economic growth [11]. Particularly, savings and economic growth have positive effect on each other in the long-run for example, Carroll and Weil have established two interesting. For example, new empirical facts: (1) at the aggregate level, periods of high income growth appear to be followed by periods of high saving; and (2) among young households, those households who should expect faster income growth appear to save more than households who should expect slower income growth [13]. Moreover, economic growth should be strengthened in order to achieve high level of domestic investment both in the short and long runs [14].

Hence, RGDP is an increasing function of capital flows, gross domestic savings and gross domestic investment which can be given as below:

$$\ln RGDP = f(\ln GCF, \ln GDS, \ln GDI) \quad (1)$$

Furthermore, Equation (1) augmented by including two explanatory factors, human capital and openness of (international) trade over the function of RGDP. Human capital is important source of long -term growth because of its positive policy that enhance public and private investment in human policy capital, therefore, promote long-run economic growth [15]. Additionally, Barro (1991), confirms that human capital plays a special role in a number of models of endogenous economic growth [11]. Moreover, exchange rate and trade-openness per capita exhibited positive and significant impacts on GDP per capita [9]. In contrast, Ulaşan does not support the proposition [16] that opennss has a direct relationship with economic growth in the long-run [17]. Hence, economic reforms in these areas should take priority over the policies enhancing trade openness (ibid).

Accordingly, Equation (1) becomes as follows:

$$\ln RGDP = f(\ln GCF, \ln GDS, \ln GDI, \ln HC, \ln OT) \quad (2)$$

Where, RGDP _real gross domestic product, GCF _capital flow, GDI _Gross domestic investment, GDS _Gross domestic saving, HC _Human capital; and OT _Openness of trading.

Econometric Model

The developed econometric model of Equation (2) is given as follows:

$$\ln RGDP = \beta_0 + \beta_1 \ln GCF + \beta_2 \ln GDS + \beta_3 \ln GDI + \beta_4 \ln HC + \beta_5 \ln OT + \varepsilon_{it} \quad (3)$$

Where, β_0 is the intercept of dependent variable, RGDP; is the ith parameter β_i,(i=1,2,3,4,5) associated with explanatory variables, GCF, FDI, GDS, HC, and OT, respectively; and ε_{it} is the white noise error term.

Method of Data Analysis and Estimation Techniques

The first step in building dynamic econometric models involve a detailed investigation of the characteristics of the individual time series variables. When discussing stationary and non-stationary time series, the need to test for the presence of unit roots in order to avoid the problem of spurious regression should be stressed. Unit root test should be conducted in order to determine whether individual variables are stationary or not.

International Capital Flows and Economic Growth

Co-integration Test: ARDL Bounds Testing Approach

There are various techniques for conducting the Co-integration analysis among time-series variables. The Study adopts the so-called autoregressive distributed lag (ARDL) bound which appears to be applied in recent empirical investigations since this method has certain econometric advantages relative to other co-integration procedures. For example, first, it is applicable irrespective of the degree of integration of the variables (i.e. purely I (0), I(1) or mixture of both) i.e. it avoids the pre-testing of the order of integration of the variables; second, the short-run and long-run parameters of the model are estimated simultaneously i.e. the error correction term be considered in its lagged period; and third , the ARDL approach is more robust/strong/ and performs better for small sample sizes.

The ARDL approach requires estimating the conditional error correction version for variables under estimation. Arising from the above, the augmented ARDL version of the model specified earlier is expressed as:

$$\Delta RGDP_t = \alpha_0 + \sum_{i=0}^{p} \beta_i \Delta \ln RGDP_{t-i} + \sum_{i=0}^{q_1} \gamma_i \Delta \ln GCF + \sum_{i=0}^{q_2} \theta_i \Delta \ln GDS + \sum_{i=0}^{q_3} \pi_i \Delta \ln GDI + \sum_{i=0}^{q_4} \phi_i \Delta \ln HC + \sum_{i=0}^{q_5} \varphi \Delta \ln OT + \delta_1 \ln GDP_{t-1} + \delta_2 \ln GCF_{t-1} + \delta_3 \ln GDS_{t-1} + \delta_4 \ln GDI_{t-1} + \delta_5 \ln HC_{t-1} + \delta_6 \ln OT_{t-1} + \varepsilon_{it} \quad (4)$$

where, δ_i , (i=1,2,3,4,5) - the parameters that the corresponding long-run multipliers, and $\beta_i, \gamma_i, \theta_i, \pi_i, \phi_i, \varphi_i$ are the short-run dynamic coefficients of the underlying ARDL model.

From Equation (4), firstly test the null hypothesis of no Co-integration, $H_0 : \delta_i$, i=1,2,3,4,5 against the alternative using F-test with upper and lower critical values that are calculated automatically and reported after the ARDL regression estimates. Then finally, the order of the lag distribution function had been selected using one of the standard information criteria such as Akaike Information Criterion (AIC) and Schwartz-Bayesian Criterion (SBC). According to Pesaran and Shin (1995) recommend that the Schwartz-Bayesian Criteria (SBC) is preferable to other model specification criteria because it often has more parsimonious/economical/ specifications [11]. Therefore, a more parsimonious model is selected using the SBC criteria with the maximum lag order of two.

The Error Correction Models (ECM)

Estimating a dynamic equation in the levels of the variables is problematic and differencing the variables is not a solution; and consequently, any information about the long run is removed. The more suitable approach the easier to convert the dynamic model into an error correction model (ECM). It is shown that this contains information on both the short-run and long-run properties of the model, with disequilibrium as a process of adjustment to the long-run model (Harris and Sollis, 2008) [18]. The error correction (EC) representation of the ARDL model can be expressed as:

$$\Delta \ln RGDP_t = \alpha_0 + \sum_{i=0}^{p} \beta_i \Delta \ln RGDP_{t-i} + \sum_{i=0}^{q_1} \gamma_i \Delta \ln GDS + \sum_{i=0}^{q_2} \theta_i \Delta \ln GDI + \sum_{i=0}^{q_3} \pi_i \Delta \ln HC + \sum_{i=0}^{q_4} \phi_i \Delta \ln OIT + \psi ECM_{t-1} \quad (5)$$

where: ψ is the speed of adjustment and ECM_{t-1} is error correction term lagged by one period.

The existence of an error-correction term among a number of co-integrated variables implies that changes in the dependent variables are a function of both the level of disequilibrium in the Co-integration relation (expressed by the ECM) and the changes in other explanatory variables.

Granger Causality Test

There are three approaches to implement the Granger causality test depending on time-series properties of variables__ a VAR model in the level data (VARL), a VAR model in the first-differenced data (VARD), and a vector error correction model (VECM). The VECM approach which involves pre-testing through unit root and co-integration tests suffers from size distortions and can often lead to mistaken conclusions about causality. Hence, the study adopted the VAR approach. The lag augmented VAR representation of Equation (2) is given as below:

$$\ln RGDP_t = \beta_{10} + \sum_{i=1}^{p} \theta_{1i} \ln RGDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \delta_{1i} \ln RGDP_{t-i} + \sum_{i=1}^{p} \pi_{1i} \ln GCF_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \Omega_{1i} \ln GCF_{t-1} + \sum_{i=1}^{p} \lambda_{1i} \ln GDS_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \gamma_{1i} \ln GDS_{t-i} + \sum_{i=!}^{p} \eta_{1i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \mu_{1i} \ln GDI_{t-i} + \sum_{i=1}^{p} \phi_{1i} \ln HC_{t-1} + \sum_{i=p+1}^{p+d_{\max}} \varphi_{1i} \ln HC_{t-1} + \sum_{i=1}^{p} \omega_{1i} \ln OIT_{t-1} + \sum_{i=p+1}^{P+d_{\max}} \Psi_{1i} \ln OIT_{t-1} + \varepsilon_{1t} \ldots \quad (6)$$

$$\ln GCF_t = \beta_{20} + \sum_{i=1}^{p} \theta_{2i} \ln RGDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \delta_{2i} \ln RGDP_{t-i} + \sum_{i=1}^{p} \pi_{2i} \ln GCF_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \Omega_{2i} \ln GCF_{t-1} + \sum_{i=1}^{p} \lambda_{2i} \ln GD + \sum_{i=p+1}^{p+d_{\max}} \gamma_{2i} \ln GDS_{t-i} + \sum_{i=!}^{p} \eta_{2i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \mu_{2i} \ln GDI_{t-i} + \sum_{i=1}^{p} \phi_{2i} \ln HC_{t-1} + \sum_{i=p+1}^{p+d_{\max}} \varphi_{2i} \ln HC_{t-1} + \sum_{i=1}^{p} \omega_{2i} \ln OIT_{t-1} + \sum_{i=p+1}^{P+d_{\max}} \Psi_{2i} \ln OIT_{t-1} + \varepsilon_{2t} \ldots \quad (7)$$

$$\ln GDS_t = \beta_{30} + \sum_{i=1}^{p} \theta_{3i} \ln RGDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \delta_{3i} \ln RGDP_{t-i} + \sum_{i=1}^{p} \pi_{3i} \ln GCF_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \Omega_{3i} \ln GCF_{t-1} + \sum_{i=1}^{p} \lambda_{3i} \ln GDS_{t-i}$$
$$+ \sum_{i=p+1}^{p+d_{\max}} \gamma_{3i} \ln GDS_{t-i} + \sum_{i=!}^{p} \eta_{3i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \mu_{3i} \ln GDI_{t-i} + \sum_{i=1}^{p} \phi_{3i} \ln HC_{t-1} + \sum_{i=p+1}^{p+d_{\max}} \varphi_{3i} \ln HC_{t-1}$$
$$+ \sum_{i=1}^{p} \omega_{3i} \ln OIT_{t-1} + \sum_{i=p+1}^{P+d_{\max}} \Psi_{3i} \ln OIT_{t-1} + \varepsilon_{3t} \ldots\ldots \quad (8)$$

$$\ln GDS_t = \beta_{30} + \sum_{i=1}^{p} \theta_{3i} \ln RGDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \delta_{3i} \ln RGDP_{t-i} + \sum_{i=1}^{p} \pi_{3i} \ln GCF_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \Omega_{3i} \ln GCF_{t-1} + \sum_{i=1}^{p} \lambda_{3i} \ln GDS_{t-i}$$
$$+ \sum_{i=p+1}^{p+d_{\max}} \gamma_{3i} \ln GDS_{t-i} + \sum_{i=!}^{p} \eta_{3i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \mu_{3i} \ln GDI_{t-i} + \sum_{i=1}^{p} \phi_{3i} \ln HC_{t-1} + \sum_{i=p+1}^{p+d_{\max}} \varphi_{3i} \ln HC_{t-1}$$
$$+ \sum_{i=1}^{p} \omega_{3i} \ln OIT_{t-1} + \sum_{i=p+1}^{P+d_{\max}} \Psi_{3i} \ln OIT_{t-1} + \varepsilon_{3t} \ldots\ldots \quad (9)$$

$$\ln GDS_t = \beta_{40} + \sum_{i=1}^{p} \theta_{4i} \ln RGDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \delta_{4i} \ln RGDP_{t-i} + \sum_{i=1}^{p} \pi_{4i} \ln GCF_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \Omega_{4i} \ln GCF_{t-1} + \sum_{i=1}^{p} \lambda_{4i} \ln GDS_{t-i}$$
$$+ \sum_{i=p+1}^{p+d_{\max}} \gamma_{4i} \ln GDS_{t-i} + \sum_{i=!}^{p} \eta_{4i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \mu_{4i} \ln GDI_{t-i} + \sum_{i=1}^{p} \phi_{4i} \ln HC_{t-1} + \sum_{i=p+1}^{p+d_{\max}} \varphi_{4i} \ln HC_{t-1}$$
$$+ \sum_{i=1}^{p} \omega_{4i} \ln OIT_{t-1} + \sum_{i=p+1}^{P+d_{\max}} \Psi_{4i} \ln OIT_{t-1} + \varepsilon_{4t} \ldots\ldots \quad (10)$$

$$\ln GDI_t = \beta_{50} + \sum_{i=1}^{p} \theta_{5i} \ln RGDP_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \delta_{5i} \ln RGDP_{t-i} + \sum_{i=1}^{p} \pi_{5i} \ln GCF_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \Omega_{5i} \ln GCF_{t-1} + \sum_{i=1}^{p} \lambda_{5i} \ln GDS_{t-i}$$
$$+ \sum_{i=p+1}^{p+d_{\max}} \gamma_{5i} \ln GDS_{t-i} + \sum_{i=!}^{p} \eta_{5i} \ln GDI_{t-i} + \sum_{i=p+1}^{p+d_{\max}} \mu_{5i} \ln GDI_{t-i} + \sum_{i=1}^{p} \phi_{5i} \ln HC_{t-1} + \sum_{i=p+1}^{p+d_{\max}} \varphi_{5i} \ln HC_{t-1}$$
$$+ \sum_{i=1}^{p} \omega_{5i} \ln OT_{t-1} + \sum_{i=p+1}^{P+d_{\max}} \Psi_{5i} \ln OIT_{t-1} + \varepsilon_{5t} \ldots\ldots \quad (12)$$

where $\theta_i s, \delta_i s, \pi_i s, \Omega_i s, \lambda_i s, \gamma_i s, \eta_i s, \mu_i s, \phi_i s, \varphi_i s, \omega_i s, \Psi_i s$ are parameters of the model; p is the true lag length; ε_{it} are the residuals of the model which represents in natural logarithm.

Equations (6) - (12) were estimated to determine the direction of causality between the variables under consideration. From (6), Granger causality from $\ln GCF_t$ to $\ln RGDP_t$ implies $\pi_{11} = \pi_{12} = \ldots = \pi_{1p} \neq 0$; Granger causality from $\ln GDS_t$ to $\ln RGDP_t$ implies $\lambda_{11} = \lambda_{12} = \ldots = \lambda_{1p} \neq 0$; Granger causality from $\ln GDI_t$ to $\ln RGDP_t$ implies $\eta_{11} = \eta_{12} = \ldots = \eta_{1p} \neq 0$. From (7), Granger causality from $\ln RGDP_t$ to $\ln GCF_t$ implies $\theta_{21} = \theta_{22} = \ldots = \theta_{2p} \neq 0$; Granger causality from $\ln GDS_t$ to $\ln CF_t$ implies $\lambda_{21} = \lambda_{22} = \ldots = \lambda_{2p} \neq 0$; Granger causality from $\ln GDI_t$ to $\ln GCF_t$ implies $\eta_{21} = \eta_{22} = \ldots = \eta_{2p} \neq 0$. From (8), Granger causality from $\ln RGDP_t$ to $\ln GDS_t$ implies $\theta_{31} = \theta_{32} = \ldots = \theta_{3p} \neq 0$; Granger causality from $\ln GCF_t$ to $\ln GDS_t$ implies $\pi_{31} = \pi_{32} = \ldots = \pi_{3p} \neq 0$; Granger causality from $\ln GDI_t$ to $\ln GDS_t$

implies $\eta_{31} = \eta_{32} = \ldots = \eta_{3p} \neq 0$. From (9), Granger causality from $\ln RGDP_t$ to $\ln GDI_t$ implies $\theta_{41} = \theta_{42} = \ldots = \theta_{4p} \neq 0$; Granger causality from $\ln CF_t$ to $\ln GDI_t$ implies $\pi_{41} = \pi_{42} = \ldots = \pi_{4p} \neq 0$; Granger causality from $\ln GDS_t$ to $\ln GDI_t$ implies $\eta_{41} = \eta_{42} = \ldots = \eta_{4p} \neq 0$. Then, Granger causality is tested using the modified Wald (MWald) test which is theoretically very simple, as it involves estimation of a VAR model augmented in a straight forward way.

Impulse Response Function (IRF)

In empirical research, it is often necessary to know the response of one variable to an impulse in another variable in a system that involves a number of further variables as well. Thus, one would like to investigate the impulse response relationship between two variables in a higher dimensional system [19]. To this end, generalized impulse response which is invariant to the ordering of the variables in the VAR has been used.

Results and Discussions

Descriptive Statistics

Before directly going to the econometric estimation, it is better to have a look at the descriptive statistics of the variables under consideration. This is vital because this statistics summarizes the statistical properties of the series in the model such that some explanations about the behavior of the series can be offered at a glance (Table 1).

Table 1: Descriptive Statistics of variables in the model

Statistics	lnRGDP	lnGCF	lnGDS	lnGDI	lnHC	lnOT
Mean	11.0652	8.9304	8.2093	2.1780	2.0972	1.8216
Median	10.9885	8.7647	8.2121	2.1707	2.1056	1.8399
Maximum	12.0414	11.7789	10.714	2.4663	2.3716	2.0687
Minimum	10.5044	7.22023	6.2982	1.9767	1.8403	1.5781
Std. Dev.	0.42322	1.39209	1.0682	0.1530	0.1290	0.1253
Skewness	0.85051	0.45506	0.3776	0.2831	0.1205	0.0816
Kurtosis	2.66122	2.01514	2.5295	1.8138	2.3518	2.1051
Sum	343.0211	276.8414	254.4884	67.5179	65.0126	6.4695
Observations	30	30	30	30	30	30

Unit Root Testing

The null hypothesis for the test in ADF depicts that the data series under consideration has unit root while the alternative hypothesis claims that the series is stationary. As can be seen from Table 2, ADF test witnessed that RGDP in natural log at level is non-stationary since the null hypothesis couldn't reject the unit root at 1%, 5 %, and 10% level of significance. Additionally, the ADF test shows that none of the variable is stationary at level. On the other hand, when the first difference of natural log of RGDP is considered, it becomes stationary at 1%, 5% and 10% level of significances. Coming to the ADF test, the result reveals that the first difference of lnRGDP and other variables are stationary at 1%, 5% and 10% level of significance. Consequently, the null hypothesis of unit root is rejected at 1%, 5% and 10% level of significance.

Table 2: Result for the ADF-Unit Root Test

Variables at the level						
Variables	**Test Statistics**	**1%CV**	**5%CV**	**10%CV**	**P-Value**	**Recommendation**
lnOT	-0.983	-3.723	-2.989	-2.625	0.7595	I(1)
lnHC	-0.827	-3.723	-2.989	-2.625	0.8112	I(1)
lnGDI	0.648	-3.723	-2.989	-2.625	0.9887	I(1)
lnGDS	-0.494	-3.723	-2.989	-2.625	0.8931	I(1)
lnGCF	1.441	-3.723	-2.989	-2.625	0.9973	I(1)
lnRGDP	2.285	-3.723	-2.989	-2.625	0.9989	I(1)
Variables at the first difference						
dflnOT	-5.058	-3.723	-2.989	-2.625	0.0000***	
dflnHC	-7.966	-3.723	-2.989	-2.625	0.0000***	
dflnGDI	-6.250	-3.723	-2.989	-2.625	0.0000***	
dflnGDS	-7.765	-3.723	-2.989	-2.625	0.0000***	
dflnGCF	-6.250	-3.723	-2.989	-2.625	0.0000***	
dflnRGDP	-4.378	-3.723	-2.989	-2.625	0.0003***	
Note: CV represents critical value, *** is significant at 1% and it shows that the variable is stationary. I(1) implies that the variable is stationary at first difference.						

In general, the ADF test from Table 2 shows that all variables are integrated at first order, I (1) i.e. all variables are stationary at their first difference. Thus, the determination of co-integration relationships using the ARDL technique does not face a problem from the existence of I(2) or beyond variables in the model specified.

Co-integration Test and Estimation of Long-run Relationship

A two-step procedure is used in estimating the long-run relationship: an initial examination of the existence of a long-run relationship among the variables in Equation (2) is followed by an estimation of the short-run and long-run parameters.

Bound Test

The results in the bound test (Table 3) shows that lnRGDP, lnGCF, lnGDS, lnGDI, lnHC and lnOT are co-integrated when lnRGDP is taken as dependent variable without intercept (i.e. constant = 0) because F-statistic, written as FlnRGDP (lnRGDP| lnGCF, lnGDS, lnGDI, lnHC, lnOT) = 4.7154 [with lag order of (1,0,0,0,0) selected by the SBC] is greater than both lower and upper bounds at 95% critical values of Narayan (2004) and Pesaran, Shin & Smithet which are 2.5080 and 3.9478, respectively. However, while the intercept (i.e. constant 0) included (considered) [20, 21]. In the model, the result shows that variables are not co-integration because F-statistics value, 2.5821 less than both upper and lower bounds which are 3.1815 and 4.5996, respectively. Hence, taking the model without intercept is preferable to test the co-integration. (Note: the existence of a clear co-integrating equation indicates that there is a long-run relationship among the variables [21].

Before estimating the long-run relationship and the short-run dynamics of the model, it is important to analyze performance of the ARDL estimates through the diagnostic tests. Further the result revels that R- squared is 99 percent and it is statistically significant (P = 0.000) at 1% level of significance implying that the model fits well. Moreover, the model (ARDL estimates) is free from the problem of serial correlation, functional form, heteroskedasticity and normality as revealed in LM and F version of tests because the null hypothesis couldn't reject on each test statistic (Table 3).

Table 3: Results of Bounds Test for Co-integration

Dependent Variable (Excluding Intercepts)	Order of ARDL	F-Statistics	Decision
FlnRGDP (lnRGDP| lnGCF, lnGDS, lnGDI, lnHC, lnOT)	(1,0,0,0,0,0)	4.7154*	Cointegrated
F lnGCF (lnGCF | lnRGDP, lnGDS, lnGDI, lnHC, lnOT)	(1,0,1,0,0,1)	16.8935*	Cointegrated
F lnGDS (lnGDS | lnGCF, lnRGDP, lnGDI, lnHC, lnOT)	(0,0,0,1,0,0)	---	
F lnGDI (lnGDI | lnGCF, lnGDS, lnRGDP, lnHC, lnOT)	(1,1,0,0,0,0)	14.2454*	Cointegrated
F lnHC (lnHC |, lnGCF, lnGDS, lnGDI, lnRGDP, lnOT)	(0,0,0,1,0,0)	----	
F lnOT (lnOT |, lnGCF, lnGDS, lnGDI, lnHC, lnRGDP)	(1,0,0,0,0,0)	2.6000	Non-integrated

Table 4: Estimated Long-run Coefficients using the ARDL Approach

Estimated Long Run Coefficients using the ARDL Approach			
ARDL (0,0,1,0,1,1) selected based on Schwarz Bayesian Criterion			
Dependent Variable in lnRGDP			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
lnGCF	3.2651	1.6328	1.9997[0.057]*
lnGDS	-3.4458	1.7935	-1.9212[0.067]*
lnGDI	-26.5916	14.7476	-1.8031[0.084]*
lnHC	31.0953	15.2222	2.0428[0.052]*
lnOT	1.7171	0.91013	1.8866[0.071]*
R-Squared	0.98981	R-Bar-Squared	0.98768
S.E of Reg.	0.04690	F-Stat. F(5,24)	466.1148[0.000]
Diagnostic Test			
Test Statistics	LM Version	F Version	
A: Serial Correlation	CHSQ(1) = 0.38599[0.534]	F(1,22) = 0.28675[0.598]	
B: Functional Form	CHSQ(1) = 0.38084[0.537]	F(1,22) = 0.28287[0.600]	
C: Normality	CHSQ(2) = 1.0562[0.590]	Not applicable	
D: Heteroscedasticity	CHSQ(1) = 3.8315[0.050]	F(1,28) = 4.0996[0.053]	
Note: * indicate that significance at 10% level of significance. Figures in parenthesis are p-values. (A)Lagrange multiplier test of residual serial correlation; (B)Ramsey's RESET test using the square of the fitted values; (C)Based on a test of skewness and kurtosis of residuals; (D)Based on the regression of squared residuals on squared fitted values.			

Table 4 presents the estimated coefficients of the long-run relationship along with the diagnostic tests of the model. Based on the results, the long-run growth equation is given as:

$$\ln RGDP = 3.2651 \ln GCF - 3.4458 \ln GDS - 26.5916 \ln GDI + 31.0953 \ln HC + 1.7171 \ln OT \text{ ....} \quad (13)$$

P-value (0.057) (0.067) (0.084) (0.052) (0.071)

The estimated coefficients show that gross capital flow, human capital and openness of trading have a statistically significant positive impact on economic growth, which is in line with theoretical argument that capital flow, human capital and openness contribute to economic growth. More specifically, the elasticity of capital flow indicates that a 1% increase in capital flow leads to 3.265 percent increase in economic growth on average, keeping other variables constant. Similarly, the long-run elasticity of human capital is 31.095 and openness of trading is 1.717 which imply that a 1% rise in human capital and openness of trading result in about 31.095 and 1.717 percent increase in economic growth, respectively.

However, as seen Table 3, the long-run model suggests that gross domestic saving and gross domestic investment have significantly ($p < 0.1$) negative effect on economic growth. Particularly tabulation reveals that , the long-run elasticity of gross domestic saving is -1.9212and gross domestic investment is -1.803 which imply that a 1% increase in gross domestic saving and gross domestic investment result in about 1.921 and 1.803 percent decrease in economic growth, respectively . However, a quick review of literature on the relationship between savings and economic growth indicates a positive relationship between domestic savings and economic growth [10].

The Short Run Dynamic Modeling: (Error Correction Model)

After estimating the long-run coefficients, the error correction representation is obtained (see on Table 3). The result of the short-run dynamic growth model is presented in Table 4. About 64.7 percent of the variation growth is explained by explanatory variables included in the model. R-squared which is 64.66 is statistically significant at 5% level of significance implying that the model fits well since the explanatory variables are jointly significant at 5% level of significance.

The coefficient on the lagged error-correction term is highly significant at one percent level of significance with the expected sign (negative), which confirms the result of the bounds test for co-integration. The estimated coefficient of the ECMt-1 is equal to 0.17 which states that departure (disequilibria) from the long-term growth path due to a certain shock is adjusted (converge back to long-run equilibrium) by 17 percent over the next year, significant at the 1% level of significance.

Table 5: Short Run Dynamics Result for the Selected ARDL Model

Error Correction Representation for the Selected ARDL Model (ARDL (1,0,0,0,0,0) selected based on Schwarz Bayesian Criterion)			
Dependent Variable is Δ *In RGDP*			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
Δ In *GCF*	0.55738	0.19936	2.7958[0.010]**
Δ In *GDS*	-0.58823	0.24737	-2.3779[0.026]**
Δ In *GDI*	-4.5395	1.8002	-2.5217[0.019]**
Δ In *HC*	5.3083	1.9962	2.6592[0.014]**
Δ In *OT*	0.29312	0.13992	2.0949[0.047]**
ECM_{t-1}	-0.17071	0.057872	-2.9498[0.007]***
R-Squared	0.64662	R-Bar-Squared	0.57300
S.E. of Reg.	0.046905	F-Stat. F(5,24)	8.7832[0.000]
Notes: Figures in parenthesis are p-values. Δ represents the first difference. *** &** means the coefficients are significant at 1% & 5% level of significance respectively.			

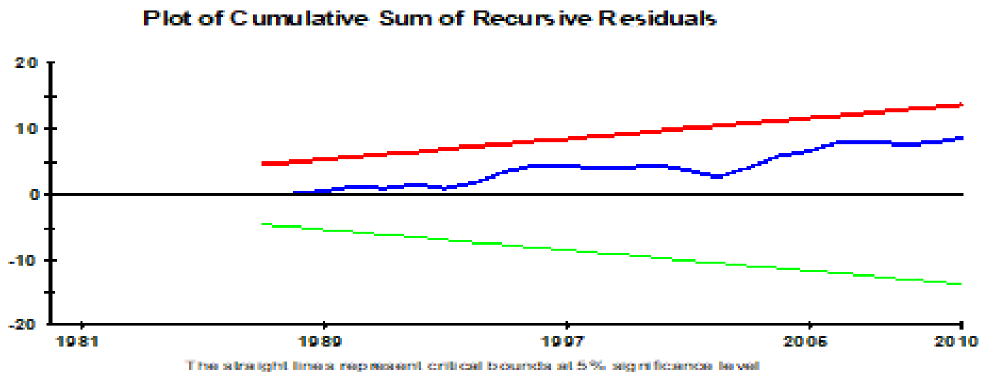
Based on Table 5, the short-run dynamics of growth equation is given as:

$$\begin{aligned}&\Delta \ln RGDP = 0.55738\Delta\mathrm{lnGCF} - 0.58823\Delta\mathrm{lnGDS} - 4.5395\Delta\mathrm{lnGDI} + 5.3083\Delta\mathrm{lnHC} + 0.2931\Delta\mathrm{lnOT} - 0.1707\mathrm{ECM}_{t-1}\\ &\text{P - value} \quad (0.010) \quad (0.026) \quad (0.019) \quad (0.014) \quad (0.047) \quad (0.007) \quad \ldots\ldots \quad (14)\end{aligned}$$

From this equation, the result reveals that the estimated coefficients of lnGCF, lnHC and lnOT are statistically significant with the positive sign. In line with the postulates of growth theories; gross capital flow, returns to schooling (human capital) and trade openness have a positive effect on real gross domestic product of Ethiopia in the short-run. Even though gross domestic savings (lnGDS) and gross domestic investment (lnGDI) are statistically significant, they have a negative effect on the real economic growth of Ethiopia in the short-run. Particularly, since (gross) capital flow and real gross domestic product have positive relationship, the one percentage change in percentage of GDF to RGDP ratio causes RGDP to be changed approximately by 0.56 percent, other variables remaining constant.

Stability Test

The stability of the long-run coefficient is tested by the short-run dynamics. Once the error correction model has been estimated the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) are applied to assess the parameter stability [22]. Figure 1 show plots of CUSUM and CUSUMSQ of the growth equation in its SR version are drown.



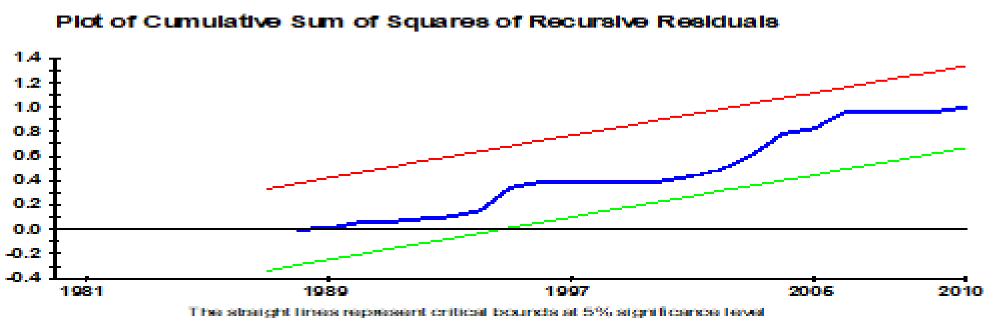


Figure 1: Stability Test: Plots of CUSUM and CUSUMSQ

Granger Causality Test

As seen from Table 6, the optimal lag length is one. Since all variables become stationary after the first differencing, it implies that dmax is also one. Then a system of VAR estimates in levels with a total of (dmax +k=1+1) which is 2 lags; where k is the lag length selected by information criteria. Using this information, the system of equations (i.e. Equations 6 -12) is jointly estimated as a "Seemingly Unrelated Regression Equations" (SURE) model.

Table 6: Estimates of long-run Granger Causality Wald Tests

Equation	Excluded	x^2	Prob. > x^2
lnRGDP	lnGCF	3.9538	0.138
lnGCF	lnRGDP	0.02683	0.987

Table 6 shows that the null hypothesis that 'Granger no-causality from (gross) cash flow to economic growth' could be rejected since the causality is insignificant even at 10% level of significance. Hence, the alternative hypothesis that 'Granger causality from gross capital flow to economic growth' is accepted. That is, gross capital flow causes positively the economic growth with scalar of 3.9538. Similarly, when the reverse effect checked on economic growth on gross capital flow, it causes by amount of scalar 0.02683 positively. Therefore, the result reveals that the Granger causality between gross capital flow and economic growth is bi-directional effect. That is, gross capital flow Granger causes economic growth and there is a feedback from economic growth. But, the effect of the reverse cause (i.e. from economic growth to gross capital flow) is weaker than the effect from gross capital flow to economic growth.

Impulse Response Functions (IRF)

The impulse response functions of variable lnRGDP and lnGCF for eight years is estimated generalized Table 7 and illustrates graphically in Figure 2. While consider Impulse (lnGCF) and Response (lnRGDP) that a one standard deviation disturbance originating from economic growth result in an approximately 4.76 percent increase in gross capital flow in the first period. Similarly, it continuously increases to about 24.7 percent in the third period and starts increasing after the fifth period and reaches about 33.5 percent in the 8th period implying that the impact of gross capital flow on economic growth is positively increased in both short-run and long-run. Thus, the impulse of domestic cash flow on the economic growth is increasing response.

Table 7: Generalized Impulse Responses to one SE shock in the equation for lnRGDP

IRF(varbasic), Impulse (lnGCF), Response (lnRGDP)	
Horizon	IRF
0	0.000000
1	0.047602
2	0.116382
3	0.166032
4	0.210189
5	0.247131
6	0.279681
7	0.308682
8	0.335229
IRF(varbasic), Impulse (lnGCF), Response (lnRGDP)	
Horizon	IRF
0	0.000000
1	0.094813
2	0.038955
3	0.031539
4	0.013343
5	0.002886
6	-0.006844
7	-0.014321
8	-0.02063

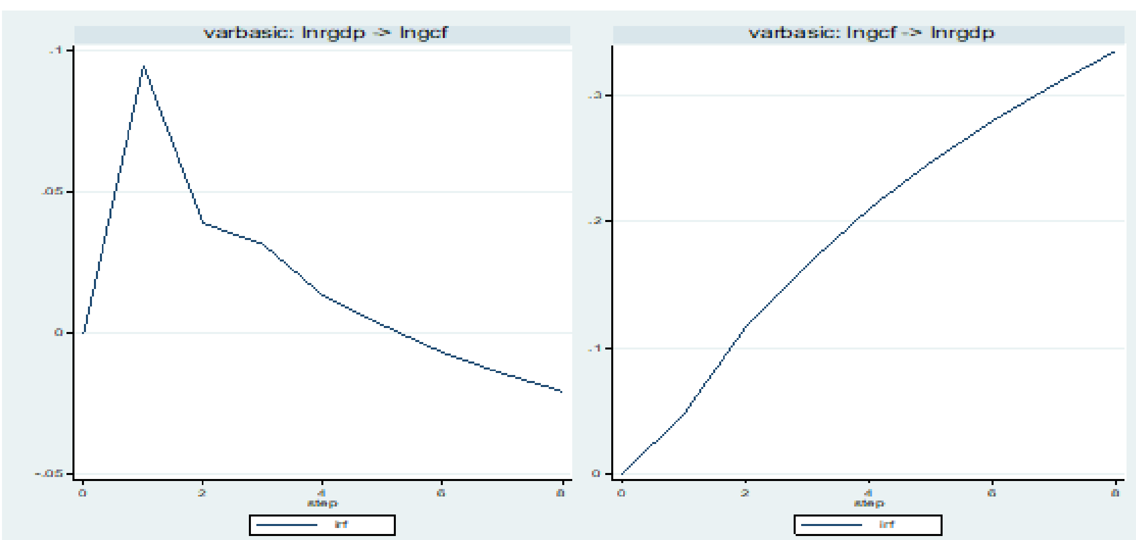


Figure 2: Impulse-Response Function (IRF): lnRGDP vs lnGCF

However, when we see in reverse direction by considering Impulse (lnRGDP) and Response (lnGCF) that a one standard deviation disturbance originating from economic growth results in an approximately 9.48 percent increase in gross capital flow in the first period. But it continuously declines to about 0.29 percent in the fifth period and starts negatively decreasing after the fifth period and reaches about 2.06 percent in the 8th period implying that the impact of economic growth on gross cash flow causes positively decreased for short-run and negatively decreased for long-run. Thus, the impulse of economic growth on the domestic cash flow is a decreasing response.

Conclusion and Policy Implications

Conclusion

The evidence offers on the relationship among the real gross domestic product (lnRGDP), gross capital flow (lnGCF), gross domestic saving (lnGDS), gross domestic investment (lnGDI), and openness of trade (lnOT) in Ethiopia. The series used in the analysis was tested for stationarity, using Augmented Dickey-Fuller (ADF) . The result estimates that the variables are not stationary at level, though stationary at first difference. On the Johansen Cointegration test, it shows the presence of long-run relationship among the cointegrating variables. Furthermore, an Engle-Granger 2-Step procedure was applies and an error correction model (ECM) develops from long-run static model. The error correction term in the short-run dynamic model has a statistically significant coefficient with the appropriate negative sign and this is a requirement for dynamic stability of the model.

As determinants of growth, the long-run coefficients of the natural logarithm of gross capital flow, human capital and openness of trading are positive and statistically significant at 10% percent level of significance, implying that these three variables have a significant and positive impact on growth in the long-run. However, the long-run coefficients of gross domestic saving and gross domestic investment are significantly negative effect on economic growth.

Similarly, ARDL based short-run dynamic modeling (Error Correction Model) for growth shows that gross capital flow, human capital, and trade openness have statistically significant positive effect on growth in the short-run. Furthermore, the stability of the estimated parameters of both short-run and long-run relationships is supported by CUSUM and CUSUMSQ stability tests. The direction of causal relationship among the gross capital flow and economic growth using the Granger causality tests suggests that the direction of Granger causality from gross capital flow to economic growth which is in line with the conventional wisdom. That is, gross capital flow causes positively the economic growth. In turn, even though the Granger reverse causality from economic growth to gross capital flow is weaker, it a positive cause. Therefore, the result reveals that the Granger causality between gross capital flow and economic growth is bi-directional effect. That is, gross capital flow Granger causes economic growth and there is a feedback from economic growth.

However, Granger causality running from gross capital flow to economic growth is stronger and positively increased as suggested by impulse response and variance decompositions in both short- and long-run. But, Granger causality running from economic growth to gross capital flow is weaker and negatively decreased in long-run, even though it positively decreases in short-run.

Policy Implication

Empirical evidences show that the capital flows of a country can be either positive or negative based on their import and export levels, economic and political stability, and financial markets. Strong capital flows into a country can result in many benefits. As firms and people invest new capital from outside countries, this can lead to new factories, research and development advances, and technology improvements. Ultimately, the results in more jobs, increase incomes lower prices, and higher standards of living for citizens. One risk of too much capital inflow is that inflation could result if a country is already operating at full capacity and continues to receive strong foreign investment.

Furthermore, capital flows are very important because of their potential effects on the macroeconomic stability, monetary and exchange rate management as well as competitiveness of the export and external sectors viability of a country. This is because no matter how the nature of capital flows (flows over a medium-to long-term), they are expected to influence the monetary aggregates, especially, the economy's net foreign assets (NFA), inflation as well as real effective exchange rate, aggregate output (GDP) and possibly the domestic interest rates.

Consequently, any policy recommendation on this should understand, the nature, what drives the capital flows and the impact of its sudden surge or reversal on economy. It is recommended that government should continue to pursue trade and foreign exchange policies that would ensure competitiveness of the export sector viability and economic growth, while foreign direct investment should be encouraged amidst thriving business environment that would engender economic growth.

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