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Causality between External Debt and Capital Flight in Sub-Saharan Africa

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Abstract

Over the past few decades, the foreign liabilities of the majority of countries in Sub-Saharan Africa have grown dramatically, propelling most nations into the status of Highly Indebted Poor Countries, when these liabilities reached unsustainable levels in the 1990s. At the same time, increases in capital flight from the region followed a parallel trend, leading scholars to draw on "revolving door" models to explain the apparent positive covariation of external debt and capital flight in the region. This paper investigates the causality between external debt and capital flight in a cross-section of Sub-Saharan African countries using co-integration and error-correction models. Although dual causality, which is consistent with the revolving door hypothesis, cannot be rejected for the majority of countries, empirical evidence highlights the lead of external debt over capital flight. The significance of error-correction terms points to a long-run co-integrating relationship between external debt and capital flight in a large number of countries.

This paper—a product of the Poverty Reduction and Economic Management Division, The World Bank Institute—is part of a larger effort in the department to understand the dynamic interaction between capital flight and external with a view of enhancing domestic resource mobilization in support of growth and poverty reduction in Post-HIPC Completion Point countries in Sub-Saharan Africa. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at hfofack@worldbank.org.

Causality between External Debt and Capital Flight in Sub-Saharan Africa

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I. Introduction

Over the past decades, external debt and capital flight have come to symbolize two faces of the same coin in the development puzzle. In Sub-Saharan Africa, the means and distributions associated with these two series have grown unabated, with the cumulative stock of capital flight markedly exceeding the stock of external debt in a large number of countries [Ndikumana and Boyce (2008)].[2] While the dramatic increase in external debt is to a certain extent understandable, especially given the recurrence of balance of payments crisis and external disequilibrium in the majority of low-income countries faced with negative terms of trade shocks, the sustained increases of capital flight— the voluntary exit of private residents' own capital either for safe haven or for investment made in foreign currency— is less obvious; in part because the majority of developing countries confronted with massive outflows of resources are also highly capital-scarce.

The covariation of external debt and capital flight, reflected in concurrent increases in the two series, is neither new nor restricted to the Sub-Saharan African region, however. At the height of the debt crisis that emerged from the near insolvency status of many countries in Latin America in the 1980s, and later posed a major threat to the international financial system, Nicolas Brady, then US Treasury Secretary, recommended that measures contemplated by international financial institutions to address that crisis "*placed special emphasis on the design of new policies that could stem and indeed reverse capital flight*" [Pastor (1990)].[3] Naturally, the underlying assumption of this policy prescription is the existence of a possible one-to-one correspondence between the rising stock of external debt and capital flight. Implicitly, it suggests that the latter may be driving the former, a scenario that a growing strand of the literature has characterized as 'revolving door' or 'round tripping' [Pastor (1990), Boyce (1992)].

Although the correlation between capital flight and external debt may not necessarily be perfect, it is difficult to rule out a priori the existence of a positive association. Under this time-dependent relationship, massive outflow of resources in the form of capital flight may continuously fuel the debt cycle; alternatively resource inflows in the form of external debt may provide the foreign reserves needed to sustain capital flight under the "round tripping" or "revolving door" hypothesis.

Take two extreme cases of countries in Sub-Saharan Africa, Botswana, one of the few non-HIPC countries in the region, with a very low external debt-to-GDP ratio, and at the other end of the spectrum, the Congo Republic, which had a very high external debt-to-GDP ratio prior to reaching the Completion Point under the Enhanced HIPC Initiative.[4] In spite of the very similar initial conditions of these two countries—relatively small population size and natural-resources rich— they have followed a divergent path on the foreign liabilities landscape. While the Congo Republic has a debt-to-GDP ratio averaging 155 percent and a cumulative stock of flight capital to GDP in excess

[2] In particular, capital flight has grown more rapidly than external debt in the region, resulting in net outflows of resources. Recent estimates suggest that capital flight has increased even more rapidly, and would account for over twice the size of external debt. Reflecting this emerging trend, a growing number of scholars have labeled the Sub-Saharan Africa region as "net creditor" to the rest of the world [Boyce and Ndikumana (2001)].
[3] Under this plan, the repatriation of capital flight to source countries in was the cornerstone of the debt strategy in Latin America. This strategy was also accompanied by stabilization programs, and as such, access to debt relief under IMF programs was conditional on successful repatriation of capital flight, among other criteria. However, under the Enhanced HIPC Initiative, which took a large number of Sub-Saharan African countries to the Completion Point, debt relief is not conditional upon repatriation of flight capital, and might undermine prospects of capital infusion in support for long-run growth [Fofack and Ndikumana (2009)].
[4] The Congo Republic external debt amounted to US$9 billion in 2004 (in NPV terms), which makes it one of the world's most indebted countries on a per capita basis. It reached the Completion Point under the Enhanced HIPC in 2006, and was granted debt relief equivalent to US$1.7 billion in 2004 NPV terms under that initiative.

of 402 percent, Botswana exhibits some of the lowest ratios— about 5 percent for external debt-to-GDP and negative 11 percent for capital flight-to-GDP.[5]

The negative value of the capital flight to GDP ratio in Botswana reflects the fact that the uses of foreign exchange actually exceed the recorded sources (net inflows of capital and repatriation). On the other hand, the positive sign and scope of flight capital in the Congo Republic reflects excess capital flight where actual outflows of foreign reserves exceed effectively recorded ones. Interestingly, capital flight, which increased dramatically to account for over twice the size of foreign liabilities, when imputed interest earnings are accounted for, is associated with a rapid accumulation of external borrowings in the Congo Republic. The parallel increase of these two series does indeed suggest the existence of a positive correlation between external debt and capital flight. However, this positive correlation might not necessarily imply causation.

Since the Latin American debt crisis, the causality between capital flight and external debt has been the subject of numerous studies and research. These studies have largely been approached from the conceptual and theoretical angle, highlighting four possible direct causal linkages whereby debt could either drive or fuel capital flight and vice versa [Boyce (1992) and Ajayi (1997)].[6] In an attempt to empirically test this hypothesis, Boyce (1992) uses regression analysis in a model that allows simultaneity to investigate the determinants of capital flight and external debt in the Philippines.[7]

Similarly, Ajayi (1997) hypothesizes the existence of dual causality between capital flight and external debt in Sub-Saharan Africa. However, more recent techniques and test of causality have not been used to assess the validity of the hypothesized dual causality in Sub-Saharan Africa. In order to complement these studies, this paper uses a methodological approach based on the theory of cointegration and Granger causality to investigate the causality between external debt and capital flight in a cross-section of countries in Sub-Saharan Africa.

The application of the error correction Granger causality model to the time series supports the existence of a causal relationship between external debt and capital flight in Sub-Saharan Africa. In particular, the results show that external debt and capital flight are co-integrated in the majority of countries, with past values of external debt having explanatory power over capital flight in most countries. This result further supports the established "round tripping" hypothesis. However, the reverse causality from capital flight to external debt is equally strong in a number of countries, especially when the standard Granger causality model is adjusted for error correction, pointing to the existence of a possible dual causality between capital flight and external debt in a large number of countries.

This causal relationship is also supported by nonparametric tests. In particular, the one-sided alternative under the Spearman Rank Correlation test easily rejects the null hypothesis of independence in favor of the alternative direct association whereby large values of capital flight are likewise associated with large values of external debt. This last result implies that the ordered sequence of external debt and capital flight is not random. Non-randomness implies dependency where there is a strong tendency towards co-movements with the distributions underlying the two series following the same trend.

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[5] See Table 1 in the Annex for more details.

[6] Note that a number of studies have also raised the prospects of indirect linkages, whereby external debt accumulation and capital flight could independently be driven by exogenous factors such as poor macroeconomic management. However, empirical tests do not support the independence argument.

[7] The model found debt disbursements to be a highly significant determinant of capital flight in the Philippines. In a reverse causality the model finds external debt to be significant and positively affected by capital flight, suggesting that capital flight is a determinant of external debt.

The remainder of the paper is organized as follows. The next section focuses on empirical analysis and particularly uses a nonparametric method to infer on the nature of the association between the distribution of external debt and capital flight. Section III discusses a methodological approach to infer on the causality between capital flight and external debt, with emphasis on error correction Granger causality models. Section IV discusses empirical results and policy implications. The last section concludes.

II. Data Analysis

The external debt series is obtained from the World Bank Debt Table. The estimated capital flight series has been kindly provided by Ndikumana and Boyce (2008).[8] This last series is constructed from three different sources: the IMF's Trade Statistics, World Bank World Tables and IMF Balance of Payments Statistics. The need to reconcile these different sources to construct the capital flight series arises from the difficulty of gathering accurate information on capita flight as a result of widespread use of trade misinvoicing. The recourse to trade misinvoicing is partly motivated by the desire to evade customs duties, import restrictions and capital controls, and has, to certain extent, reinforced the illicit nature of flight capital in the landscape of global capital flows. Although labor-intensive, the integration of different sources of information reduces the discrepancy between recorded inflows and outflows of foreign exchange.[9]

The resulting capital flight series is very comprehensive in its coverage; it includes low and middle-income, HIPC and non-HIPC countries, from a large cross-section. Though debt overhang and subsequent relief predominantly concerns low-income and severely indebted countries, capital flight affects both low- and middle-income countries in the region. Hence, the sample has 40 countries, accounting for most of the region's foreign liabilities and capital flight, reflecting the inclusion of leading capital flight candidates in the sample.[10] The two series are annual averages spanning the years 1970-2004, included.[11] In particular, they cover the decade that saw a number of countries accede the HIPC Completion Point. In this regard, they provide the basis for assessing the dynamics of capital flight during the HIPC era. Additionally, the comprehensive coverage makes it possible to investigate the dynamics of capital flight across region, controlling for external debt.

This section focuses on the dynamics and dependency structure of capital flight and external debt. The empirical analysis assumes that the movements underlying these two series follow a bivariate distribution symbolizing the two faces of the same coin. Though this assumption of time-invariant pairing may appear as relatively strong, I would propose that we abide by it for now and then subject the coin to tossing; so that we can explore the dynamics interaction or path-dependency of the two series using graphical and nonparametric methods. The graphical method draws on a scatter plot diagram to assess the nature of the association between the two series. In contrast, inference from nonparametric methods is based on the Spearman Rank Correlation test, which does not necessarily require imposing any functional distribution to the data [Gibbons (1996)]. This test assesses whether the two series are dependent or alternatively not identically distributed.

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[8] This new series is based on a more refined methodology which adjusts the change in external debt to account for debt write-offs within the Enhanced HIPC initiative. In addition, this revised series is adjusted for underreporting of remittances. For further details on estimation, see Ndikumana and Boyce (2008).

[9] As a result of this discrepancy, capital flight is often recorded as errors and omissions in the Balance of Payments statistics [IMF (2006)].

[10] For instance, the 40 countries account for more than 96 percent of total stock of external debt owed by the region to the rest of the world. The sample selection is due to limited data. The few countries not sampled include: Equatorial Guinea, Eritrea, Gambia, Guinea Bissau, Liberia, Mayotte, Namibia and Somalia.

[11] However, there are sample variations across countries which result in an unbalanced design.

Naturally the "revolving door" or "round tripping" hypothesis will hardly stand any test of validity if the distributions underlying the movements of the two series are independent and identically distributed. In theory, the independence assumption would imply that the distribution underlying the movements of capital flight, let say in the Congo Republic, would be the same, irrespective of the country's debt profile, and the scale of capital flight unaffected by the distribution of external debt, including in the extreme case of complete absence of external liabilities.

Intuitively, such a strong independence assumption would be difficult to defend. One just needs to look at the conditional distribution of foreign reserves given the level of external debt in any small country that is highly vulnerable to terms of trade shocks and is a price-taker in the global market. In principle, the risks of balance-of-payments crises which are the primary motivations for external financing in the majority of low-income countries are less likely when a country is enjoying a strong and growing reserves position. For instance, if R_t and E_t represent the level of foreign reserves and external financing in a given year t, respectively, then the distribution of foreign reserves conditioned on external indebtedness under the independence assumption can be represented by:

$$\begin{aligned} f(R_t \mid E_t) &= \frac{f(R_t, E_t)}{f(E_t)} \\ &= \frac{f(R_t) * f(E_t)}{f(E_t)} \qquad (1) \\ &= f(R_t). \end{aligned}$$

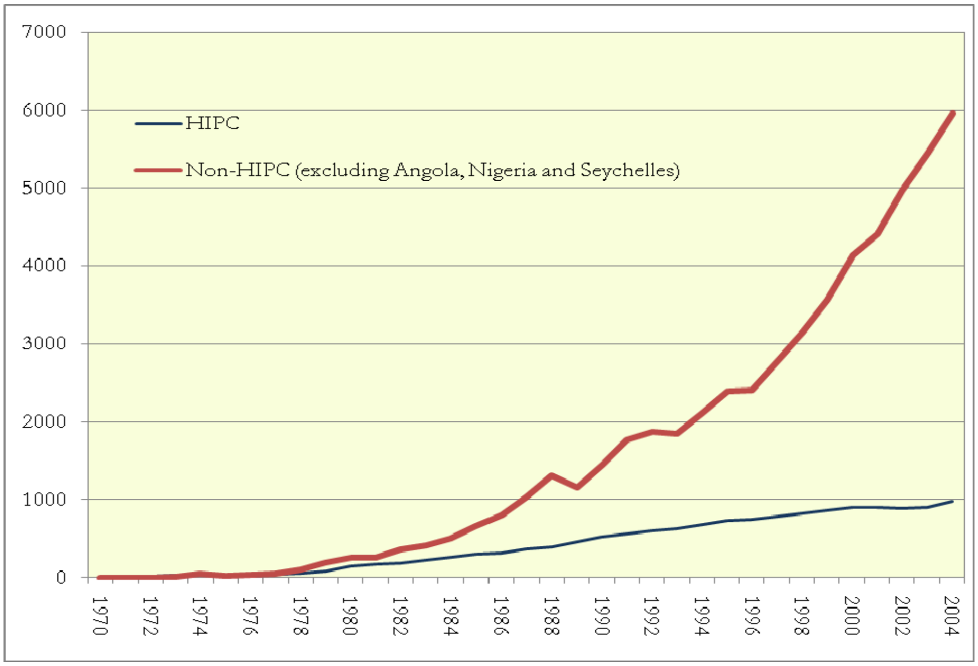
Equation (1) provides a functional representation under the independence assumption. Yet as a result of structural current account deficits and consistent with the symmetric argument—net international debt is the accumulation of current account deficit over time—countries which saw their foreign reserves base dwindle to a couple of months of imports often rely on external financing to maintain the minimum cushion required to secure the continuity of imports [Griffith-Jones (2007)].[12] Hence and consistent with economic theory, this symmetric argument may actually contradict the independence hypothesis on both empirical and theoretical grounds.

At the same time, the curve associated with the movements of capital flight followed a continuously rising trend, suggesting that private residents continue to increase their holding of foreign currency-denominated assets, just as the reserve base was shrinking. Interestingly, the rising trend of capital flight in a context of deteriorating reserve position is consistent in HIPC and non-HIPC countries, though it is more pronounced for the latter, particularly from the mid-1990s onward (see Figure 1).

In this regard, the sustainability of a minimum threshold of reserves depends on the accumulation of external debt, which increases the supply of foreign exchange needed to secure imports and holdings of foreign-currency denominated assets. In other words, though the functional representation of foreign reserves may depend on a host of factors, including productivity growth, exports competitiveness, real exchange rate alignment, it cannot be completely independent of external debt for small economies vulnerable to terms of trade shocks because these economies are generally undiversified and less competitive. This should further contradict the independence assumption.

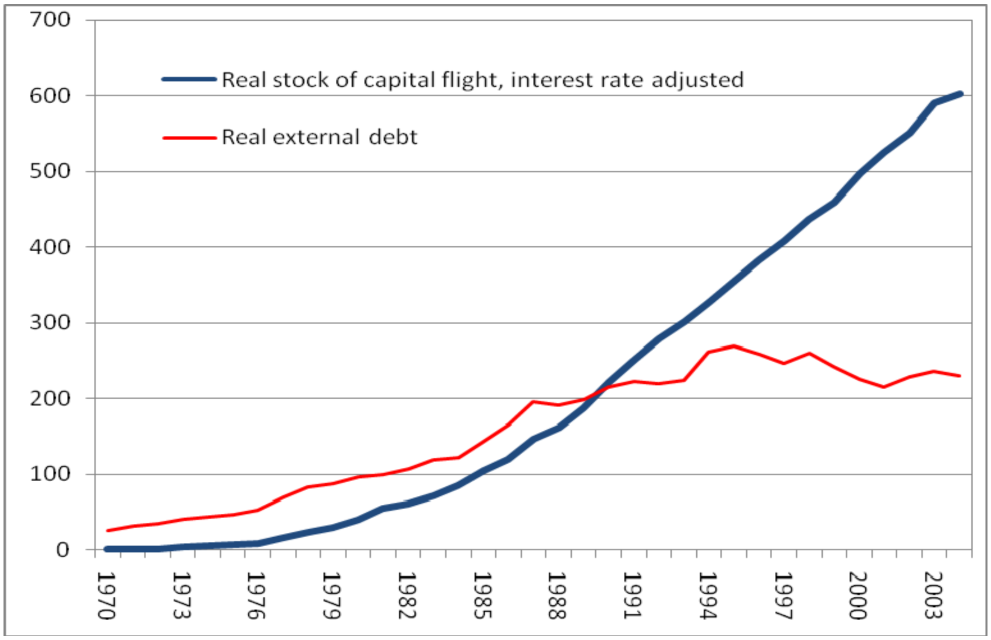
[12] In fact an empirical analysis shows that many countries saw their reserve base falls to less than 5 months of imports at the height of balance of payments crisis, which in principle should make it harder to increase the holding of foreign-currency denominated assets by private residents.

Figure 1: Stock of real capital flight per capita (in constant 2004 US dollar)



Sources: IMF, World Bank, Ndikumana and Boyce (2008).

Figure 2: Cumulative external debt stock and capital flight
(in billions of constant 2004 US dollar)



Sources: IMF, World Bank, Ndikumana and Boyce (2008).

Figure 2 plots the cumulative distribution of external debt (thick and solid line) and capital flight (thin and solid line) over their support. The two series are adjusted for interest payments and underreporting of remittances. In spite of the rapid accumulation of debt owed by countries in the region to the rest of the world, cumulative capital flight, though marginally smaller than external debt in the early 1970s, grew more rapidly and has been uniformly superior to the cumulative stock of debt, with the gap between the two distributions widening over time.

The acceleration of flight capital is reflected in the curve of the distribution associated with movements of capital outflows. It has the steepest slope and curvilinear shape. In fact, since the 1970s, the distribution of capital flight has grown unabated. Furthermore, the growth rate has remained strong and increased even more after the 1980s, despite the occurrence of negative spikes in a few countries (net inflows) and irrespective of the macroeconomic environment.[13]

In effect the flows distribution reveals the occurrence of spikes of negative outflows (net inflows of capital and repatriation) in the early 1980s and late 1990s.[14] However, these negative spikes did not affect the aggregate distribution of capital flight, as illustrated by Figure 2. Probably, the impressive and sustained growth could be due to compounded interest payments and to the fact that spikes of net inflows were confined to a limited number of years and countries. In fact, the reversal in flight capital was short-lived.

The unrelenting increase may therefore also reflect the return to accelerated growth rates in the late 1990s. In particular, capital flight estimates (in flow terms) between 1999 and 2004 are approximately US$90 billion (in constant 2004 prices), with US$36.2 billion recorded in 2003, the largest single annual outflow over the entire support of the distribution. An annual outflow of this magnitude suggests that capital flight remains a serious problem in the region and may undermine HIPC development effectiveness, particularly its potential for domestic resources mobilization in support of investments and economic growth.

These risks of undermining the development impact in countries which have reached the Completion Point under the HIPC Initiative are all the more important because when the distribution of capital flight is controlled for external debt, it shows a contrast between low-income and relatively high-income countries. At the lower end of the distribution, the countries with the lower debt ratios, which have relatively high per capita income, exhibit some of the lowest capital flight estimates. In fact flight capital is negative in a number of higher-income countries. At the same time the majority of countries with the highest scale of foreign liabilities are also saddled with a large scope of capital flight. This dichotomy at the continental level almost mirrors, and to certain extent generalizes the contrast between Botswana and the Congo Republic alluded to earlier. This contrast is illustrated by Figure 1 in the Annex.

This figure provides a scatter plot of external debt and capital flight for these countries. A liner regression line is fitted to the scatter plot, with capital flight on the $y-axis$, and external debt on the $x-axis$. The increasing slope of this line supports the positive association between capital flight and external debt, with the two series rising concurrently. Even though external debt and capital flight are expressed as a percentage of GDP for cross-countries comparisons, estimates of real capital

[13] For instance a close look at the distribution of the ratio of capital flight over external debt expressed in per capita terms shows a consistent increase since the 1970s, irrespective of the HIPC status. And the gap between the two distributions appears to be larger in the early 1980s and mid-1990s when countries embarked on the structural adjustment program, suggesting a deceleration in capital flight in low-income and HIPC countries.
[14] Interestingly, the spikes of negative outflows (capital repatriation) occurred in the early 1980s, during the initial phase of structural adjustment programs and in the late 1990s within the context of the HIPC Initiative. For further details, see Table 1 in the Annex.

flight are markedly above the regression line for the majority of low-income and severely indebted countries, suggesting that excess foreign liabilities is indeed correlated with higher rate of capital flight in these countries.

In particular, Zambia, which acceded to debt relief under the HIPC initiative in 2006, is almost an outlier. It has one of the highest capital flight-to-GDP ratios and one of the highest external debt-to-GDP ratios. Mozambique is another sampled country that mirrors Zambia, particularly on the scale of external debt. It has the highest ratio of external debt-to-GDP (over 170 percent). On the other hand, flight capital and external debt fall below the regression line for a number of countries which have lower debt ratios. In particular, Botswana which has the lowest debt ratio has interest rate adjusted real stock of capital flight estimates of about 50 per-cent of GDP. Interestingly, the few low-income countries which enjoy negative flight and repatriation (Benin and Senegal) also have low debt ratios and are leading recipient of remittances.[15]

More generally, the regression line fitted to the data under the linearity assumption points to a positive correlation between external debt and capital flight. The generalization of this apparent positive correlation between capital flight and external debt observed in the Congo Republic to a large number of countries in the region suggests a path-dependency. This dependency is further investigated by comparing empirical distributions underlying the movements of these two series using the Spearman Rank correlation analysis. The Spearman Rank correlation is a nonparametric test, which assumes that the data consists of n pairs of observations, $(x_1, y_1), (x_2, y_2), \cdots, (x_n, y_n)$, where the pairs x_i and y_i are measured on ordinal scale and represent capital flight and external debt, respectively. Let $h(\bullet)$ and $k(\bullet)$ be rank-ordering functions such that:

$h(x_i) = u_i$, with, $u_i \leq u_{i+1} \leq \cdots \leq u_n$ and $k(y_i) = v_i$, with, $v_i \leq v_{i+1} \leq \cdots \leq v_n$, then $(x_1, y_1), (x_2, y_2), \cdots, (x_n, y_n) \to (u_1, v_1), (u_2, v_2), \cdots, (u_n, v_n)$. Inference from the Spearman Rank Correlation coefficient is based on the following rank correlation statistics:

$$R = \frac{12\sum_{i=1}^{n}(u_i - \bar{u})(v_i - \bar{v})}{n(n^2 - 1)} \qquad (2)$$

This rank correlation is a descriptive statistic that reflects the degree of association between sample pairs of observations [Gibbons (1996)].[16] And to the extent that external debt and capital flight are considered two sides of the same coin in the proposed experimental design, this statistic can be used as the basis for testing the existence of a possible association between these two variables. It varies between $(-1 \leq R \leq 1)$. When there is no relationship between the variables, they are independent and the movement of one of the variables has no effect on the other. In this case the statistics takes the value $R = 0$.

On the other hand it takes a positive value when there is a direct association and a negative one when there is an inverse association. In the case of a perfect association, the statistic takes the

[15] In per capita terms, these countries have the largest amount of remittances flowing into Sub-Saharan Africa, and the net inflows of capital or repatriation by private residents may simply reflect the scale of remittances in these countries [Gupta, Pattillo and Wagh (2007)]].

[16] In theory and expressed in this form, this rank correlation statistics is exactly equal to the ordinary Pearson product-moment correlation coefficient in parametric statistics.

value $(|R|=1)$; and when $R=-1$ there is perfect disagreement. Perfect agreement occurs when $R=1$.[17] Perfect agreement means that large values of one variable are associated with large values of the other, and small values are likewise associated. For instance, under the present design excess capital flight would be associated with further accumulation of foreign liabilities either before in the debt-fueled capital flight scenario or after under the capital flight-fueled external debt assumption. Accordingly, this analysis can be applied to the data to test the null hypothesis of independence versus the one-sided alternative of direct association $(R>0)$. Formally these two hypotheses can be represented by:

$$H_0 : \text{No association (independence between external debt and capital flight)}$$
$$H_+ : \text{Direct association.}$$

The choice of the one-sided alternative of direct association is motivated by empirical investigation which suggests the existence of a positive association between these two variables. In particular, investigating the nature of the association between external debt and capital flight in the Philippines, Boyce (1992) find a positive association between net disbursement and capital flight, with a correlation coefficient in the order of magnitude of 0.70. Similarly the association between capital flight and external debt is positive in Sub-Saharan Africa, with an estimated rank correlation coefficient statistics of $R=0.9645$.

A value of R this large calls for the rejection of the null hypothesis of independence in favor of the alternative direct type of association between capital flight and external debt. This result is further supported by the right-tail probability value of the statistics. In particular, the *p-value* in the right tail is less than 0.002, suggesting significance at the 1 percent level. In other words large values of capital flight are associated with large external debt; and smaller values of capital flight are associated with lower external debt in the sub-sample of countries. The next section provides an overview of the methodology used to investigate the causal relationship between the two variables.

III. Methodology and Estimation

Let the time series K_t and D_t represent the stock of capital flight and external debt, respectively. The series K_t is said to Granger-cause D_t if the inclusion of lagged values of K_t in the conditioned information set, which has lagged values of D_t results in a statistically significantly better prediction of D_t [Granger (1969)]. A priori, there is no reason to go against the underlined hypothesis of dual causal relationship. Existing studies have found that, on one hand, capital flight either drives or fuels external borrowing (flight-driven and flight-fueled external borrowing); while on the other, external borrowing either drives or fuels capital flight (debt-driven and debt-fueled flight).[18] Under this assumption, short-run causality between capital flight and external debt can be assessed by running a two-way causality test on the two series.

[17] Such association might be called direct because the variables are moving in the same direction. In an inverse relationship, the variables move in opposite directions—large values of one variable are associated with small values of the other, approaching perfect disagreement.

[18] Debt-driven capital flight refers to a situation where excess external borrowing motivates the intent of private residents to shift their own capital abroad to escape confiscation risks, inflation tax or outright depreciation in case of currency devaluation. Debt-fueled capital flight refers to a situation when borrowed funds are directly transferred abroad. Under this scenario, external debt provides the resources and motivations for capital flight. Capital flight-driven external borrowing refers to a situation when continued outflow of funds

There are many reasons why the hypothesized dual causal relationship may hold in Sub-Saharan Africa. After all, the shortage of foreign reserves in the majority of undiversified commodity-dependent economies facing chronic balance-of-payments crises in the region is such that countries have had to continuously rely on external borrowings, in the form of official development assistance or private capital inflows, to secure access to foreign reserves. In turn this mode of deficit financing may enhance the acquisition of foreign-currency denominated assets via the capital flight channel, resulting in debt-fueled capital flight.

At the same time, unceasing capital outflows from Sub-Saharan Africa may entertain current account deficits, and hence lock countries in the vicious circle of continued recourse to external indebtedness to bridge the ever growing financing gaps—the flight-driven external borrowing. Meanwhile the revolving door may also be self-contained in a uni-dimensional setting, especially in a context of unproductive public investments and when the growing cost of external debt services increases the demand for foreign exchange.

Additionally, the causal relationship between capital flight and external debt may be reinforced by the asymmetric response of foreign creditors and private domestic agents to country risk. While the majority of foreign creditors extending loans to developing countries benefits from an implicit insurance coverage provided by government guarantee of automatic payment in case of default under the sovereign state doctrine of "*governments do not go bankrupt*", private domestic agents in debt-saddled nations confronted with current account and fiscal deficits do not enjoy the same protection, even for licitly acquired assets. In fact economic agents in severely indebted countries face inflation tax, confiscation risk and real depreciation of domestic assets particularly when outright devaluation of a local currency is contemplated to mitigate external disequilibrium.[19]

Furthermore, the implicit insurance coverage extended to external creditors may nurture the culture of moral hazard at the global level, especially when access to foreign reserves is systematically secured from international financial institutions by countries running large balance-of-payments deficits [Lane and Phillips (2000)]. Overtime the sovereign state doctrine and the systematic coverage provided under the international financial architecture have reduced incentives for foreign creditors and borrowing countries to take preventive measures against debt overhang. Ultimately, this option has only reinforced the sustainability of the debt-driven capital flight hypothesis.

However, the asymmetric response of domestic and foreign creditors to country risks is likely to remain strong even outside the umbrella of the international financial architecture. Threats in the form of trade sanctions and ineligibility to foreign assistance are a powerful deterrent for countries which may be contemplating a default on their external commitments [Jayachandran and Kremer (2006)]. This asymmetry in the treatment of foreign and domestic creditors has been reflected in the accumulation of arrears to domestic suppliers by governments in the majority of countries in the region while remaining current on their external commitments, in spite of the direct economic and welfare costs of the former [Christensen (2005)].[20]

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creates a financing gap bridged through external financing. Finally flight-fueled external borrowing refers to a situation in which domestic residents' exported capital is borrowed back under the round tripping hypothesis.

[19] Over the years, devaluation has been at the core of stabilization programs implemented in low-income countries. In particular, the preference of this policy scheme has been largely motivated by its underlined effectiveness in reducing domestic expenditures and changing the composition of expenditures between foreign and domestic goods, as part of expenditure-switching and reducing measures [Rodrik (2006)].

[20] In particular, domestic arrears have direct impact on output growth and domestic production. They also crowd out private sector lending when domestic debt becomes excessive.

More recently however, the concept of odious debt has been articulated in the economic literature to correct this asymmetry and align foreign liabilities with net benefits accruing to recipient countries. In the meantime, the asymmetric response of foreign creditors and private domestic agents to country risks, and the systematic bias in the treatment of creditors by developing countries' governments have strengthened and even sustained the hypothesized dual causality between capital flight and external debt, warranting further investigation of a possible long-run relationship.

In what follows we outline a four-step approach to investigate that relationship using cointegration techniques— modified standard Granger causality test. In the first stage, we apply the standard Granger causality test, which is designed to analyze bivariate weakly stationary stochastic processes to the joint distribution of capital flight and external debt.[21] This test can be formally represented by the following vector autoregressive (VAR) system:

$$K_t = \sum_{i=1}^{m1} \alpha_{1i} K_{t-i} + \sum_{i=1}^{m2} \alpha_{2i} D_{t-i} + \varepsilon_{1t} \qquad (3)$$

$$D_t = \sum_{i=1}^{n1} \beta_{1i} K_{t-i} + \sum_{i=1}^{n2} \beta_{2i} D_{t-i} + \varepsilon_{2t} \qquad (4)$$

If there is only a one-way causality, let say, K_t (capital flight) Granger-causes D_t (external debt), but not vice versa, then all coefficients β_{2i} should be statistically significantly different from zero and there should be at least one coefficient α_{2i} which is statistically significantly different from zero. Although capital flight may be motivated by other factors—such as interest rates differentials, quality of governance, institutions and development of the financial market—the proposed bivariate model focuses exclusively on capital flight and external debt relationships, and does not account for these factors. However, the significance of these factors is likely to vary across countries; and it is expected that the white noise error term in the above equation would capture the variation of capital flight (external debt) that is not fully explained by changes in external debt (capital flight).

Despite the interest and various applications of this test, its suitability is limited when a time series has unit root because the transformation to stationarity by mean of a difference filter may alter the nature of the long-run relationship that is of interest [Agénor and Taylor (1993)]. In particular, the hysterisis in capital flight illustrated by persistent increases in capital outflows even in the face of improved macroeconomic environment— reduction of fiscal deficits and macroeconomic volatility— may suggest a long-run relationship and stability of the hypothesized dual causality.

In the second stage, we apply a unit root test to the data under the null hypothesis of stationarity around a deterministic trend against the alternative unit root. We use the Phillips-Perron nonparametric test, which accommodates models with a fitted drift and a time trend to discriminate between unit root nonstationarity and stationarity about a deterministic trend. The test is applied to the two series across the 40 countries. Table 1 summarizes the results, highlighting cases where no cointegartion relationship exists between real external debt (RED) and real capital flight (RKF).[22] In particular, when the unit root test is applied to the capital flight series, stationarity is present in only one country. However, when it is applied to the external debt series, stationarity is detected in three countries.

[21] Note that the Granger causality test tends to be the most appropriate and robust test in a two-dimensional setting when the underlying data follows a bivariate distribution.
[22] See Table 2 in the Annex for complete results.

Table 1: Phillips-Perron Unit Root Test and Cointegration Test Applied to External Debt and Capital Flight

	Unit Root Test		Johansen Cointegration Test
	RED	RSKF	At least one cointegration relation exists
Angola	I(1)+trend	I(1)+trend	Yes
Benin	I(1)+drift	I(0)+trend	No
Botswana	I(1)+drift	I(0)	No
Burkina Faso	I(1)+drift	I(1)+drift	Yes
Burundi	I(1)	I(1)	Yes
Cameroon	I(1)	I(1)	Yes
Cape Verde	I(1)	I(1)	Yes
Central African Republic	I(1)+trend	I(1)+trend	Yes
Chad	I(1)	I(1)	Yes
Comoros	I(1)+drift	I(0)	No
Congo, Dem. Rep.	I(1)	I(1)	Yes
Congo, Rep.	I(1)+drift	I(1)+drift	Yes
Cote d'Ivoire	I(1)	I(1)	Yes
Ethiopia	I(1)+trend	I(1)+trend	Yes
Gabon	I(1)	I(1)	Yes
Ghana	I(1)+drift	I(1)+drift	Yes
Guinea	I(1)+trend	I(1)+trend	Yes
Kenya	I(1)+trend	I(1)+trend	Yes
Lesotho	I(1)	I(1)	Yes
Madagascar	I(1)	I(1)	Yes
Malawi	I(1)+drift	I(1)+drift	Yes
Mali	I(1)+drift	I(0)	No
Mauritania	I(1)	I(1)	Yes
Mauritius	I(0)+trend	I(1)+drift	No
Mozambique	I(0)+drift	I(1)	No
Niger	I(0)+drift	I(1)	No
Nigeria	I(1)+drift	I(1)+drift	Yes
Rwanda	I(1)	I(1)	Yes
Sao Tome and Principe	I(0)+trend	I(1)+drift	No
Senegal	I(1)	I(1)	Yes
Seychelles	I(1)	I(1)	Yes
Sierra Leone	I(1)+drift	I(1)+drift	Yes
South Africa	I(1)+trend	I(1)+trend	Yes
Sudan	I(1)+drift	I(1)+drift	Yes
Swaziland	I(0)+trend	I(1)	No
Tanzania	I(1)	I(1)	Yes
Togo	I(1)+drift	I(1)+drift	Yes
Uganda	I(1)+trend	I(1)+trend	Yes
Zambia	I(1)+drift	I(1)+drift	Yes
Zimbabwe	I(1)+trend	I(1)+trend	Yes

Source: Author's calculations.

The presence of the unit root calls for the implementation of a non-stationary time series analysis. The co-integration theory provides the alternative to the standard Granger-causality test in the presence of a non-stationary time series. Co-integration is therefore applied to the data in the third step [Engle and Granger (1987)]. Let $I(0)$ be a time series integrated of order zero, and $I(1)$, a time series requiring first order differencing to achieve stationarity. In general, any linear combination of $I(1)$ series will also be $I(1)$. However, if a linear combination of two series is also $I(0)$, then the series are co-integrated. In other words, if x_1 and x_2 are each $I(1)$ and the co-integrating equation represented by the sequence $z_t = x_{1t} - \alpha x_{2t}$, is $I(0)$, then x_1 and x_2 are said to be co-integrated; and the co-integration parameter is unique when it exists.[23]

The co-integration technique also provides a useful statistical definition of long-run equilibrium underpinning the movements of two non-stationary time series.[24] In particular when the linear combination of x_1 and x_2 is a stationary stochastic process, the two variables are said to be in a 'state of statistical equilibrium'. On the other hand, when this condition is not met, the two series do not display any tendency towards direct co-movement, whereby large values of capital flight are likewise associated with large increase in external debt. However, if the tendency towards co-movement persists in the long run, then the series should be co-integrated with the co-integrating parameter $\alpha = 1$.

In principle, when this condition is satisfied, short-run divergences tend to be eliminated by equilibrating forces, and the long-run tend towards co-movement is unaffected. For instance, the occurrence of spikes of negative capital flight under concurrent increase in external debt will not affect the long-run causal relationship between the two series. In addition to testing for stationarity, the Phillips-Perron unit root test also provides information on the co-integrating nature of movements underlying the distributions of time series. This procedure is complemented by the Johansen test (last column of Table 1).

Highlighted countries indicate non existence of a co-integration relationship. Consistent with the Phillip-Perron procedure, the Johansen test rejects the null hypothesis of non-co-integration relationship between the two series in 9 countries, further supporting the alternative existence of a co-integration relation in 31 countries. The co-integration relationship in the larger sub-sample implies that past values of external debt (capital flight) affect changes in capital flight (external debt). For countries falling in this category, the null hypothesis is easily rejected at the 5 percent level of significance in favor of the alternative co-integrating relationship.

The presence of a co-integration relationship in a large number of countries supports the hypothesized causal relationship between capital flight and external debt. However, the non-stationary nature of these time series calls for the inclusion of error correction term to the standard Granger causality test [Engle and Granger (1987)]. This correction is implemented in the last stage in the procedure. Consider a vector of observations on $nI(1)$ time series, X_t, which are co-integrated with co-integrating vector α, i.e. $\alpha' X_t \approx I(0)$. Then, according to the Granger representation theorem, there exists an error-correction representation of the form[25]:

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[23] The uniqueness of this parameter is guaranteed only in the bivariate case. According to Engle and Granger (1987), there may exist up to n-1 distinct co-integration combinations among the set of n variables.

[24] Though, Toda and Phillips (1994) have found that Granger causality tests in error correction models suffer from nuisance parameter dependencies asymptotically and, in some cases nonstandard limit theory.

[25] Equation (5) provides an error correction representation of the standard Granger representation theorem, where $\alpha' X_{t-1} = Z_{t-1}$ is a $r \times 1$ vector of stationary random variables.

$$A(L)\Delta X_t = -\gamma\alpha' X_{t-1} + \beta(L)\varepsilon_t \qquad (5)$$

where $A(L)$ is a matrix polynomial in the lag operator L with $A(0) = I_n$, γ is a $n \times 1$ non-null vector of constants, $\beta(L)$ is a scalar polynomial in L and ε_t is a vector of white-noise disturbance terms. The long-run equilibrium solution to equation (5) is $\alpha' X = 0$. In the short run, deviations from the equilibrium will feedback on the changes in X_t in order to force the convergence towards the equilibrium. If an element of the X vector is being driven directly by the equilibrium error, then it is responding to feedbacks. However, if the nth element of γ is zero, then the nth element of X_t is responding only to short-term shocks generated by the stochastic environment. Thus error-correction augmented vector autoregression estimates allow a distinction between short-run and long-run causality.

When co-integration is detected, inference from Granger causality is based on equations (6) and (7), which are a modified version of the standard test.

$$\Delta K_t = \kappa_1 + \gamma_1(K_{t-1} - \alpha D_{t-1}) + \sum_{i=1}^{n} \lambda_i \Delta K_{t-i} + \sum_{i=1}^{n} \beta_i \Delta D_{t-i} + \mu_t \qquad (6)$$

$$\Delta D_t = \kappa_2 + \gamma_2(K_{t-1} - \alpha D_{t-1}) + \sum_{i=1}^{n} \vartheta_i \Delta K_{t-i} + \sum_{i=1}^{n} \delta_i \Delta D_{t-i} + \upsilon_t \qquad (7)$$

Equation (6) tests the causality from external debt to capital flight, while equation (7) tests the causality from capital flight to external debt. However, when a co-integration relation cannot be detected, the standard Granger causality test applies and there is no need for error-correction. In this context, the co-integrating equation is not included in the estimation set and $(\gamma_1 = \gamma_2 = 0)$. Still, estimating the parameters in equation (6) and (7) is facilitated by a prior knowledge of the optimum lag order in the VAR model. This optimum lag length of vector autoregression system is determined by minimizing the Akeike Information Criterion (AIC) [Akaike (1969)].[26]

The results of the Akeike test procedure are reported in Table 3 in the Annex. The estimated number of lags is relatively low for a large number of countries under this criterion. This suggests a rather strong positive association between external debt and capital flight whereby time lag between inflow and outflow of funds is short, further supporting the debt-fueled capital flight hypothesis under revolving door models [Ajayi (1997), Ndikumana and Boyce (2003)]. Interestingly enough, the optimum lag takes on the value of 1 for the leading capital flight candidates in the sub-region (Angola, Democratic Republic of Congo, Cote d'Ivoire and Nigeria).

IV. Empirical Results and Policy Implications

In theory, when the series K_t and D_t are co-integrated, the co-integrating term $Z_t = K_{t-1} - \alpha D_{t-1}$ is stationary. The inclusion of this term in equation (6) and (7) differentiates the error correction

[26] Though initially used in the context of estimating the optimum number of lags in vector autoregressive models, applications of the Akaike's Information Criterion has been extended to the selection of regression models and to the estimation of the optimum number of components in a mixture density model for the simulated power data.

model from the standard Granger-causality. Under this modified alternative lagged values of D_t may help explain changes in K_t better, even if past changes in D_t $(D_{t-i}, \forall i \geq 1)$, do not. The choice of this alternative is motivated by the fact that the observed causality between the two series may be driven by trend uniformity in the two distributions. In principle, the probability of no causality should converge to zero when the underlying variables have a common trend.

The scope of policy options increases under this alternative. In particular, the inclusion of the error correction term in the model expands the range of tests, from the two-by-two dual causality to a wider range of options.[27] These tests account for the error correction term when capital flight is the dependent variable, and alternatively when external debt is the dependent variable and capital flight is part of the right hand side variables in the model. Inference is also based on joint effects, when assessing the combined effects of error correction and external debt on capital flight on one hand, and the effects of error correction and capital flight on external debt, on the other. In each case, inference is based on the F-statistics, which is estimated by comparing the residual sum of squares under the unrestricted model with the residual sum of squares under the restricted one $(\gamma_1 = \beta_i = 0)$ and $(\gamma_2 = \vartheta_i = 0)$.[28]

However, in the absence of a co-integrating relationship, the standard Granger causality test applies. Nine countries fall under this category. The results of the standard Granger causality analysis applied to these countries are provided in Table 4 in the Annex. They reveal the existence of a dual causal relationship between capital flight and external debt in two countries. In particular the F-test easily rejects the null hypothesis that external debt (capital flight) does not Granger cause capital flight (external debt) in these countries. The F-test results are shown in the first row followed by tails probability estimates (*p-values*) right below.

The test is repeated up to the maximum number of 5 lags for each country. In Mauritius, the null hypothesis is rejected at the 1 percent level of significance in the fourth lag when the causality runs from capital flight to external debt. The results and direction of causality are consistent in subsequent lags. Similarly, the null hypothesis is rejected at the 10 percent level of significance when the causality runs from external debt to capital flight, suggesting the existence of dual causality between capital flight and external debt. Interestingly, these empirical results are consistent with the hypothesized dual causal relationship [Ajayi (1997), Ndikumana and Boyce (2003)].

However, in a number of countries, empirical tests either suggest a unidirectional causality or fail to reject the null hypothesis of non-causal relationship. For instance the causality runs exclusively from external debt to capital flight in both Mali and Niger. Under this uni-directional alternative, the null hypothesis is rejected at the 10 and 5 percent level of significance in Mali and Niger, respectively, further suggesting that external debt Granger causes capital flight. Moreover, the relatively low lagged order points to short-run responses of capital flight following accumulation of foreign liabilities. This response rate is consistent with the debt-fueled capital flight hypothesis, whereby inflow of resources

[27] The initial set of options for inferring on the nature of the relationship between external debt and capital flight would include the case where external debt Granger cause capital flight or fails to do so; and the reverse case where capital flight Granger causes external debt or fails to do so.

[28] In general, the F-statistics is derived from the Wald procedure using the following formulation: $F_{hnc} = \dfrac{(RSS_2 - RSS_1)/(Np)}{RSS_1[SN - N(1+p) - p]}$, where SN denotes the total number of observations, RSS_2 denotes the restricted sum of squared residuals obtained under the null hypothesis, and RSS_1 is the unrestricted sum of squared residuals.

in the form of external debt provides the reserves and motivations for capital flight [Boyce and Ndikumana (2003)].[29]

The error correction model is applied to the remaining nonstationary time series. This model accounts for dual causality and for the deviation from the equilibrium. More specifically, changes in the capital flight series K_t from the previous period consist of changes associated with movements of external debt D_t along the long-run equilibrium path plus the part that is due to deviation from the long-run equilibrium [Engle and Granger (1987)]. Inferences from this alternative model are based on the different hypotheses summarized in Table 2. While hypotheses testing in the first row refers to the case where causality runs from external debt to capital flight (equation (6)), test specifications in the second row refer to the reverse case when the causality runs from capital flight to external debt.[30]

Table 2: Summary of hypothesis tested

Based on Equations (6) and (7)		
$ECT \overset{?}{\rightarrow} \Delta K$ $H_0 : \gamma_1 = 0$ $H_1 : \gamma_1 \neq 0$	$\Delta D \overset{?}{\rightarrow} \Delta K$ $H_0 : \beta_i = 0$ $H_1 : \beta_i \neq 0$ for all i = 1 to n	$ECTand\Delta D \overset{?}{\rightarrow} \Delta K$ $H_0 : \gamma_1 = \beta_i = 0$ $H_1 : \gamma_1 \neq \beta_i \neq 0$ for all i = 1 to n
$ECT \overset{?}{\rightarrow} \Delta D$ $H_0 : \gamma_2 = 0$ $H_1 : \gamma_2 \neq 0$	$\Delta K \overset{?}{\rightarrow} \Delta D$ $H_0 : \vartheta_i = 0$ $H_1 : \vartheta_i \neq 0$ for all i = 1 to n	$ECTand\Delta K \overset{?}{\rightarrow} \Delta D$ $H_0 : \gamma_2 = \vartheta_i = 0$ $H_1 : \gamma_2 \neq \vartheta_i \neq 0$ for all i = 1 to n

The first test (top and left quadrant) infers on the implications of the error correction term on capital flight; the second test (first row and second column) infers on the implications of external debt for capital flight; while the third test (first row and third column) focuses on the joint effect of error correction and changes in external debt on capital flight. Tests in the second row follow the same logic except that external debt is used as the response variable and inference is based on factors that Granger causes external debt to change over time. The results of these tests are summarized in Table 3. More detailed results with estimated F-statistics and *p-values* are provided in Table 5 in the Annex.

[29] According to estimates derived by Ndikumana and Boyce (2008), approximately 60 cents of every dollar accruing to the Africa in the form of external borrowing in the period 1970-2004 left the continent the same year.

[30] In the past most studies investigating the nature of the association of between capital flight and external debt have drawn on standard regression techniques whereby external debt (capital flight) are alternatively used as regressors in a set of right-hand side variables to identify the determinants of capital flight (external debt) in developing countries. For instance, Lensink, Hermes and Murinde (1998) single out external debt as one of the key determinants of capital flight in Sub-Saharan Africa. Similarly, Pastor (1990) and Mikkelsen (1991) found external debt to be a significant determinant of capital flight in Latin America.

Table 3: Error Correction Granger Causality Test Summary Results

	ECT → Δk	Δd → Δk	Δd and ECT → Δk	ECT → Δd	Δk → Δd	Δk and ECT → Δd
Angola	No	No	No	No	No	No
Benin	---	No	---	---	No	---
Botswana	---	No	---	---	Yes	---
Burkina Faso	No	No	No	No	No	No
Burundi	Yes	Yes	Yes	No	No	No
Cameroon	No	No	No	No	No	No
Cape Verde	No	No	No	No	No	No
Central African Republic	Yes	Yes	Yes	No	No	No
Chad	No	Yes	Yes	Yes	Yes	Yes
Comoros	---	No	---	---	No	---
Congo, Dem. Rep.	No	No	No	No	No	No
Congo, Rep.	Yes	No	Yes	No	No	No
Cote d'Ivoire	Yes	No	Yes	No	No	Yes
Ethiopia	No	No	Yes	Yes	Yes	Yes
Gabon	Yes	No	Yes	No	Yes	Yes
Ghana	Yes	No	No	No	No	No
Guinea	No	No	No	No	No	Yes
Kenya	No	No	No	No	No	No
Lesotho	Yes	No	Yes	Yes	Yes	Yes
Madagascar	Yes	Yes	Yes	No	Yes	Yes
Malawi	No	No	No	No	No	No
Mali	---	No	---	---	No	---
Mauritania	No	No	No	No	No	Yes
Mauritius	---	No	---	---	Yes	---
Mozambique	---	No	---	---	No	---
Niger	---	Yes	---	---	No	---
Nigeria	Yes	No	Yes	No	No	No
Rwanda	No	No	No	No	No	No
Sao Tome and Principe	---	No	---	---	No	---
Senegal	Yes	No	No	No	No	Yes
Seychelles	No	No	No	No	No	No
Sierra Leone	Yes	Yes	Yes	No	No	No
South Africa	Yes	Yes	Yes	No	No	No
Sudan	No	Yes	Yes	Yes	No	Yes
Swaziland	---	No	---	---	Yes	---
Tanzania	Yes	No	Yes	Yes	No	Yes
Togo	No	No	No	Yes	Yes	Yes
Uganda	No	No	No	No	No	No
Zambia	No	Yes	Yes	No	No	No
Zimbabwe	No	No	No	No	Yes	Yes

Source: Author's calculations.

The results support the existence of a uni-directional causality between external debt and capital flight. Uni-directional causality is present in 9 countries to which the error correction model is applied. The results are robust under the restricted model when the null hypothesis is considered with $\beta_i = 0$. The null hypothesis that external debt does not Granger cause capital flight is rejected in the majority of countries in favor of the alternative which supports the existence of uni-directional causality running from external debt to capital flight. For most countries where causality is present the F-statistics is relatively large and the null hypothesis is easily rejected at the 10 percent level of significance or lower.

Additionally, the consistently positive sign of the coefficient associated with changes in external debt in the error correction model, even in countries where the null hypothesis fails to be rejected, further supports the existence of a direct association between external debt and capital flight. In fact the positive association detected from empirical analysis is sustained under the Granger causality test, suggesting that increases in external debt tend to contribute to capital flight acceleration. The signs of the coefficient associated with the error-correction term are also consistently positive and the null hypothesis of non-causality is rejected in the majority of countries.

Likewise the null hypothesis of a non-causal relationship between external debt and capital flight is rejected when the joint effect is investigated (intersection of first row and third column in Table 2). Under the joint-effect, the null hypothesis assumes that neither the error correction terms, nor the changes in external debt affect the distribution of capital flight. This hypothesis is also rejected in the majority of cases (15 countries) at the 10 percent level of significance or lower. Moreover the signs of the coefficient associated with the joint effect are invariably positive. These results are consistent with inference from the marginal distribution, when the coefficients associated with error correction terms and external debt turn out to be highly significant.

The unidirectional causality, whereby external debt Granger causes capital flight in the majority of countries highlights the lead of external debt over capital flight in Sub-Saharan Africa. In the past, this lead has equally been supported empirically. In particular, Lensink, Hermes and Murinde (1998) found external debt to be a significant determinant of capital flight when a standard regression analysis was applied to a subset of pooled data selected from the region. Under this lead, external debt tends to either drive or fuel capital flight in the region. Hence external debt may emerge as the heads driving the tails in the co-integrating relationship captured by the two faces of the same coin analogy alluded to earlier in the introductory section.[31]

The significance of the error correction term under different modeling specifications, particularly when the causality runs from external debt to capital flight points to the existence of a long-run causal relationship between the two series. For the majority of countries, the null hypothesis is easily rejected at the 5 percent level of significance, implying that external debt does indeed Granger causes capital flight. Note that the error correction term allows the long-run components of co-integrating variables to obey equilibrium constraints under the alternative to the standard Granger causality [Engle and Granger (1987)]. The significance of the error correction term therefore implies that disequilibrium from co-movements tend to be corrected in sub-sequent periods.

Similarly, the significance of the causality test holds when the modified Granger causality test with error correction runs from capital flight to external debt. The different hypothesis tests underlying this reverse causality are summarized in the last row of Table 2. Of particular interest are inferences of error correction term on capital flight. Under this reverse causality, the null hypothesis that capital flight does not Granger cause external debt is rejected in ten countries. Interestingly the power of the test is relatively large, and the null hypothesis is rejected at the 10 per cent level of significance or lower in numerous countries (see Table 5 in the Annex).

However, there is some improvement when the restricted model is adjusted to include the error correction term. Under this adjustment, capita flight grander causes external debt in a large number of countries. In the remaining countries where the error correction term is not significant, the co-

[31] Ndikumana and Boyce (2002) provide a good summary and overview of various studies investigating the determinants of capital flight across the developing world using regression analysis. In addition to external debt, other significant determinants of capital flight include: macroeconomic environment, fiscal policy, risks and returns to investments, financial depth and political and governance variables.

integrated structure of the two variables suggests that external debt may be weakly exogenous. In particular, the signs of the coefficients associated with the right-hand side variables (error correction terms and capital flight) are all positive, further supporting the positive association, whereby increases in capital flight might be associated with or followed by a correlative increase in external debt and vice versa.

These empirical results notwithstanding, causality does not necessarily imply a one-to-one correspondence between external debt and capital flight, however; a scenario which may single out foreign aid as the exclusive conduit for capital flight and implicitly assumes that the latter might have motivated the recourse to external financing in the first place. In practice the accumulation of foreign liabilities originated from the recurrence of balance-of-payments crises following succession of negative terms of trade shocks in commodity-dependent economies. Moreover, the excess of flight capital over external debt in a large number of countries suggests that the pool fueling the former may surpass the foreign liabilities landscape to include country's own resources, raising concerns related to governance and accountability in the uses of public resources.[32]

Intriguing still is the dramatic increase of foreign liabilities which have resulted in debt overhang, with tremendous economic and welfare costs, in the face of excess flight capital [Elbadawi et al. (1997), Pattillo et al. (2004)].[33] In particular, the cycle of external indebtedness stifled economic growth without necessarily mitigating the exposure to negative shocks. Over time, the recurrence of negative terms of trade shocks locked the majority of countries in an infinite loop of foreign indebtedness. Additionally and by the established causality, the inherent vicious circle of external indebtedness fueled capital flight which further compounded the problem, dwarfing the limited resources from already capital-scarce countries. In fine, most of these countries found themselves caught in the debt poverty trap [Easterly (2002), Artadi and Sala-i-Martin (2003), Fofack (2007)].[34]

Reflecting the prohibitive costs of debt overhang, the HIPC initiative was launched in 1996, and has since lowered the stock of external debt and debt service payments in a number of countries. Nevertheless, while accession to debt relief may broaden the government fiscal space, stemming and even reversing capital flight to effect massive investments under the 'Big Push' model may be essential to achieving export diversification and increasing fiscal revenue while at the same time raising the HIPC overall effectiveness [Dornbusch (1991), Fofack and Ndikumana (2009)].[35]

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[32] Indeed the countries recording the largest outflows of capital (Angola, Cameroon, Democratic Republic of Congo, Congo Republic, Cote d'Ivoire, Ethiopia, and Nigeria) have also topped the global ranking of corruption and good governance published annually by Transparency International [Sala-i-Martin and Subramanian (2003)].

[33] In particular, Elbadawi, Ndulu and Ndung'u (1997) provide a good overview of implications of debt overhang for economic growth in Sub-Saharan Africa.

[34] The macroeconomic and welfare costs of capital flight for low-income countries are significant, and have been documented extensively [Pastor (1990), Dooley and Kletzer (1994), Ajayi (1997), Ndikumana and Boyce (2003)]. In the short run, massive capital outflows are likely to undermine growth when private capital formation are delayed or simply hindered as a result of drainage of national savings. In the medium to long term, delayed expansion of gross capital formation and investment may cause the tax base to remain narrow, and even shrink in a context of assets decumulation, and ultimately undermine public investments which are complement or/and catalyst for private capital formation [Agénor et al. (2003)]. Naturally and to the extent that capital flight may encourage external borrowings, debt service payments will increase and further compromise public investment. Furthermore, capital flight may have adverse distributional consequences on the overwhelming majority of poor in low-income countries in that it heightened income inequality.

[35] In fact, a latest UN report concluded that capital flight was undermining growth and economic development prospects, and called upon African governments to consider a temporary amnesty to allow capital to be repatriated in support of investment and economic growth.

Already, reviews of HIPC are highlighting a rapid deterioration of external debt indicators in a growing number of post-completion point countries [Sun (2004), World Bank (2006)].[36] In this regard, the established causality between capital flight and external debt may strengthen ongoing efforts to increase domestic resource mobilization and savings in support of investment and growth, and enhance the long-run sustainability of HIPC threshold indicators.

V. Conclusion:

In the face of long-run and persistent co-movements of capital flight and external debt, which both increased dramatically in Sub-Saharan Africa, this paper investigates the covariation and nature of the association between the two series, using nonparametric methods and Granger causality error correction models. The dramatic increase of these two series had significant implications for investments and growth in the region. In particular, they have been accompanied by sustained periods of economic downturns characterized by decumulation of capital stock and balance of payment crisis. Ultimately, they propelled numerous countries into a debt crisis in the 1990s, with many of them seeking eligibility to the HIPC initiative when their external debt became unsustainable.

The focus on a causal relationship between these two series undertaken by this study could shed some light on the causes and origins of capital flight and avert another cycle of external indebtedness in countries which reached the completion point under the HIPC initiative. Indeed, the study spans a period of more than three decades and covers a relatively large sample of countries, including HIPC and non-HIPC countries. It is based on the most recent data on capital flight, and hence allows extension of the analysis to the HIPC completion point era, when a number of severely indebted countries acceded to debt relief.

This framework also assesses the nature and the existence of a possible long-run relationship between the two series. This assessment is undertaken by first applying the Spearman Rank Correlation test to the data. The application of this test to the bivariate time series reveals the existence of a direct positive association between capital flight and external debt. The nonparametric rank correlation test rejects the null hypothesis that the distributions underlying the movements of the two series are independent and identically distributed, in favor of the alternative direct positive association. Under this alternative, the underlined co-movement of the two series is consistent with inference from revolving door models, especially to the extent that debt-driven or fueled capital fight or alternatively flight-driven or fueled external indebtedness require that the two series have a common trend.

At the same time, revolving door models implicitly assumed the existence of causality and possibly dual causality. This assumption is tested using Granger causality error correction models as the Phillips-Perron Unit Root test reveals the presence of a co-integrating relationship in the distributions of external debt and capital flight in the majority of countries. While the null hypothesis of non-causal relationship is rejected, the error correction Granger causality test overwhelmingly

[36] A review by the World Bank Independent Evaluation Group conducted in 2006, found that the key indicators of external debt sustainability have deteriorated significantly and quite rapidly in a sizable number of post-HIPC Completion Point countries. In some of these countries, these ratios once again come to exceed HIPC thresholds. This evaluation concluded that debt reduction alone is not a sufficient instrument to affect the multiple drivers of debt sustainability, and call for investment booms in support of export diversification, sound fiscal management, terms of new financing and improved public debt management. However, the success of these measures will be mitigated if fiscal and public debt management initiatives do not emphasize policies to prevent and reverse capital flight.

favors uni-directional causal relationship between the two series. In particular, the causality runs from external debt to capital flight in numerous countries. Moreover, the significance of the error correction term points to a long-run causal relationship between external debt and capital flight.

However, though consistent with the debt-driven and fueled capital flight hypothesis, the established causality may provide only a partial explanation to the capital flight hemorrhage afflicting the Sub-Saharan Africa region, especially, given the magnitude and the excess flight capital over the stock of external debt, and the continued expansion of flight capital even when external debt is controlled for. Additionally, existing empirical studies also highlight the hysterisis in capital flight in the face of improved macroeconomic environment and reduced volatility. In this regard and by way of furthering understanding of capital flight dynamics, future research could investigate the proportional variation of capital flight that is accounted for by accumulation of external liabilities and the threshold at which capital flight may become extremely costly for growth using sensitivity analysis.

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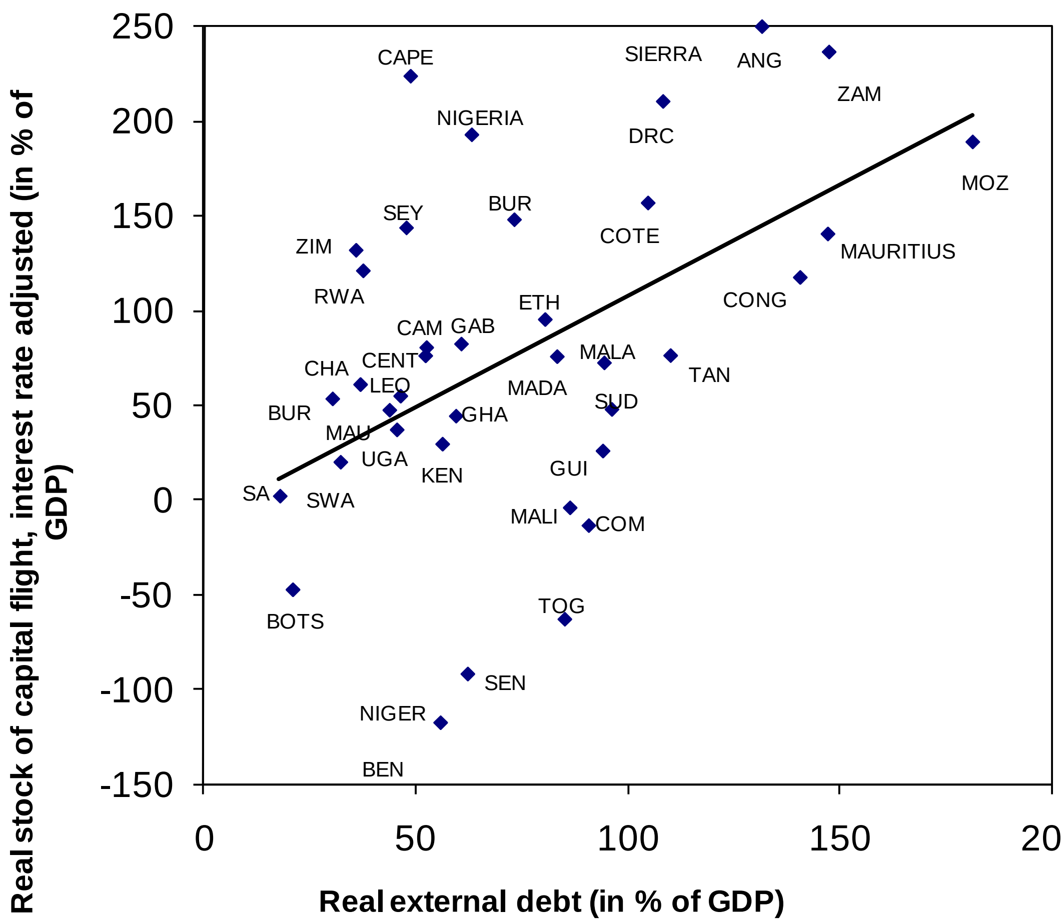
Annexes: Relevant Figures and Tables

Figure 1: Scatter Plot External Debt and Capital Flight



Annex Table 1
Capital flight and external debt in a selected sample of countries
(in million 2004 US $)

	Cumulative real capital flight with imputed interest earnings	Real external debt	Ratio of interest rate adjusted real stock of capital flight to external debt
Botswana	-1,087	510	-2.13
Comoros	-169	309	-0.55
Swaziland	1,343	471	2.85
Mauritius	650	2296	0.28
Congo Republic	17,475	6,741	2.59
Zambia	19,814	7,279	2.72
Mauritania	4,006	2,312	1.73
Mozambique	14,273	5,047	2.83
Total Sub-Saharan Africa	**602,063**	**229,756**	**2.62**

Capital flight and external debt in a selected sample of countries
(in percentage of GDP 2004)

	Cumulative real capital flight with imputed interest earnings	Real external debt	Ratio of interest rate adjusted real stock of capital flight to external debt
Botswana	-11	5	-2.13
Comoros	-47	85	-0.55
Swaziland	53	19	2.85
Mauritius	11	38	0.28
Congo Republic	402	155	2.59
Zambia	365	134	2.72
Mauritania	259	149	1.73
Mozambique	241	85	2.83
Total Sub-Saharan Africa	**199**	**93**	**2.62**

Annex Table 2: Phillips-Perron Unit Root Test: External debt and capital flight

Ho: Variable has a unit root	RED			RSKF		
	Trend	Constant	None	Trend	Constant	None
Angola	-2.481655 0.3304	---	---	-2.038318 0.5447	---	---
Benin	---	-1.244601 0.6434	---	-2.726865 0.2337	---	---
Botswana	---	-2.091653 0.2491	---	---	---	-0.466418 0.5045
Burkina Faso	---	1.737063 0.9995	---	---	1.921801 0.9997	---
Burundi	---	---	1.255297 0.9436	---	---	4.251172 0.9999
Cameroon	---	---	0.856181 0.8905	---	---	2.158127 0.9912
Cape Verde	---	---	9.236547 1	---	---	5.667501 1
Central African Republic	-1.474567 0.8188	---	---	-1.641428 0.7548	---	---
Chad	---	---	2.93742 0.9987	---	---	2.318406 0.9935
Comoros	---	-0.922768 0.7686	---	---	---	-1.079184 0.2457
Congo, Dem. Rep.	---	---	0.446515 0.8053	---	---	4.169401 1
Congo, Rep.	---	-1.009797 0.7386	---	---	5.360522 1	---
Cote d'Ivoire	---	---	-0.125531 0.6331	---	---	4.742761 1
Ethiopia	-0.564419 0.9749	---	---	0.346134 0.9981	---	---
Gabon	---	---	0.0581 0.6945	---	---	8.550381 1
Ghana	---	-0.263587 0.9202	---	---	7.86694 1	---
Guinea	-1.392546 0.8451	---	---	0.122564 0.9947	---	---
Kenya	-0.74189 0.9613	---	---	-1.942926 0.6104	---	---
Lesotho	---	---	1.254971 0.9436	---	---	0.494119 0.816
Madagascar	---	---	0.037952 0.6881	---	---	3.93636 0.9999
Malawi	---	1.796502 0.9996	---	---	1.283697 0.998	---
Mali	---	-0.856305 0.7897	---	---	---	-1.234002 0.1951
Mauritania	---	---	0.554826 0.8311	---	---	2.716106 0.9976
Mauritius	-3.123478 0.1172	---	---	---	-1.883081 0.335	---
Mozambique	---	-2.479908 0.1348	---	---	---	1.965354 0.985
Niger	---	-1.754151 0.396	---	---	---	9.662292 1
Nigeria	---	-1.316088 0.6107	---	---	7.257378 1	---
Rwanda	---	---	3.250605 0.9994	---	---	4.109452 1
Sao Tome and Principe	-2.305087 0.4173	---	---	---	1.373816 0.9983	---
Senegal	---	---	0.322651 0.773	---	---	5.888787 1
Seychelles	---	---	1.508935 0.9635	---	---	9.935726 1
Sierra Leone	---	-1.612453 0.4655	---	---	3.613457 1	---
South Africa	-2.947249 0.193	---	---	-1.969893 0.5957	---	---
Sudan	---	-1.818223 0.3657	---	---	0.766281 0.9919	---
Swaziland	-2.408333 0.369	---	---	---	---	2.952535 0.9987
Tanzania	---	---	0.066397 0.6972	---	---	2.513588 0.9959
Togo	---	-2.009457 0.2816	---	---	3.411531 1	---
Uganda	-2.035929 0.5615	---	---	0.405271 0.9985	---	---
Zambia	---	-1.714749 0.415	---	---	-0.207161 0.9282	---
Zimbabwe	-1.379449 0.849	---	---	-2.162193 0.4902	---	---

Annex Table 3 - Akaike Test							
		Number of lags					
	Lags chosen by Akeika Criteria	0	1	2	3	4	5
Angola	1	65.04589	60.82525*	61.08191	61.33036	61.29871	
Benin	1	59.01796	53.13798*	53.41621	53.29425	53.4752	53.4563
Botswana	3	56.79996	53.10932	51.53887	51.26956*	51.42566	51.48503
Burkina Faso	5	58.4101	52.47631	52.4094	52.47929	52.42003	52.33149*
Burundi	4	54.9739	51.09395	51.08966	50.60215	50.7993	48.80287*
Cameroon	4	66.18038	59.31541	59.29552	59.37723	59.29420*	59.46036
Cape Verde	5	53.83578	48.03968	47.94917	47.79819	47.83584	47.19315*
Central African Republic	2	57.70138	51.82192	51.66657*	51.67721	51.91383	52.00808
Chad	2	56.34759	51.86918	51.58911*	51.59107	51.87599	51.98441
Comoros	2	49.10077	47.56681	47.04315*	47.10223	47.42348	47.72986
Congo, Dem. Rep.	1	66.96584	60.17985*	60.25778	60.46067	60.39194	60.48324
Congo, Rep.	1	64.60588	58.73556*	58.99524	58.97791	59.03078	59.18288
Cote d'Ivoire	1	69.93079	61.01316*	61.25391	61.46517	61.63423	61.43831
Ethiopia	1	67.27956	59.17233*	59.22655	59.44438	59.40717	59.49182
Gabon	1	63.33886	56.77753*	56.8586	57.02978	57.11763	57.01459
Ghana	3	62.63613	57.0113	57.17993	56.98061*	57.0992	57.20622
Guinea	5	52.87013	51.83965	51.20944	51.53011	50.02591	49.86671*
Kenya	1	62.62166	57.41918*	57.48337	57.60961	57.74242	57.47448
Lesotho	5	53.84258	48.95713	48.81466	48.72064	48.31992	47.61636*
Madagascar	3	63.60052	56.96071	56.56978	56.54981*	56.62449	56.74801
Malawi	1	57.84775	53.59248*	53.70854	53.62647	53.67837	53.77108
Mali	1	58.02551	53.74326*	53.76506	53.86492	54.00584	54.09339
Mauritania	1	59.67996	53.70738*	53.86379	53.79478	53.77862	53.89383
Mauritius	5	57.6574	55.01974	55.15082	55.21511	54.26026	54.16202*
Mozambique	5	64.94886	60.7285	61.09734	60.78868	61.05444	60.35482*
Niger	1	61.03799	53.98449*	54.01775	54.18725	54.26026	54.2186
Nigeria	1	73.94842	65.72425*	65.87102	65.85311	66.01381	65.97814
Rwanda	4	57.23775	50.5377	49.96443	49.99531	49.96045*	50.13368
Sao Tome and Principe	5	50.99452	45.00003	45.18762	45.29096	44.9405	44.67878*
Senegal	3	63.27991	56.75866	57.01964	56.71182*	56.95935	57.08946
Seychelles	5	53.38006	49.22026	49.2389	49.28522	49.00122	48.83623*
Sierra Leone	5	59.85552	52.40124	52.20557	52.28525	51.84815	51.74648*
South Africa	1	65.39576	64.19554*	64.20962			
Sudan	3	65.09472	59.83847	59.96585	58.65845*	58.87164	58.92385
Swaziland	1	53.50715	50.16308*	50.22783	50.35252	50.56591	50.56016
Tanzania	1	63.05911	59.55499*	59.69808	59.8258	59.95221	60.10048
Togo	5	57.67609	52.92992	52.83698	53.03329	53.21563	52.77714*
Uganda	5	61.24249	54.66958	54.73285	54.84918	54.68268	54.51543*
Zambia	5	65.18171	58.6589	58.52907	58.56407	58.5955	58.51420*
Zimbabwe	2	64.52373	57.99407	57.61713*	57.77172	58.05166	57.96917

Annex Table 4

Granger Causality (No Vector Error Correction): External Debt and Stock of Capital Flight, interest rate adjusted (in constant 2004 U.S. dollars)

	Ho: Capital flight does not Granger cause external debt (both in constant 2004 U.S. dollars) *H1: Capital flight Granger causes external debt (both in constant 2004 U.S. dollars)*					*Ho: External debt does not Granger cause capital flight (both in constant 2004 U.S. dollars)* *H1: External debt Granger causes capital flight (both in constant 2004 U.S. dollars)*				
	Number of lags					**Number of lags**				
	1	2	3	4	5	1	2	3	4	5
Angola	9.86012	2.40157	5.25254	3.14043	3.14043	0.91892	0.2401	0.18814	0.09529	0.09529
	0.0085 ***	0.1459	0.0408 **	0.1871	0.1871	0.3567	0.7914	0.9007	0.9771	0.9771
Benin	0.36933	0.2754	0.02989	0.12082	0.22266	2.14555	0.58598	0.40728	0.21094	0.21464
	0.5484	0.7616	0.9928	0.9732	0.9471	0.1545	0.5643	0.7494	0.929	0.9509
Botswana	0.03923	3.42332	2.87714	1.22627	1.13234	4.03257	2.98441	2.51735	1.60869	2.00166
	0.8445	0.05 *	0.0617 *	0.3366	0.3884	5.51E-02 *	0.0704 *	0.0873 *	0.2178	0.1408
Burkina Faso	0.64342	0.72994	0.18582	1.28651	0.80686	8.90024	3.88997	2.35882	2.13335	1.92578
	0.4288	0.4912	0.905	0.307	0.5596	0.0056 ***	0.0328 **	0.0968 *	0.1124	0.1398
Burundi	0.5843	1.01619	0.46337	0.19307	0.1446	0.06413	0.93389	3.20647	1.92752	17.6641
	0.4558	0.389	0.7141	0.9344	0.9714	0.8033	0.4179	0.0705 *	0.2107	0.0079 ***
Cameroon	2.69919	0.94708	1.4901	1.16319	0.73894	32.7008	10.4981	3.45147	2.09318	1.51566
	0.1105	0.3999	0.2414	0.3539	0.6036	3.00E-06 ***	0.0004 ***	0.0317 **	0.1161	0.2318
Cape Verde	6.55575	5.5425	2.5152	2.88357	3.10473	2.4242	2.43631	0.67963	0.93701	1.58411
	0.0191 **	0.0148 **	0.1039	0.0794 *	0.0859 *	0.136	0.1192	0.58	0.4812	0.2796
Central African Republic	0.08831	0.64706	1.0135	0.69009	0.77568	4.50173	4.59906	4.11943	3.01101	2.467
	0.7683	0.5312	0.4033	0.6066	0.5792	0.042 **	0.0187 **	0.0167 **	0.0401 **	0.0697 *
Chad	2.45865	9.78457	3.52369	2.35311	2.21922	5.0532	4.45925	4.24436	3.83458	3.08458
	0.13	0.001 ***	0.0362 **	0.1009 *	0.1197	0.034 **	0.0243 **	0.0196 **	0.0243 **	0.051 *
Comoros	0.24912	0.27105	0.74177	0.66001	0.99272	0.7135	0.45336	0.27523	0.1703	0.21884
	0.6229	0.7656	0.5436	0.6314	0.4731	0.4078	0.6426	0.8423	0.9494	0.9455
Congo, Dem. Rep.	0.5278	0.1891	0.12965	1.32862	1.60533	3.55862	1.98848	1.64395	1.63923	1.21262
	0.473	0.8287	0.9416	0.2906	0.2067	0.0686 *	0.1558	0.2045	0.2	0.3411
Congo, Rep.	0.37227	0.27213	0.2793	0.39859	0.44012	2.84754	1.30092	2.78653	2.48412	2.397
	0.5464	0.7638	0.8398	0.8074	0.8147	0.1019	0.2888	0.0625 *	0.0748 *	0.0782 *
Cote d'Ivoire	7.72068	2.32159	1.6067	0.61508	0.7698	25.2863	7.16404	2.8619	1.97964	3.79361
	0.0092 ***	0.1167	0.2129	0.6563	0.5831	2.00E-05 ***	0.0031 ***	0.057 *	0.1329	0.015 **
Ethiopia	1.69203	2.81052	2.10796	3.09202	2.86664	1.14748	0.87098	0.77171	2.52213	2.07969
	0.2029	0.0772 *	0.1246	0.0367 **	0.043 **	0.2923	0.4296	0.5207	0.0701 *	0.1129
Gabon	0.00069	3.02488	1.66515	1.26224	1.19387	0.06702	0.20292	0.29637	0.36586	0.29466
	0.9792	0.0712 *	0.2121	0.3307	0.373	0.798	0.818	0.8275	0.8289	0.906
Ghana	0.20252	0.23796	1.35047	1.02048	0.61023	0.02932	0.25841	0.18533	0.24334	0.27817
	0.6558	0.7898	0.2807	0.4185	0.6932	0.8652	0.7741	0.9054	0.9106	0.9194
Guinea	9.11602	12.5846	5.50283	2.03099	2.18089	2.3574	2.46878	0.90276	0.623	0.9642
	0.0086 ***	0.0011 ***	0.0201 **	0.2089	0.2768	0.1455	0.1265	0.477	0.6632	0.5483
Kenya	1.01346	0.82752	1.4422	0.88089	0.32951	2.24605	1.93204	1.57575	1.43623	2.04099
	0.3219	0.4475	0.2542	0.4914	0.8889	0.1441	0.1637	0.2201	0.2554	0.1185
Lesotho	5.22678	2.34229	3.13395	3.23165	4.71369	0.23006	0.29638	1.37401	4.03112	5.81986
	0.0306 **	0.1186	0.0484 **	0.0382 **	0.0098 ***	0.6355	0.7463	0.2795	0.0177 **	0.0041 ***
Madagascar	0.53111	2.29838	2.72219	3.03766	2.08465	2.48476	5.46234	5.91981	3.50989	2.26434
	0.4716	0.1191	0.0657 *	0.039 **	0.1122	0.1251	0.0099 ***	0.0034 ***	0.0232 **	0.0895 *
Malawi	1.97793	1.48669	1.14414	0.95808	0.74736	2.4945	1.66502	1.0944	1.60413	0.79803
	0.1696	0.2434	0.3506	0.4499	0.598	0.1244	0.2074	0.3698	0.2087	0.5646
Mali	0.50291	0.03845	0.03926	0.0714	0.38027	4.15034	2.7089	2.45229	2.29271	1.38651
	0.4835	0.9623	0.9894	0.99	0.856	0.0502 *	0.084 *	0.0868 *	0.0917 *	0.2735
Mauritania	2.11456	0.73513	1.95316	1.84436	1.50424	2.99816	2.71038	1.92145	1.30083	0.69207
	0.157	0.4895	0.1506	0.162	0.2435	0.0944 *	0.086 *	0.1556	0.3052	0.6368
Mauritius	0.56912	0.45586	0.32529	5.53498	5.10374	5.66966	3.59107	3.12671	3.75203	3.54402
	0.4577	0.6398	8.07E-01	5.40E-03 ***	0.0083 ***	0.0252 **	0.0447 **	0.05 *	0.0245 **	0.0306 **
Mozambique	1.64668	1.04456	1.41763	1.10215	2.34709	0.45859	1.83967	1.13221	0.83534	0.78968
	0.2166	0.3777	0.2899	0.4183	0.1854	0.5074	0.1953	0.3784	0.5393	0.5991
Niger	0.04237	0.58797	0.43903	0.32415	0.44921	2.54642	3.39852	2.67607	2.41095	3.31893
	0.8383	0.5622	0.7271	0.8587	0.8086	0.1207	0.0477 **	0.0689 *	0.0798 *	0.0254 **
Nigeria	0.19448	0.20073	0.55717	0.45125	0.84523	5.10441	3.04108	3.00081	1.23702	0.97302
	0.6623	0.8193	0.6482	0.7704	0.5346	0.031 **	0.0638 *	0.0495 **	0.3242	0.4591
Rwanda	2.02666	4.2863	0.89888	1.84037	1.07149	15.7653	5.89725	3.44973	3.05951	1.95883
	0.1645	0.0238 **	0.4556	0.157	0.4069	0.0004 ***	0.0073 ***	0.0317 **	0.038 **	0.1315
Sao Tome and Principe	0.00698	0.06825	0.5141	0.43262	0.74998	1.88446	0.13123	0.45283	0.97502	1.63745
	0.9341	0.9342	0.678	0.7829	0.603	0.1831	0.8778	0.7187	0.4521	0.23
Senegal	0.39126	0.12923	2.3703	1.51493	1.12006	7.42866	2.83599	3.35749	1.43381	1.00911
	0.5369	0.8794	0.0995 *	0.2399	0.3913	0.0111 **	0.0784 *	0.0382 **	0.2634	0.4461
Seychelles	3.51459	2.90668	2.35019	4.96217	6.95684	0.09396	2.38311	2.57752	3.88556	2.36129
	0.0755 *	0.0821 *	0.1165	0.0156 **	0.0087 ***	0.7624	0.1224	0.0953 *	0.0332 **	0.1342
Sierra Leone	0.28768	0.41833	0.18551	1.82811	1.40925	5.97816	2.1537	1.91803	4.60965	5.03507
	0.5955	0.6622	0.9052	0.1594	0.2657	0.0204 **	0.1349	0.1525	0.0074 ***	0.0042 ***
South Africa	0.0842	0.17525	0.0842	0.17525	0.17525	2.65752	5.0969	2.65752	5.0969	5.0969
	0.7801	0.8454	0.7801	0.8454	0.8454	0.1471	0.0794 *	0.1471	0.0794 *	0.0794 *
Sudan	5.84195	1.93521	3.23563	2.0439	0.75924	1.58048	0.52098	4.05174	3.17105	2.27543
	0.0217 **	0.1632	0.0392 **	0.1231	0.5901	0.2181	0.5996	0.0178 **	0.0336 **	0.0883 *
Swaziland	0.17204	0.11224	0.06419	0.53671	0.62782	0.05735	1.29393	0.52729	0.40637	0.92271
	0.6816	0.8943	0.9782	0.7106	0.6814	0.8125	0.2926	0.6684	0.8016	0.4932
Tanzania	2.96027	1.86179	1.01059	1.08967	1.58393	9.56254	5.81079	3.1866	2.23815	2.2593
	0.0977 *	0.1791	0.4098	0.3948	0.2327	0.0048 ***	0.0094 ***	0.0473 **	0.1106	0.1098
Togo	0.61307	1.77176	1.6699	3.81722	4.21118	0.09585	0.895	1.44683	0.85434	0.39968
	0.4404	0.1916	0.2039	0.0204 **	0.0136 **	0.7592	0.4218	0.2576	0.5096	0.8415
Uganda	0.04814	0.11808	0.13002	1.40166	2.4139	0.11397	0.37483	0.49686	0.75366	0.99989
	0.8278	0.8891	0.9413	0.2662	0.0744 *	0.7379	0.6908	0.6878	0.5663	0.4444
Zambia	0.63449	0.08672	0.35694	0.58341	0.59836	30.9009	11.8708	8.05555	7.3741	6.05615
	0.4318	0.9172	0.7845	0.6779	0.7017	4.00E-06 ***	0.0002 ***	0.0006 ***	0.0006 ***	0.0016 ***
Zimbabwe	0.75151	0.807	1.15984	0.7448	0.48184	16.601	4.64588	2.97198	2.05453	2.0262
	0.3946	0.4596	0.3524	0.5764	0.7834	0.0004 ***	0.0213 **	0.0593 *	0.138	0.1468

Note: F-test results are given in the first line, the probability values are given in the second line. If the probability value is between 0.05 and 0.1, we reject H0 at 10 percent significance level (shown with *). If it is between 0.05 and 0.01, we reject H0 at 5 percent significance level (shown with **). If it is less than 0.01, we reject H0 at 1 percent significance level (***).

Annex Table 5

Granger Causality Test : External Debt and Stock of Capital Flight
(in constant 2004 U.S. dollars, interest rate adjusted)

Ho: There is no causality

	ECT → Dk	Dd → Dk	ECT and Dd → Dk	ECT → Dd	Dk → Dd	ECT and Dk → Dd
Angola	0.41788	0.241938	2.100584	2.415106	0.258223	1.945564
	0.672023	0.636021	0.178515	0.151156	0.625056	0.200879
Benin		0.004154			1.61007	
		0.949169			0.217174	
Botswana		0.409302			3.123682	
		0.74848			0.055236 *	
Burkina Faso	1.690029	1.042466	1.476567	0.335943	0.997546	0.73127
	0.220058	0.431291	0.25293	0.719905	0.452146	0.649156
Burundi	18.17464	9.700535	11.8784	0.04823	0.473504	1.679934
	0.021051 **	0.045995 **	0.03382 **	0.953639	0.758544	0.359144
Cameroon	1.78101	0.488404	1.541656	1.906184	0.862715	1.149892
	0.196901	0.744194	0.221229	0.177471	0.504936	0.374691
Cape Verde	2.591028	1.13606	1.411981	0.098271	2.283073	3.338429
	0.222018	0.489187	0.422971	0.909204	0.264279	0.175028
Central African Republic	3.313143	4.444347	3.259323	0.160777	1.352639	0.98091
	0.053629 *	0.022802 **	0.028633 **	0.852391	0.277568	0.436518
Chad	1.671093	3.726533	3.078471	4.631567	2.765113	4.765437
	0.217488	0.045497 **	0.044531 **	0.024795 **	0.091266 *	0.009199 ***
Comoros		0.008435			1.787062	
		0.991605			0.199297	
Congo, Dem. Rep.	1.46002	2.161578	1.679773	1.585274	0.364603	1.906494
	0.249989	0.153057	0.194843	0.223377	0.551001	0.15236
Congo, Rep.	5.13489	0.10384	4.696247	0.885712	0.421849	0.628224
	0.0132 **	0.749846	0.009467 ***	0.4245	0.521713	0.603312
Cote d'Ivoire	8.031642	0.034455	5.499269	2.280346	0.176117	2.519504
	0.001832 ***	0.85413	0.004423 ***	0.1216	0.678053	0.079143 *
Ethiopia	1.193948	0.089862	2.922208	3.544607	4.353454	2.530034
	0.31852	0.766649	0.052004 *	0.042962 **	0.046509 **	0.07827 *
Gabon	5.061177	0.328795	3.563467	1.788002	5.093416	4.672135
	0.017298 **	0.573095	0.033687 **	0.194317	0.035988 **	0.013118 **
Ghana	4.327609	0.308617	2.013637	0.590835	1.248252	0.779276
	0.026683 **	0.818884	0.118252	0.562812	0.317502	0.575721
Guinea	1.392675	0.090833	1.477657	2.347191	1.225476	12.32462
	0.302707	0.914098	0.295306	0.15773	0.343349	0.001688 ***
Kenya	1.843394	0.106305	1.462066	1.426369	1.061386	1.87307
	0.17765	0.746904	0.246991	0.257706	0.31204	0.157971
Lesotho	8.361762	2.142927	5.116942	5.957385	5.467525	4.651736
	0.007337 ***	0.142799	0.010579 **	0.019784 **	0.011077 **	0.01466 **
Madagascar	5.586807	3.352197	2.68249	2.325204	3.307464	2.750163
	0.011338 **	0.038385 **	0.050144 *	0.122409	0.040028 **	0.046073 **
Malawi	2.097858	0.913369	1.426669	1.348157	0.717045	0.957424
	0.142275	0.347701	0.25671	0.276647	0.404558	0.426987
Mali		1.410611			0.948947	
		0.799564			0.912333	
Mauritania	2.128951	1.410611	1.749266	2.163408	0.948947	2.623779
	0.140882	0.246577	0.183772	0.136824	0.339704	0.073712 *
Mauritius		1.856076			8.921076	
		0.195464			0.002772 ***	
Mozambique		4.579226			0.528749	
		0.120213			0.751099	
Niger		4.525489			1.099652	
		0.042677 **			0.303639	
Nigeria	11.47962	0.038587	8.099936	0.127838	0.348233	0.716886
	0.000247 ***	0.84574	0.000525 ***	0.880526	0.560022	0.55054
Rwanda	0.879677	0.81028	1.555964	0.726163	0.737219	0.884253
	0.432014	0.534817	0.216968	0.497404	0.578677	0.526241
Sao Tome and Principe		1.984674			0.843194	
		0.175215			0.551788	
Senegal	3.026643	0.517518	1.33384	1.8839	2.278258	2.427403
	0.075091 *	0.675814	0.297232	0.182388	0.116322	0.07794 *
Seychelles	0.476943	2.225177	2.181923	1.211814	0.832623	1.521829
	0.651971	0.229212	0.235178	0.387757	0.586724	0.359311
Sierra Leone	6.692795	3.544831	2.815403	0.768378	1.850073	1.721741
	0.008365 ***	0.025794 **	0.043803 **	0.481179	0.16343	0.178361
South Africa	13.52634	7.316608	8.858546	0.371603	0.085616	0.984753
	0.03481 **	0.073479 *	0.055105 *	0.717491	0.788896	0.50489
Sudan	0.076698	3.877609	2.467992	4.510388	2.187926	3.064941
	0.926428	0.023709 **	0.065762 *	0.023462 **	0.119563	0.03126 **
Swaziland		0.393667			4.557907	
		0.759155			0.016129 **	
Tanzania	7.399259	0.450747	5.043122	5.829838	0.936972	5.406402
	0.012823 **	0.509299	0.016268 **	0.009687 ***	0.344075	0.006467 ***
Togo	2.096576	0.843142	1.033536	3.0912	4.662829	7.456286
	0.169276	0.546613	0.460832	0.08604 *	0.015723 **	0.001889 ***
Uganda	2.649585	0.809018	1.315982	2.521046	1.617592	1.572878
	0.103418	0.561032	0.308579	0.113792	0.215506	0.218052
Zambia	1.521122	3.233826	4.936607	0.973881	0.269668	0.531629
	0.250326	0.035304 **	0.004598 ***	0.400259	0.922692	0.79754
Zimbabwe	1.950167	1.80689	2.127996	1.96472	2.864882	3.156701
	0.172788	0.194301	0.121722	0.170756	0.084676 *	0.041152 **

Note: F-test results are given in the first line, the probability values are given in the second line. For probability value between 0.05 and 0.1, we reject H0 at 10 percent significance level (shown with *); if it is between 0.05 and 0.01, we reject H0 at 5 percent significance level (shown with **); and when it is less than 0.01, we reject H0 at 1 percent significance level (***).