Saving-Investment Correlation and Capital Mobility in Sub-Saharan African Countries: A Reappraisal through Inward and Outward Capital Flows' Correlation

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Abstract

This paper analyses the Feldstein-Horioka puzzle in 15 sub-Saharan African countries accounting for the correlation between inward and outward capital flows. Applying cross section, panel data, and even time series analyses, we show that our results are consistent with previous studies related to developing countries.   More interesting, we confirm, for sub-Saharan African countries, the recent hypothesis of Georgepoulos and Hejazi (2009) that the Feldstein-Horioka home bias is unrelated to the correlation between inward and outward capital flows for developing countries. Although the saving-investment coefficient weakens in the correlation adjusted regression, we show that the coefficient on Flows, the variable which accounts for the correlation between inward and outward capital flows is always positive and insignificant. We argue that the downward movement in the saving-investment coefficient is due the omission of some factors (foreign aid and trade openness) which are relevant for developing countries in the framework of the Feldstein-Horioka analysis. We also state that our results are more likely to reflect the poor financial structure of the countries in our sample. Therefore, we suggest that policymakers in Sub-Sahara Africa should put more emphasis in creating and developing efficient financial market which could favor portfolio diversification.

Keywords: Feldstein-Horioka Puzzle, Panel data, Sub-Saharan Africa, Saving-Investment correlation, Capital Mobility, Capital Flows, Foreign aid

1. Introduction

One of the most discussed facts in international economics is undoubtedly the curious high and positive saving-investment association, a result contained in the seminal paper of Feldstein and Horioka(1980, Henceforth FH).The FH claim has gradually imposed itself as a stylized fact, although regression coefficients are rarely sufficiently robust to become established as stylized facts. Moreover, attempts to show that the FH result was fragile almost failed (Coakley et al., 1998). As noted by Baxter and Crucini(1993), one of the most stable regularities observed in the data is the fact that national saving rates are highly correlated with national investment rates, both in time series analyses of individual countries and in cross sections in which each country is treated as a single data point. In fact, the controversy around what has been dubbed the Feldstein-Horioka puzzle lies not on the two authors' finding, but more on the interpretation given to the high coefficient. Feldstein and Horioka(1980) argue that the high saving-investment correlation(Note 1) is an evidence of weak international capital mobility among OECD countries. Several studies therefore have tried to challenge the Feldstein-Horioka results (see, Coakley et al., 1998; Frankel, 1992; and Obstfeld , 1995 for a critical survey). The main idea developed by those studies is that the Feldstein-Horioka equation may capture some other parameters than the supposed capital mobility. Some authors for instance, have parameterized the FH equation in terms of current account. In this framework, the FH interpretation is that, given zero capital mobility, changes in saving are reflected in changes in investment and have no effect on the current account. For Dornbusch(1991), the FH finding runs counter to the spirit of the open economy literature in which, under of conditions of perfect capital mobility, changes in national saving rates are primarily reflected in the current account, not in investment. Some authors have shown that saving and investment rates appear to be integrated of order one for most OECD countries (Gundlach and Sinn, 1992; Jansen, 1996; Coakley et al., 1996; Coiteux and Olivier, 2000 and Coakley et al., 2004). However, the solvency constraint requires that the balance of payments (as a share of GDP) be stationary since debt cannot explode. Therefore, the cross-section regression which measures the average long-run coefficient will tend to capture the unit coefficient implied by the solvency constraint, irrespective of the degree of capital mobility. Some simulation studies based on dynamic stochastic general equilibrium (DSGE) models have suggested various specifications of shocks and economic structures that generate a high time-series correlation between saving and investment, even under complete capital markets (Note 2). Those business cycle shocks include productivity shocks, fiscal shocks and term of trade shocks. However, the potency of those shocks in influencing the FH coefficient is relative, as demonstrated by Sunghyun(2001). Some researchers

argue that the test for capital mobility in the FH framework involves testing a join hypothesis of a high saving-investment association and real interest rate parity. For Frankel (1992), the Feldstein Horioka puzzle is not surprising as it seems, because it stems from the failure of some form of interest rate parity, for which many conventional arguments can be made (transaction costs, regulation, etc). Consumption smoothing approach on its part, as developed by Obstfeld(1995), Ghosh(1995) or Ghosh and Ostry(1995) suggests excess capital mobility in both advanced and developing countries therefore challenging the FH result. Several other studies, aiming at challenging the FH puzzle are based on the large country effect (Murphy, 1984; Haberler, 1980, Obstfeld, 1986, Baxter and Crucini, 1993; Dooley et al., 1987); estimation methodology; high investment risk and weak diminishing returns (Kraay and Ventura2000); investment risk and adjustment costs to investment (Ventura, 2003), and the presence of a time trend in the FH relationship (Georgepoulos and Hejazi, 2004).

In their recent contribution, Georgepoulos and Hejazi(2009) argue that the high correlation between domestic investment and national savings rates might be explained by the absence of the correlation between inward and outward capital flows in the standard FH specification. When allowing the home bias to depend directly on the correlation between inward and outward capital flows, these authors find lower home bias for developed and emerging countries, but not for developing countries. This paper aims at shedding more light on this issue focusing exclusively on Sub-Saharan African countries, as these countries might have their own specificities. Using a sample of 15 Sub-Saharan African countries, we reassess the hypothesis of Georgepoulos and Hejazi(2009). Our main finding is that when accounting for the correlation between inward and outward capital flows, the saving-investment coefficient falls substantially in our sample of developing countries. However, the correlation between inward and outward capital flows is far to be responsible of this downward movement, as the coefficient related to this variable is insignificant and positive in all of our specifications. We therefore argue that the low saving retention coefficient is due to other factors like aid flows or trade openness rather than market flows. That is, correlation between inward and outward capital flows does not lead to downward home bias. The paper is organized as followed: Section 2 provides a brief review of the relevant literature, focusing more in developing countries. In section 3 we describe our methodology and our data. Empirical results are provided in section 4, while section 5 concludes.

2. Literature review

The main interpretation of the Feldstein-Horioka result is that capital is less mobile among OECD countries, due to the high and positive correlation between saving and investment rates. This interpretation is in fact challenged in many studies, as capital markets in OECD countries are widely perceived as globally integrated. On the contrast, many authors using various samples of developing countries find that the estimated coefficient of saving on investment is lower or close to zero (Dooley et al., 1987; Wong, 1990; Vamvakidis and Wacziang, 1998; Isakson, 2001; Mamingi, 1997, Payne and Kumazawa, 2005; etc). Therefore, if the saving-investment correlation measures capital immobility, some might conclude that capital is perfectly mobile among developing countries. For Kasuga(2003), this is hard to believe and authors have provided many explanations to this other puzzle. One explanation given to justify the low saving retention in developed countries is the effect of nonmarket flows, especially, foreign aid. Payne and Kumazawa(2005) argue that if foreign aid is important but omitted, this weakens the saving-investment correlation, which would imply greater capital mobility than is actually the case.   This view is shared by Montiel(1994), Mamingi(1997) or Isaksson(2001). Indeed, when including foreign aid in the traditional Feldstein –Horioka equation, the saving retention increases significantly. Another view, developed by Vamvakidis and Wackziang(1998) is that the Feldstein-Horioka result holds only for OECD countries and vanishes when any other sample of countries is considered. The authors relate this situation to risk diversification incentives. They suggest that opportunities for diversification are greater among developing countries than among industrial countries. Therefore, the saving-investment correlation may be biased downward in a sample with both developing and developed countries. However, Vamvakidis and Wackziang (1998) explain that their results are only suggestive of the fact that capital inflows are a major determinant of investment in no-OECD countries. These inflows, as they argue, may be the result of official transactions (Government borrowing from other governments and foreign financial aid) and do not necessary signal evidence of financial markets integration. When investigating on the saving-investment correlation in developing countries, Kasuga(2003) shows that the saving retention reflects more the structure of a country's financial structure and not capital mobility. Using some indices for financial development to improve the original Feldstein-Horioka equation, Kasuga(2003) finds that the saving retention is low for developing countries and high for industrialized countries. It is noteworthy to mention that within the sample of developing countries, middle-income countries experience more capital mobility than lower income countries. That is, the larger the

country, the lower is the saving retention, hence; the more mobile is the capital in this country (Mamingi, 1997). This result is counter to the finding in developed countries that there is a positive correlation between country size and saving-investment correlation, the so-called larger country effect. Nevertheless, Mamingi(1997) argues that larger developing countries have, in general, better infrastructure, human capital, and less capital control, which makes investment opportunities more attractive to foreign investors. Wong (1990) emphasizes that the size of the non-traded sector and the degree of openness can explain the saving-investment coefficient. Adedeji and Thorton(2007) find relative low saving retentions in OECD and African countries, using panel cointegration techniques for 50 developed and developing countries.They conclude that capital has been very mobile in OECD countries and in African countries, although the result for the last group is surprising. Georgepoulos and Hejazi(2009) argue that the correlation coefficient between national savings and domestic investment rates can be biased upward if correlations between inward and outward capital flows are neglected. Thus, allowing the home bias to depend directly on these correlations yields lower home bias estimates for the sample of developed and emerging economies, but not for developing countries. In their sample of developing countries, Georgepoulos and Hejazi(2009) use 10 Sub-Saharan African countries. We enlarge this sample to include more countries (fifteen in total) for which data are available. Insulating sub-Saharan African countries in this work help us to pick up more accurate conclusions and propose some policy recommendations for this particular sample of countries.

3. Empirical methodology and data description.

a. Specification of the econometric model

The aim of this paper is to assess the extent to which the correlation between inward and outward capital flows affects the estimated saving retention coefficient of 15 Sub-Saharan African countries (Note 3) in the FH framework. For this purpose our methodology consists in two steps, that is, we estimate two specifications of the FH model. The first specification is the standard FH approach and is as followed:

$$\left[GDI_t / GDP_t \right] = \alpha_0 + \alpha_1 \left[GNS_t / GDP_t \right] + u_t \qquad (1)$$

Where GDI measures gross domestic investment, GNS gross national savings, GDP gross domestic product, u_i is the error term and i indexes country. As in FH (1980), the data for each country are averaged over the period 1980-2004, and hence there is one observation per country-that is, the regression is cross sectional(note 4). The estimate of α_1 captures the FH bias in terms of where increases in domestic savings are invested.

Then to account for capital flows correlation, the standard FH specification is augmented as follows:

$$\left(GDI / GDP \right)_{it} = \beta_{0t} + (\beta_1 + \beta_2 Corr_{it})\left(GNS / GDP \right)_{it} + e_{it} \qquad (2)$$

Where Corr stands for the correlation between inward and outward capital flows for each country. There is both a subscript for country i and period t as the model is estimated in a panel where we average observations over time periods, as well as in a cross-section where we average observations over the entire sample, in which case the subscript t would be suppressed and β_{0i} would become β_0. According to Georgepoulos and Hejazi(2009), if the relationship between investment and savings rates were unrelated to the correlation between inward and outward flows, then the estimated value of β_2 would equal zero, and specification (2) would collapse to a standard (panel-version of the) FH specification. The hypothesis here is that a high positive correlation between inward and outward capital flows would bias the FH coefficient upward; that is by accounting for that correlation, the estimated relationship between investment and savings should be lower. That means, $\beta_2 < 0$.

Before describing our data, it is useful to emphasize on our sample countries. First, the countries selected are those for which data were available. In most of the Sub-Saharan African countries, we were unable to find data, especially those refined data on inward and outward capital flows which are obtained from the IFS database. This significantly reduces our sample and we only have 15 countries at the end. Second, in most of the countries, financial markets still either at their infancy like Cameroon and Gabon in Central Africa, or inefficient in term of market capitalization as is the case in West Africa (Benin, Cote-d'Ivoire, Mali, Senegal, and Togo). One of the consequences might be the low level of market flows within these countries.

Last and not the least, as all the countries in our sample are less developed countries, one should hypothesize that aid flows in those countries play a crucial role on investment. Quoting the World Bank (1995, p.313) Mamingi(1997) notes that "For many less developed countries(LDCs) the foreign savings made available through official development assistance (ODA) are equivalent to a sizable share of GDP and to the bulk of investment".

b. Data description

Data for savings and investment rates are from the World Development Indicator database of the World Bank (2006). As in Payne and Kumazawa(2005), we use Gross fixed capital formation per GDP as the indicator for the investment rate, while Gross domestic savings per GDP stands for the saving rate. Table 1 provides means and standard deviations on investment and savings rates for the countries in our sample.

As can be seen in this table, the mean savings rates for most countries still low, sometimes not different from zero like in Mozambique or Rwanda and to some extend Benin. However, it should be noted that those data are little bit different from those reported by Georgepoulos and Hejazi(2009). Data from the World Development Indicator produce quite higher means than those of the Penn World Table. Our sample period is also quite smaller than that of Georgepoulos and Hejazi which goes from 1975 to 2004. Table.1 also indicates that half of the countries in our sample have quite similar investment rates as the developed countries reported in Georgepoulos and Hejazi(2009; Table 1, Panel A). However, Table 1 shows that both investment and savings rates display higher variations in Sub-Saharan African countries.

Data for capital flows (not reported) are obtained from the IMF's balance of payments database. Capital inflows represent inflow of FDI (IMF label 78bed), portfolio equity investment (78 bmd) and portfolio debt investment (78 bnd). Capital outflows represent outflow of FDI (78bdd), outward portfolio equity investment (78bkd), and outward portfolio debt investment (78bld). Capital flows are relative to GDP (99b for nominal GDP in local currency, market exchange rate). Those data show that both capital inflows and capital outflows are very low for most of the countries in our sample. In general, African countries receive less foreign direct investment (FDI) and outward FDI is most of the time either close to zero or negative. This feature is more pronounced concerning foreign portfolio debt flows and foreign portfolio equity flows. Either of these capital flows seems nonexistent in most of Sub-Saharan African countries.   Data In these categories are either zero or negative. Of course, this is reflected in the correlation (Note 5) between inward and outward capital flows as displayed in fig.1

A part from 4 countries (Benin, Botswana, Cameroon and Mozambique), these correlations are negative for all the other countries in our sample. It has been argued that capital inflows and outflows might be correlated due to diversification reasons (Portfolio flows) or comparative advantage motives. As pointed out by Georgepoulos and Hejazi(2009), FDI flows for developed countries tend to be intra-industry, a feature that is less plausible for developing counties like those from Sub-Saharan Africa. Most African countries are specialized in the production of primary goods and not in manufactured goods or heavy industry (Automotive industry for instance) which are more likely to favor intra-industry transfer of FDI. Another explanation is the inefficiency or the inexistence of financial markets to favor portfolio diversification in either side. Kasuga(2003) for example points out that most developing countries have bank-based or relatively inefficient financial sectors and this might explain why the saving-investment correlation is low. It shall be recalled that most of the countries in our sample does not have efficient financial markets.

In the special case of portfolio flows (equity securities and debt instruments) a recent paper by De Santis and Luhrmann(2009) demonstrates that population ageing, countries' institutions in term of rule of law, property rights, freedom, and democratic values; liquidity as money stock to GDP, and deviation from the Uncovered Interest Parity(UIP) besides their influence on the capital account balance, also have significant effects on equity and debt flows. As most Sub-Saharan African countries exhibit poor performances in those factors, one can therefore understand why net portfolio flows are so low in those countries.

4. Empirical Results

For each of the specifications in Section 3, we run a series of regressions. First, we estimate a cross section, where data for each country are averaged over the entire sample period. In that case, there is only one observation per country. Second, we average the data over 5-year periods, resulting in 5 observations for each country, thus yielding a panel. Third, the data are averaged over 3-year periods, resulting in 8 observations for each country (the last observation is the average of 4 periods). We begin by reporting the results for the standard FH equation. Those results are displayed in panel A of Table 2. These results show that the saving-investment coefficient is estimated between 0.208 and 0.243 and is highly significant, according to the p-values in parentheses. For regressions in panel data, we ran the Hausman specification test which tells us whether random effect model is rejected over the fixed effect model. The results, as shown in the last column of Table 2.A confirm the superiority of the random effect model over the fixed effect model. Overall, those results are consistent with previous studies that have also found low saving-investment coefficients for developing countries. Payne and Kumazawa(2005) for instance in their replication of the standard FH specification, found a 0.209 value for the saving-investment coefficient in the random effect model. But their Hausman test rejects the

random effect model in favor of the fixed effect model. Vamvakidis and Wacziang(1998) using OLS with decade averages and panel data specifications with both yearly and 5-year averages also report home biases ranging from 0.202(OLS, 1970-1979 period) to 0.2.46(Fixed effects, yearly data, 1970-1993). The value of this coefficient is 0.227 when the authors average data over five year periods. Our model specification also seems good, as the adjusted R-squared in the second column of results are quite high, in contrast with those reported by Payne and Kumazawa(2005).

We now turn to the results of the second model specification, also called the correlation adjusted model by Georgepoulos and Hejazi(2009). Those results are contained in Panel B of Table 2. Our first finding is that there is a downward movement in the saving-investment coefficient (β_1), especially when applying panel data regressions. The coefficient moves respectively from 0.208 to 0.125(3-year averages) and from 0.237 to 0.168(5-year averages). On the contrary, β_1 rises slightly, when controlling for the correlation between inward and outward capital flows with full sample averages. At first sight, one might think of the effect of the correlation variable (Corr) in this regression. If this variable is relevant but omitted in the regression, it might push upward the saving-investment coefficient like is the case in the standard FH specification (Georgepoulos and Hejazi, 2009). However, a close look at the results in the second column of results in Table B reveals that regardless of the model used, the coefficient in *Flows (Note 5)* is insignificant. Moreover, this coefficient (β_2) is found to be positive in our case and in all specifications, contrasting with Georgepoulos and Hejazi(2009) for whom the variable must have a negative sign. Therefore, we state that the downward movements in the saving retention are unlikely to be related to the inclusion of the correlation between inward and outward capital flows in the standard Feldstein-Horioka regression. In Section 3, our data revealed that in most of our countries, capital flows are very low, leading also to low and even negative correlations between inward and outward capital flows. It has been established in many studies (Payne and Kumazawa, 2005; Mamingi, 1997; Vamvakidis and Wacziang, 1998; etc) that nonmarket capital flows; especially foreign aid flows and trade openness are those variables more likely to affect the saving-investment coefficient in developing countries. We didn't introduce foreign aid flows or trade openness variables in our models. However, most of the countries in our sample are found in the sample used for example by Payne and Kumazawa(2005). Not accounting for those variables in our case might have weakened the saving-investment correlation, even accounting for inward and outward capital flow correlations (which are irrelevant in explaining the FH puzzle for developing countries). For the bulk of the countries in our sample, financial markets, where they exist, are inefficient, therefore unable to trigger portfolio diversification among countries. Our results in both FH specifications are likely to reflect the poor financial structure of Sub-Saharan African countries as it has been proved by Kasuga(2003). In fact, our saving-investment correlations are not too different from those reported by Kasuga(2003) for developing countries.

A number of researchers arguing that the cross-section approach is misleading in the framework of the FH puzzle advocate the use of a time-series approach, especially for developing countries (see Mamingi, 1997; Adedeji and Thornton, 2008). For Mamingi(1997), four main raisons justify the use of a time-series approach instead of a cross-section approach in the FH framework. First, results from cross-section models are hard to interpret. As capital mobility estimates are derived at a particular point in time, the key question of how much of an increase in saving truly ends up as domestic investment becomes difficult to answer. Further, the use of long-term averages of saving and investment ratios leads to an upward bias in capital mobility correlation. Second, there is no guarantee that capital mobility estimates for different countries are effectively equal, something cross-section models imply. Third, since the saving-investment correlation is primarily a long-run relationship, a cointegration approach is a more appropriate methodology. Finally, Mamingi(1997) argues that a time-series approach is a more appealing framework to deal with the issue of the possible association between saving-investment correlation and data quality. Consequently, we took an account of the above pitfalls by undertaking a time-series analysis. One of the difficulties here was to compute a full period data for Corr, the correlation variable. To remedy, we computed again the three-year value of the correlation, with a rolling methodology which enabled us to have 23 observations over 25 for each country. In practice, for each country, we computed the first correlation for the period spanning from 1980 to 1982. The second observation was then computed from 1981 to 1983 and so on till the end of the period. These imbrications enable us to have quite a long series for Corr then *Flows* in each country. The first step in the time series analysis is to run panel data tests for unit roots. If our data are non-stationary in level but stationary in their first levels, we then can proceed to panel cointegration tests. Finally, if our data do cointegrate, we must use other model specifications (Dynamic OLS or Full Modified OLS) rather than the usual OLS. A summary of the different panel data unit root tests is presented in Table 3. Those tests were run with data in level and with individual fixed effects. In most of the tests, the null of unit root is rejected at a high significant level, indicating that all of our variables are stationary

in level. This is quite surprising because many authors, as we stated above, consider that savings and investment are I(1) rather than I(0). However according the results obtained, there is no need to continue with cointegration tests, as we can directly run OLS regressions in a panel framework. Results of these panel regressions are displayed in Table 2. Panel C. They show that the saving-investment correlations are not different from those obtained previously. The coefficient is 0.215 and highly significant in the standard FH specification and drops to 0.084 in the correlation adjusted model. Also, the coefficient on *Flows* is still positive and insignificant.

5. Conclusion

The hypothesis that accounting for the correlation between inward and outward capital flows could yield to a lower estimate of the saving-investment coefficient was tested for the first time by Georgepoulos and Hejazi(2009). Their results indicate that the higher the correlation, the lower the home bias for developed countries and emerging countries, but not for developing countries. To shed more light on this issue, we reconsidered a wide sample of Sub-Saharan African countries in which data were available. Investigating this hypothesis only in Sub-Saharan African countries stems from the fact that those countries have some particularities relative to other developing countries. Our results, regardless of the methodology used show that accounting for simultaneity in capital flow movements do weaken the saving-investment coefficient in the countries under consideration, therefore contrasting at first sight with the findings of Georgepoulos and Hejazi(2009) for developing countries. However, the coefficient in *Flows*, the variable which accounts for inward and outward capital flows is positive and largely insignificant throughout our study. Therefore, we conclude in line with the previous study that allowing the FH coefficient to depend directly on the correlation between inward and outward capital flows does not affect the home bias in Sub-Saharan African countries. The downward movement observed in the correlation adjusted regression is due more to other factors (Foreign aid, trade openness) which are relevant for developing countries rather than the correlation between capital inflows and capital outflows. The saving-investment coefficients we obtained are quite similar to those reported by Kasuga(2003) for developing countries. Thus, our results reflect more the poor financial structure of the countries considered in the study, as we mentioned above. Policymakers in Sub-Saharan African countries should therefore put more emphasis in creating and developing efficient financial markets, for their absence is unlikely to strengthen portfolio diversification. This policy must work alongside with the inevitable process of financial liberalization and deepening. As it is argued that bilateral FDI flows are more likely to occur within the same industry, policymakers in Sub-Saharan African countries should pay great attention to their production structure, focusing more on manufactures and heavy industries than on primary goods. Whether these measures shall yield to lower or higher home biases in African countries is still questionable and gives way for further research.

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Notes

Note 1. The terms saving-investment coefficient, saving-investment correlation, saving retention or home bias are usually employed in the literature to designate where domestic savings are invested. We therefore use them alternatively in our study for the same purpose.

Note 2. See for example Finn (1990), Cardia(1991), Mendoza(1991), Backus et al.(1992) and Baxter and Crucini(1993).

Note 3. Sub-Saharan African Countries: Benin, Botswana, Cameroon, Cote d'Ivoire, Gabon, Kenya, Mali, Mauritius, Mozambique, Rwanda, Senegal, Seychelles, South Africa Swaziland, Togo.

Note 4. The model is also estimated using panel averaged data over 3 and 5 year-periods respectively.

Note 5. A brief explanation of why both capital inflows and outflows might correlate is found in Georgepoulos and Hejazi(2009)

Note 6. The variable "Flows" is the one which account for the correlation between inward and outward capital flows in the correlation adjusted equation. Therefore, Flows= Corr*(GNS/GDP).

Table 1. Means and Standard deviations on Savings and Investment rates for a set of Sub-Saharan countries

Country	GDS/GDP		GNI/GDP	
	Mean	Std Dev	Mean	Std. Dev
Benin	1.96	5.04	16.31	3.59
Botwana	37.76	6.56	27.54	3.67
Cameroon	20.76	3.82	18.38	2.97
Cote d'Ivoire	19.14	4.81	13.29	4.51
Gabon	43.14	10.30	29.08	6.52
Kenya	15.76	4.11	17.73	1.78
Mali	5.44	6.13	20.61	4.28
Mauritius	22.62	4.098	23.91	3.59
Mozambique	0.03	8.32	20.37	3.45
Rwanda	0.06	10.90	15.22	2.26
Senegal	5.89	5.96	14.98	3.00
Seychelles	22.17	6.81	26.61	8.42
South Africa	22.92	5.31	18.86	4.24
Swaziland	5.20	7.44	22.35	4.90
Togo	7.96	6.33	17.83	3.91

Sources: World Development Indicator Database (2006)

Sample period: 1980-2004

Table 2. Empirical results

A. The standard FH regression $(GDI_i/GDP_i) = \alpha_0 + \alpha_1 (GNS_i/GDP_i) + u_i$

	α_1	Adjusted R-Squared	Hansen Test
3- year averages (GLS and Pooled Least squares estimates 15 countries , N=120	0.208(0.0001)	0.558	Chi-Sq. Statistic 0.514 p-value 0.473
5-years averages (GLS and Pooled Least squares estimates) 15 countries; N=75	0.237(0.0001)	0.595	Chi-Sq. Statistic 0.0156 p-value 0.900
Full sample average (OLS)	0.243(0.0061)	0.409	

B. The correlation adjusted FH regression = $(GDI/GDP)_{it} = \beta_{0i} + (\beta_1 + \beta_2 Corr_{it})(GNS/GDP)_{it} + \varepsilon_{it}$

	β_1	β_2	Adjusted R-Squared	Hausman Test	LR test statistic for heteroskedasticity
3- year averages(GLS and Pooled Least squares estimates 15 countries , N=120	0.125(0.032)	0.007(0.76)	0.63	Chi-Sq. Statistic 0.00 p-value 1	265.95(0.001)
5-years averages (GLS and Pooled Least squares estimates) 15 countries; N=75	0.168((0.01)	0.001(0.97)	0.068	Chi-Sq. Statistic 3.04 p-value 0.217	114.82(0.001)
Full sample average (OLS)	0.257(0.006	0.131(0.44)	0.391		F-stat p-value 0.94

Notes: 1. The regressions are undertaken using data averaged over 3-year periods, 5-year periods, and averaged over the entire sample. Regression results using averaged data over 3 and 5-year periods include unreported random effects.

2. The LR test statistics refer to the correlation-adjusted regression.   Null hypothesis: no heteroskedasticity. Source: Wooldridge (2002).The regression of squared residuals on explained variable were run with fixed effects

C. Results with panel data in the whole period

	α_1	β_1	β_2	Adjusted R-square
Standard FH	0.215(0.000)			0.101
Correlation Adjusted FH		0.084(0.02)	0.0079(0.60)	0.63

Note. The standard FH equation was estimated accounting for random effects while fixed effects were considered in the correlation adjusted equation.

Table 3. Summary of Panel data Unit Root Tests

Test	Variable		
	INV Flows	**SAV**	
Levin, Lin and Chin t*	-3.25(0.0006)	-4.21(0.0000)	-6.34(0.0000)
Im, Pesaran and Shin W-stat	-2.52(0.0058)	-3.33(0.0004)	-6.94(0.0000)
ADF –Fisher Chi-square	56.82(0.0022)	61.38(0.0006)	105.73(0.0000)
PP- Fisher Chi-square	65.53(0.0002)	51.25(0.0091)	179.63(0.000)

Notes: 1. The tests were performed with data in level and with individual effects

2. Probabilities of the various statistics are in brackets.

3. INV stands for investment, SAV for savings and Flows the variable accounting for correlation between inward and outward capital flows.
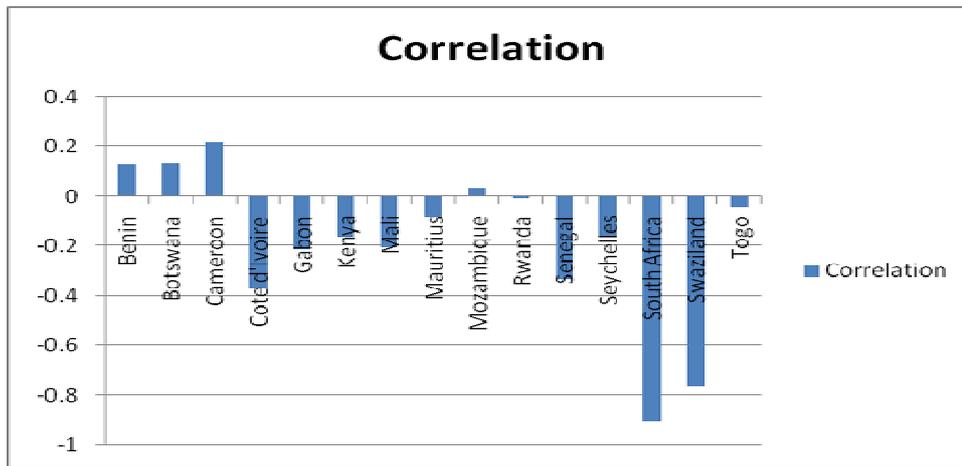
Figure 1. Correlation between inward and outward capital flows in Sub-Saharan African countries, 1980-2004.

Source. International Financial Statistics CD-ROM