

## **EVOLUTION OF CAPITAL MOBILITY IN SUB-SAHARAN AFRICAN COUNTRIES: THE FELDSTEIN AND HOROIKA APPROACH**

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### **Abstract**

The paper re-examines the level of capital mobility in 37 Sub-Saharan African countries by employing the Feldstein and Horoika framework over the period of 1980-2015. The study utilizes panel data to assess the degree of capital flows in these countries. The study findings reveal low saving-investment correlation in Sub-Saharan African countries, which indicates the presence of a high degree of capital mobility in the region. This is consistent with the previous empirical studies that employed the Feldstein-Horoika methodology in less developed countries. To complement poor savings, the study findings reveal that foreign aid, and international finance play a crucial role in financing domestic investments in many of the studied countries, with the exception of South Africa. The study recommends for innovations in improving domestic savings and regional investment environment.

**Keywords:** *Feldstein and Horoika, saving-investment relationship, capital mobility, Sub Saharan African countries*

## **1.0 INTRODUCTION**

Mobility of capital plays a crucial role in economic performance such as promoting effectiveness of macroeconomic policies (Padawassou, 2012), determining the exchange and tax rates (Levich, 1985), optimizing savings and speeding up the pace towards stable economic growth (Murthy, 2005). Furthermore, understanding the degree to which a country's domestic investment responds to domestic savings offers crucial insights to policymakers (Payne and Kumazawa, 2005). Thus, the examination of the evolution of capital flows is vital. Still, most of the recent literature on capital mobility (i.e. Drakos et al. 2018; But and Morley, 2016; Ketenci 2015, Feldstein and Bacchetta, 1989; Summers, 1988; Feldstein and Horioka, 1980) focuses on developed countries and few on African Sub-Saharan countries. Those in the latter include Agbetsiafa, (2002), De Wet and Van Eyden (2005), Payne and Kumazawa (2005), and Younas (2007). The elaborate economic and social changes that occurred in the region, especially the recent world economic crisis of 2007-2009, was expected, in one way or another, to affect the levels of capital flows.

Overall, the continent achieved an average real annual Gross Domestic Product (GDP) growth of 5.4 percent between 2000 and 2010. However, the growth slowed to 3.3 percent a year between 2010 and 2015. Recently, many efforts have been made to promote economic openness in many Sub-Saharan countries. However, there are noticeable gradual decreases in Foreign Direct Investment (FDI) inflows. According to UNCTAD's World Investment Report (2017), throughout 2013-2016, FDI flows to Sub-Saharan countries and Africa, in general, declined by 7 and 3 percent, respectively. For the private and public investment to propel growth, it requires domestic savings. In case of a gap between savings and investment, countries might need foreign

capital. Studies (i.e. Levine, 2000, 2005; Arslanalp *et al* 2010) have indicated that, financial development and investment have positive effects on economic growth. However, a low saving rate is a persistent challenge. In 2005, the World Bank estimates show that the region had the lowest saving rate among the rest of the underdeveloped areas, such as South Asia and East Asia. According to the African Economic Outlook report (2018), the region experienced a gradual decrease of saving rates from the average of 21.7 percent in 2004 to 15.9 percent in 2018. The savings ratio in Sub-Saharan countries averaged about 18 percent of the GDP, compared with 43 and 26 percent in East and South Asia, respectively.

Furthermore, the region suffers illicit financial outflows due to poor governance (Ndikumana, Boyce & Ndiaye, 2015). According to Fjeldstad *et al.* (2017), if the flight capital had been invested domestically, the state of poverty in Africa would have been reduced by an additional 2.5 percent annually. For example, there would have been 5.5 percent poverty reduction between 2002 and 2012. Poor saving rate is made worse because some of the donor countries and international organizations have started to cut aid to developing countries, including those located in Sub-Saharan Africa, which has affected capital movements as recently suggested by But and Morley (2016).

However, according to the Global Financial Index (2017), increased financial inclusion, through digital technology, has expanded the possibilities of accessing financial services for the unbanked adults in Sub-Saharan Africa. The report indicates further that about 21 percent of adults in the region own mobile money accounts, the highest share compared to the share of any other part of the world. Notably, the ongoing evolution of financial technology has delivered great benefits, including the

increase in savings for some of the Sub-Saharan countries (Jack and Suri, 2014).

Despite the recent financial, socio-economic, and structural changes noted in the region, the existing studies have so far used the data set below the year 2005 (e.g. (Agbetsiafa, 2002; De Wet and Van Eyden, 2005; Payne and Kumazawa, 2005; Younas, 2007)). These data, which did not take into account the recent socio-economic and structural changes, which occurred after the aftermath of the world financial crisis of 2007-2009.

The present paper applies the Feldstein and Horioka framework to investigate the evolution of capital mobility using the most recent set of data from the period 1980 – 2015. In addition, following the study by de Wet, the study adds Tanzania to make 37 Sub-Saharan countries. The study assesses whether the results of the previous studies regarding capital mobility are still providing additional empirical evidence, taking into account the recent world financial crisis of 2007-2009. In addition, the study examines the driving forces behind the current level of capital flows. Furthermore, the study incorporates other factors that have an influence in determining the level of capital mobility for underdeveloped countries: foreign aid, current account balance, and trade openness.

## **2.0 LITERATURE REVIEW**

The Feldstein-Horioka model is the most prominent approach in testing the level of capital mobility by examining the correlation between investment and savings. Using data from the years 1960-1974, Feldstein Horioka (1980) carried out a study in 16 Organization for Economic Co-operation and Development (OECD) countries and found that there was a high correlation between savings and investments. The author obtained the slope

coefficient of about 0.88, which indicates a low degree of capital mobility. The results were surprising because the OECD countries were perceived as having a high level of capital flow due to a higher degree of financial integration attained by the countries in the region, as well as the volume of trade among OECD countries and the higher rate of investments. Other economists considered this model as contrary to the economic theories. For that reason, they termed it as “the mother of all puzzles” (Obsfeld and Rogoff, 2000). In the aftermath of a study by Feldstein-Horoika, many other studies (i.e. Dooley 1984; Frankel 1985; Obstfeld 1985) were carried out to test and explain the puzzle. However, there have been mixed results from the previous studies in both developed and underdeveloped countries. The current study therefore focuses on reviewing the studies that employed panel data and cross-section methods for testing the correlation between savings and investment. For convenience sake, this study categorized the literature into three parts namely; studies based on developed economies, studies based on developing economies and studies based on both developed and developing economies

## **2.1 Studies based on Developed Economies**

Feldstein (1983) once again examined saving and investment relationships for OECD countries by extending the sample period for five years from the 1960-1979 period; his previous study with Charles Horoika covered the period of 1960-1974. The purpose of re-examining the extent of capital mobility in OECD countries was to capture the effects of various events that happened within that timeframe. For example, the impact of OPEC’s dramatic increase in prices in 1973 altered the current account deficits of industrial nations and ended interest equalization tax on foreign borrowing in 1974 by the United States, which lowered the needs of borrowing abroad by the United States multinationals to

finance their overseas investments. The study estimated saving retention of about 0.86, which implies a low level of capital mobility. The results obtained by Feldstein (1983) correspond to what was previously obtained by Feldstein and Horioka (1980).

However, Frankel (1991) contested the idea that a high correlation between investments and savings is a necessary sign of a low level of capital mobility; sometimes, saving-investment correlation can be high for the other reasons, which have nothing to do with capital mobility. Earlier, Obstfeld (1985) argued that population growth could result in a strong saving-investment correlation. Bayoumi (1990) was of the opinion that government policies targeting the current account of a country had been a significant factor in influencing unitary correlations between savings and investment. As Tesar (1991) argues, the correlation between saving and investment is because both saving and investment tend to react to some common conditions such as productivity shocks and low integration of international goods markets. Ozmen (2007) stated that the fixed-rate exchange regime could influence a strong correlation between savings and investment. Finally, the omission of some of the variables driving both saving and investment such as interest rates, the terms of trade, growth, and demographic variables might have significant effects on saving-investment relationships.

Many other studies regarding capital mobility were carried out in the OECD countries to test the validity of the work of Feldstein and Horioka. Some of those studies include Frankel *et al.* (1986), who conducted a study in 64 countries around the world, 50 developing countries, and 14 developed countries. The authors categorized of countries into two periods 1960-1973 and 1974-1984 and tested the Feldstein-Horioka approach. The findings

showed the level of capital mobility to be high in developing countries as compared to developed countries.

One of the most current and comprehensive studies on saving-investment relationship is that of Petreska and Blazevski (2013). Their study examined the strength of correlation between domestic savings and domestic investment in countries on transition by dividing them into three groups namely, Central and Eastern Europe (CEE), Commonwealth of Independent States (CIS), and South-East Europe (SEE). The study established that the puzzle of Feldstein-Horowitz was valid for all three groups from 1991 to 2010, but the savings and investment correlation was found to be lower than 1 in all three panels. They obtained a saving coefficient of 0.581 for SEE, 0.859 for CEE, and 0.465 for CIS. In addition, the study documented the increase in the value of saving retention coefficient for the panel that consisted of richer and larger countries.

The most recent study, albeit based on the industrialized economies is that of Drakos *et al.* (2018), the study examined the correlation between saving and investment in 14 European Union (EU) countries for the period of 1970-2015 and obtained a saving-retention coefficient of 0.6, which is statistically significant. The findings of their study indicate the existence of moderate capital mobility in the EU zone. Furthermore, they concluded that the Feldstein-Horowitz model is partially valid for the panel of 14 EU countries.

## **2.2 Studies based on both Developed and Developing Economies**

Bahmani and Chakrabarti (2005) used the Feldstein-Horoika puzzle to investigate the strength of the saving-investment relationship for the period of 1960 – 2000 in 126 countries. The authors employed the panel data regression techniques, and whose results show the savings retention coefficient of 0.54 to 0.69, which implies the existence of a low level of capital movements. The findings also revealed that countries that are participating highly in international trade are likely to have a weaker savings-investment correlation compared to countries that are not participating actively in international trade.

Dzhumashev and Cooray (2017) undertook a study to estimate capital flows for the panel of 116 countries disaggregated into Sub-Saharan Africa, North Africa, OECD, Middle East, South Asia, and East Asia and Pacific. The study revealed the savings retention coefficient of 0.32 for OECD panel, which is in line with the results of Feldstein and Horoika, and it was 0.11 for East Asia and the Pacific. Sub-Saharan Africa recorded the lowest savings retention coefficient of 0.01. Generally, the study obtained the low saving – investment coefficient ratio for all regions, except for the OECD panel, which is constituted by high-income countries. Moreover, the savings-investment relationship is obtained in the Middle East, South Asia, as well as North Africa was not statistically significant. It is important to note that the study by Dzhumashev and Cooray (ibid) included South Africa in a panel group of Sub-Saharan Africa, which was used for the estimation of capital flows. Other studies apart from South African in the estimation panel of the emerging economies include Chang and Smith (2014), and Herwatz and Xu (2010). the inclusion of South Africa in the panel of Sub-Saharan African countries may affect the level of capital mobility, given the nature



of its economy, which is quite different from that of the rest of the countries within the zone in terms of growth and market attractiveness (De Wet and Van Eyden, 2005). In addition, bigger and richer countries generate enough savings to finance their domestic investment and ultimately decrease the need of borrowing externally (Petreska and Blazevski, 2013; Wacziarg and Vamvakidis, 1998).

### **2.3 Studies on Developing Economies**

Padawassou (2012) carried out a study in 22 African countries using Feldstein-Horoika framework to examine the extent of capital mobility using time series and dynamic heterogeneous panel approach. The findings revealed that the saving rate coefficients were higher for some countries and, at the same time, lower for other countries. This implies that, the dynamic level of capital mobility was lower and higher at the same time. Therefore, the results are in contrast with the findings obtained by Feldstein-Horoika (1980), which hold that less developed countries have a high degree of capital mobility. Furthermore, the saving retention coefficient results documented by panel data results are estimated to be 0.542, which indicates a moderate extent of capital mobility. Thus, the study concludes that the Feldstein-Horoika puzzle is invalid for African countries. The findings of this study are consistent with the findings in studies by Cooray and Sinha (2005) and Agbetsiafa, (2002) which were carried out using a sample of 20 African countries to examine the saving-investment relationship. Their study findings revealed a weak saving-investment correlation, which implies that investments in the study African countries are not largely financed by domestic savings.

Cyrille (2010) used time series and panel data analysis to test Feldstein-Horowitz puzzle accounting for the correlation between inward and outward capital movements in 15 Sub-Saharan Africa over the period of 1980-2000. The findings supported earlier findings on the existence of low saving-investment correlation in case of developing economies. They obtained saving-investment coefficient that moves from 0.208 to 0.125 and from 0.237 to 0.168 for 3- and 5-year averages respectively. Moreover, according to the authors the downward movement of saving retention coefficient documented by the previous studies in developing countries resulted from omission of some relevant factors that influence investment positively such as foreign aid and trade openness. The study also recommended for the development of efficient financial market in order to assist portfolio diversification.

Islam *et al.* (2015) utilized the Feldstein-Horowitz model to estimate the capital mobility level in 40 developing countries throughout 1960–2013 using panel data regression analysis. The study results revealed the existence of capital mobility in developing countries, which was indicated by the reported slope coefficient value of about 0.27. Furthermore, the level of the documented capital mobility was much higher than the level originally obtained by Feldstein and Horowitz. The study also noted the presence of restrictions on capital movements in some of the developing countries. This might have been explained by actions of certain countries; for example, Zimbabwe imposed capital controls during the period of hyperinflation in 2008 to limit the considerable amount of funds that were moving outside the country (Pettinger, 2016). Furthermore, the attained degree of capital mobility, which is much higher as compared to that of the past decade, has been strongly attributed by the effects of a higher degree of globalization as well as economic integration.

There have been innovations in the Feldstein-Horioka framework to take the reality of the African economies by introducing other explanatory variables that exert an influence on investment; such variables include openness, current account balance, and foreign aid.

One of the few studies that focused on Sub-Saharan Africa and incorporated additional variables, which are relevant to African countries, such as current account balance, foreign aids, and openness include De Wet and Van Eyden (2005). The study applied the Fixed Effects and Random Effects techniques to examine the saving-investment relationship in 36 Sub-Saharan countries over the period ranging from 1980 to 2000. The study reported the existence of capital mobility as reported by previous studies conducted in the region. The study also documented savings retention coefficient of 0.314, 0.286, and 0.349 by using pooled model, random effects, and fixed effects techniques, respectively.

Payne and Kumazawa (2005) used a sample of 29 Sub-Saharan African countries for the data set ranging from 1980 to 2001 and employed pooled OLS, Fixed Effects, and Random Effects methods to measure the mobility of capital. The study findings revealed a low savings coefficient, as indicated by previous studies on developing countries. This study also noticed an ongoing increase in the extent of capital mobility enhanced by an increase in the level of investment. The weak savings-investment correlation in the region could be explained by the number of factors which have a positive effect on investment such as foreign aid, and the degree of economic openness (Isaksson, 2001) and financial structures of the developing countries (Kasuga, 2004).

This paper adds two issues; the number of countries included in

the sample is enlarged to 37 Sub-Saharan African countries. In addition, the study used the most recent set of data ranging from 1980-2015 to capture the evolution of capital mobility. In addition, to take into account the realities of African economy the study involved additional variables such as foreign aid and current account balance so as to draw conclusions that are more accurate as well as suggesting meaningful policy recommendations for the countries involved in the sample.

### **3.0 METHODOLOGY**

This paper seeks to investigate the level of capital mobility in 37 Sub-Saharan African countries using the Feldstein and Horioka's approach. Three different panel estimation techniques namely, Pooled OLS, Random Effects, and Fixed Effects, were employed in estimating the extent of capital mobility. The advantages of utilizing panel data are twofold. First, the technique provides robust and more efficient estimation results (Baltagi, 2005). Second, the use of Fixed Effects model permits the capturing of heterogeneity of individual countries (Gujarati and Porter, 2009). Finally, this study runs the Hausman Test to check the suitability of Fixed Effects and Random Effects (Hausman, 1978).

#### **3.1 Data**

The study employed a data set ranging for the year 1980-2015. The annual data for all of the variables namely, investment, savings, current account balance, foreign aid, and economic openness, are taken from the World Bank Development Indicators database. Moreover, unlike in the previous studies, which were carried out in the Sub-Saharan African region, the sample period covered by this study incorporates the recent financial crisis of 2007-2009. For the list of countries included in the sample and variables employed in this study, see **Appendix 1**.

Testing for panel unit roots is one of the standard practices in the contemporary panel data econometrics. Panel unit root tests are employed to determine whether the variables are stationary or otherwise because it is necessary to assess the order of integration in any data series that involves time-series data. This study used the IPS unit root test as proposed by Im, Pesaran, and Shin (1999). The application of the IPS test has shown that all variables are stationary in levels, allowing the study to employ stationary panel data techniques.

### 3.2 Panel Estimation

The panel data techniques were utilized in investigating the level of capital mobility using the model proposed by Feldstein and Horioka (1980). Their model based on investigating the correlation between savings and investment in OECD countries. To accomplish their study objectives, the authors estimated the following equation.

$$\left(\frac{I}{Y}\right)_i = \alpha_i + \beta \left(\frac{S}{Y}\right)_i + \varepsilon_i$$

However, due to the existing differences in the economic context between OECD and Sub-Saharan African countries, this study applies a modified form of the equation as in the study of De Wet and Eyden (2005). This captures the realities of the economies of the African countries and consequently obtains a robust estimation. Hence, this study employs the following equation:

$$\begin{aligned} \left(\frac{I}{Y}\right)_{it} = & \alpha_{it} + \beta_1 \left(\frac{S}{Y}\right)_{it} \\ & + \beta_2 \left(\frac{CA}{Y}\right)_{it} + \beta_3 \left(\frac{Aid}{Y}\right)_{it} + \beta_4 (Open)_{it} + \beta_5 \tau_{it} \\ & + \beta_6 \delta_{it} + \varepsilon_{it} \end{aligned}$$

Here  $\left(\frac{I}{Y}\right)_{it}$  denotes the ratio of gross domestic investment to GDP ratio in country  $i$  at time  $t$ ;  $\left(\frac{S}{Y}\right)_{it}$  represent domestic saving to GDP ratio;  $\left(\frac{CA}{Y}\right)_{it}$  stands for current account to GDP ratio and  $\left(\frac{Aid}{Y}\right)_{it}$  is the ratio of aid to GDP. De Wet and Eyden (2005) included foreign aid, and the current account variables to have a deeper insight into the contribution of these factors on saving behaviour and also make provision for foreign investment funds influenced by the current account. Previous studies apart from that of De Wet and Eyden (Ibid) did not include the current account and the foreign aid variables in one equation to avoid multicollinearity. Furthermore, the insertion of openness into the model is important since it could have a significant positive effect on the extent of capital flows as suggested by Younas and Chakraborty (2011). According to the authors, financial liberalization offers bigger opportunities for domestic savings to finance investment projects that provide the highest marginal returns in the world. Therefore, empirical models that do not take into account financial openness would possibly face an upward bias on the saving-investment coefficient.

As in De Wet and Eyden (2005), the model involved two interactive dummy variables. Interactive dummy for South Africa ( $\tau$ ) formed by multiplying the saving rate of each country by South African dummy variables; this considers the fact that the South African economy is at a different level from the rest of the Sub-Saharan African countries. Therefore, it may have a dissimilar level of capital mobility and saving behaviour because it possesses some economic characteristics of a developed country. Thus, if saving behaviour differences for South Africa

are not well controlled, then they can boost the saving rate coefficient for the rest of the region.

Following De Wet and Eyden (2005), the time interactive dummy ( $\delta$ ) is created by multiplying a time trend with the savings rate of each country. Interactive dummy variables are introduced in order to capture the changes taking place in the saving rate for the period in order to assess the policy changes aimed at promoting capital mobility. Where  $\beta_6$  is negative, it indicates that there is a decrease in the saving rate each year, and capital is becoming more mobile, therefore the implemented policy changes are effective. The positive value of  $\beta_6$  implies that there is an increase in the saving rate each year and capital is becoming more immobile. The heterogeneity of the country is captured by the country-specific coefficient  $\alpha_{it}$ .

## **4.0 EMPIRICAL RESULTS**

### **4.1 Descriptive Statistics**

Prior to empirical estimation of the model determining the level of capital mobility in Sub-Saharan Africa, data transformation was conducted in order to establish the stationarity and normality of the data relating to the study. First descriptive statistics for the data were undertaken for the variables in levels.

**Table 1: Summary of test for variables**

	<b>IR</b>	<b>SR</b>	<b>CA</b>	<b>OPEN</b>	<b>AID</b>
Mean	0.204304	0.101454	-0.060894	350.6285	0.130686
Median	0.193089	0.094205	-0.055577	0.270126	0.907358
Maximum	0.681044	0.660200	0.698590	388861.0	1.852010
Minimum	0.027329	-0.844017	-0.920580	0.000000	0.000160
Std. Dev.	0.091998	0.158614	0.124689	11671.66	0.147987
Skewness	1.351732	-0.984207	0.097400	33.27162	3.888508
Kurtosis	6.410899	8.724831	11.77736	1108.001	29.39829
Jacque-Bera	877.0135	1694.986	3564.950	5667.7294	35027.50
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	226.7775	112.6140	-67.59261	389197.6	145.0616
Sum Sq.Dev.	9.386130	27.90072	17.24209	1.511051	24.28721
Observations	1110	1110	1110	1110	1110
Cross sections	37	37	37	37	37

**Source:** Prepared by the author’s computation using E-views 10.

Table 1 presents the summary of the statistical results for the variables incorporated in the study. The descriptive statistics are helpful in providing an idea on the stability, normality and trend of the variables employed in our model. From the table above Jacque-Bera probability is 0 for all of the variables, this means that it is extremely likely that the data is drawn from normal distribution.

Also, the large variation in the variable openness, where the standard deviation for openness is far above the mean. Thus, for accuracy we also report the median, openness, which for the overall sample is 27%, well below the mean. This follows the skewness of the distribution whereby the bulk of the sample have relatively poor rate of openness, while a few has heavy rate of openness at the top that pulls up the mean.



## 4.2 Unit Root Test

Testing for panel unit roots is one of the standard practices in contemporary panel data econometrics. Panel unit root tests are employed to determine whether the variables are stationary or otherwise to avoid the problem of unreliable results due to spurious regression. This study used the IPS unit root test as proposed by Im Pesaran, and Shin (1999) and, PP Fisher Chi-square test. Application of the IPS and PP tests have shown that all variables are stationary in levels, allowing the study to employ stationary panel data techniques. See table 2 for unit test results.

**Table 2:** Unit root test results at levels

Variables	Im, Pesaran and Shin W-stat		PP-Fisher Chi-square	
	Test Statistic	P-value	Test Statistic	P-value
Investment	-3.23889	0.0006	162.635	0.0000
Saving	-2.97358	0.0015	182.543	0.0000
Current Account	-3.76045	0.0001	427.649	0.0000
Foreign Aid	-1.03637	0.0150	136.98	0.0000
Openness	-1.87732	0.0032	140.905	0.0000

**Source:** Prepared by the author’s computation using E-views 10.

## 4.3 Results from Regression Analysis

In estimating the level of capital mobility in 37 Sub-Saharan African countries over the period of 1980-2015, panel data estimation techniques are employed, particularly pooled, random effects, and fixed effects. See **Table 3** for the estimates from pooled, fixed effects, and random-effects models.

**Table 3: Results for Pooled-Effects, Fixed-Effects and Random-Effects**

Variable	Pooled Effects	Fixed Effects	Random Effects
Constant	0.156 (0.000) ***	0.164 (0.000) ***	0.165 (0.000) ***
$\left(\frac{S}{Y}\right)_{it}$	0.231 (0.000) ***	0.086 (0.000) ***	0.101 (0.000) ***
$\left(\frac{CA}{Y}\right)_{it}$	-0.249 (0.000) ***	-0.233 (0.000) ***	-0.233 (0.000) ***
$(Open)_{it}$	1.79 (0.0911) *	-1.67 (0.0922) *	-7.91 (0.0963) *
$\left(\frac{Aid}{Y}\right)_{it}$	0.073 (0.000) ***	0.135 (0.000) ***	0.121 (0.000) ***
SA Dummy			-0.037 (0.5791)
Adjusted R-squared	0.601	0.516	0.139

**Note:** P-values reported in parentheses.

Where, (\*\*\*) and (\*) stands for significance of the coefficient at 1% and 10% level of significance respectively

#### (a) The Pooled Model

The model does not take into consideration any individual country specific effects. It restricts the intercept and the slope parameter to be the same for the entire panel. Using the pooled model, the estimates for the saving rate coefficient is 0.231, which is statistically significant at 1 percent. The saving rate coefficient marked by this study is rather low in comparison to the previous studies including De Wet and Eyden (2005) and that of Payne and Kumazawa (2006) that investigated the issue in Sub-Saharan African countries. Moreover, the negative sign of the current account rate of coefficient partly indicates that the region has received a sizeable amount of funds for investment. The significance of aid ratio indicates that foreign aid largely contributes to financing regional investments. the fact that the openness variable is significant, suggests that economic openness is essential in favouring the existing weaker correlation between domestic savings and domestic investment.

#### (b) The Fixed Effects Model

Fixed-effects model allows the intercepts to vary over time but it is assumed to be the same across countries at each given point in time. The estimates for the fixed effects model from Table 1 report the saving rate coefficient of 0.086 and Adjusted R-Squared value of 0.516. These results also imply the presence of capital mobility in the region, the results are consistent with the results of the previous studies in Sub-Saharan Africa (see for example, Agbetsiafa, 2002; De Wet and Van Eyden, 2005; Payne and Kumazawa, 2005) Again, the current account coefficient tells a similar story that the funds for investment have flown into the zone. Aids coefficient ratio indicates that the foreign aid is largely financing the regional investments. In addition, this model did not include the South African dummy since the variable will be wiped out by the demeaning process used in the WITHIN estimation. The WITHIN estimation means both independent and dependent variables are subtracted from the variable's values observed. Therefore, the demeaned variables are likely to have a mean of zero (0) for every case.

### **(c) The Random-effects model**

The model normally recognizes the existence of cross section heterogeneity but diverges from the fixed effect models in the sense that it assumes heterogeneity effects are produced by a specific distribution. The random-effects model, revealed the presence of a significant low saving rate coefficient of 0.100849 (0.101) as depicted from Table 1. Moreover, this result in the Feldstein and Horoika model would imply the presence of capital mobility. Furthermore, the random-effects model demonstrated that financial aid is significant in generating investment with a coefficient of 0.121, compared to that of the fixed effects model, which was 0.135. The time dummy implies that the degree of capital mobility increased from 1980. On the other hand, the capital account ratio coefficient shows that there is an inflow of investment funds into the Sub-Saharan Africa.

On the other hand, Hausman test results are insignificant, which implies they are in favour of the random-effects models

## **5.0 CONCLUSION**

This paper re-examines the validity of the Feldstein-Horoika approach based on hypothesis that low domestic saving-investment correlation implies high level of capital mobility in 37 Sub-Saharan African countries over the period of 1980-2015 considering the recent financial crisis of 2007-2009. Based on panel data estimation techniques, the empirical results indicate the presence of a low saving rate coefficient in Sub-Saharan African countries, which implies the presence of a high degree of capital mobility in the region. This result is in line with the previous empirical studies that employed the Feldstein-Horoika approach to estimate the extent of capital mobility in the region by the use of panel data econometric modelling. prior studies include De Wet and Van Eyden (2005), Agbetsiafa (2002), Younas (2007), and Payne and Kumazawa (2005).

The persistence of a robust low saving-investment correlation might be partially explained by the excessive consumption of foreign aid by these countries to finance their domestic investment. A low saving rate among Sub-Saharan African countries is another cause of the weak correlation between savings and investments. This is due to low economic capacity of these countries to generate adequate domestic savings to meet their domestic investment needs due to inflation and shifts in demographics (Eyraud, 2009). In addition, economic openness is favourable to higher levels of investment. Since the wave of structural adjustments in the 1980s, many lesser-developed countries have undergone economic reforms, including opening of their economies to international trade and international investment. Such initiatives are more likely to influence the degree of capital movements in the region. Moreover, targeting the current account can have some influence on the level of capital mobility.

In this light, policymakers in Sub-Saharan countries should emphasise on boosting the level of domestic savings to generate adequate funds for financing domestic investment and move away from the dependence of foreign aid.

Moreover, because the region seems to depend so much on foreign investments, Sub-Saharan African countries should ensure they protect investors by making adequate efforts on the maintenance of the existing laws and regulations to attract financial inflows. This is because countries with no protection for investors, and poor maintenance of laws and order are naturally

less attractive to investors. A good example is Zimbabwe, which was suffocated with capital flight resulting from her indigenization policies in 2008.

Since domestic savings are largely financed by foreign investment, there is a need of analyzing macroeconomic policies, particularly taxes that are levied on foreign investments, as investors normally prefer to invest in countries with better yields. Therefore, if taxes levied on capital investments are very high in relation to the other parts of the world, it is likely to discourage financial inflows in terms of investments. However, transparency and infrequent policy changes remain the key factors for attaining investors' confidence.

Overall, we can conclude, that the Feldstein-Horioka puzzle is still valid for the emerging economies. Furthermore, the findings suggest that the funds in the form of FDI and international financial assistance kept flowing into the Sub-Saharan African countries despite the impact of the world financial crisis of 2007-2009.

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## APPENDIX

*I: List of countries included in the sample*

Country	
Benin	Mali
Botswana	Mauritania
Burkina Faso	Mauritius
Burundi	Mozambique
Cameroon	Namibia
Central African Republic	Republic of Congo
Chad	Nigeria
Comoros	Niger
Cote d'Ivoire	Rwanda
Ethiopia	Sao Tome and Principe
Gabon	Senegal
Gambia	Seychelles
Ghana	South Africa
Guinea-Bissau	Swaziland
Kenya	Tanzania
Lesotho	Togo
Madagascar	Uganda
Malawi	Zambia
	Zimbabwe