Navarra Center for International Development

Working Paper nº 08/2011

EMPIRICAL ASPECTS OF CAPITAL FLIGHT IN KENYA, 1970-2009

Robert Mudida
Strathmore Business School
Kenya

Navarra Center for International Development
WP-08/2011

Empirical aspects of capital flights in Kenya: 1970 - 2009
Robert Mudida
Working Paper No. 08/2011
December 2011

ABSTRACT

Capital flight remains a fundamental academic and policy issue for developing countries. During the early 1990s the debt crisis appeared to have been contained and attention to the capital flight phenomenon waned. However, capital flight still remains a serious problem for many developing countries. The outbreak of several major financial crises in the international financial system from the mid-1990s, notably in Latin America and Asia, brought renewed attention to the phenomenon of capital flight. These crises led to large outflows of capital from developing countries and the issue of capital flight regained its importance. In many developing countries capital flight constitutes an important proportion of the very resources that are critical for financing economic growth and reversing adverse economic trends (Hermes, Lensink and Murinde 2002: 1). The magnitude of capital flight from Africa has increased considerably in recent years accompanied by widespread fluctuations and volatility (Salisu 2005: 1). Despite the progress being made by some African economies towards economic and political reforms much more reform deepening is necessary to create a conducive environment for private sector participation generally and capital flight reversal. Kenya is a typical small developing economy and has experienced challenges of trying to contain capital flight.

Corresponding author: Robert Mudida
Strathmore Business School
Nairobi, Kenya

Email: rmudida@gmail.com

Introduction

Capital flight remains a fundamental academic and policy issue for developing countries. During the early 1990s the debt crisis appeared to have been contained and attention to the capital flight phenomenon waned. However, capital flight still remains a serious problem for many developing countries. The outbreak of several major financial crises in the international financial system from the mid-1990s, notably in Latin America and Asia, brought renewed attention to the phenomenon of capital flight. These crises led to large outflows of capital from developing countries and the issue of capital flight regained its importance. In many developing countries capital flight constitutes an important proportion of the very resources that are critical for financing economic growth and reversing adverse economic trends (Hermes, Lensink and Murinde 2002: 1). The magnitude of capital flight from Africa has increased considerably in recent years accompanied by widespread fluctuations and volatility (Salisu 2005: 1). Despite the progress being made by some African economies towards economic and political reforms much more reform deepening is necessary to create a conducive environment for private sector participation generally and capital flight reversal. Kenya is a typical small developing economy and has experienced challenges of trying to contain capital flight.

This paper considers capital flight in Kenya using different measures of capital flight between 1970 and 2009. It begins by reviewing the literature on capital flight measurement. It then measures capital flight using the different measures with data in the Kenyan context. Once the different measures of capital flight for Kenya are arrived at, a univariate analysis is conducted on the flight data resulting from each measure. This entails conducting tests of stationarity on the data and also modelling the time series properties of the data. In addition, the conditional volatility of the data is modelled using ARCH and GARCH models where applicable.

A Review of the literature on capital flight measurement

The literature on capital flight provides a number of different measures of capital flight. These include the hot money measure, the residual measure and the Dooley measure. Two versions of the residual measure will be utilised: one based on the World Bank study (1985) and the other on the Morgan Trust (1986) version. Calculating capital flight based on the residual method remains the most popular in the literature.

Given that there is no consensus on the definition of capital flight, the measurement of capital flight is not straightforward. Several measures have been proposed and we will first critically appraise each one. The balance of payments approach for estimating capital flight was developed by Cuddington in 1986. He argued that the most important characteristic of flight capital was it was "hot" money. Based on this analysis his estimates of capital flight are equal to the sum of reported short-term capital exports by the private non-bank sector and the balance of payments residual, errors and omissions (Cuddington 1986: 3). This method is based on the idea that capital flight goes unrecorded due to the illegal nature of these capital movements. The unrecorded capital movements are believed to appear in the balance of payments section corresponding to net errors and omissions. By concentrating on short-term flows, medium and long-term flows are excluded since they are viewed as being normal in character. This method is alternatively known as the hot money method and capital flight (KF) under this method is calculated as follows:

$$KF_h = SKO + EO \quad (1)$$

where SKO is the total amount of short-term capital outflows while EO corresponds to net errors and omissions. Challenges with this measure of capital flight are that it fails to account for capital flight in the form of acquisition of long-term financial and real assets and also neglects trade misinvoicing and smuggling. The omission of long-term capital flows contributes to an understatement of capital flight whereas trade misinvoicing could either underestimate a current account surplus or overestimate a deficit leaving the net bias of the measure ambiguous (Fedderke and Liu, 2002).

A more inclusive measure of capital flight based on the residual method has also been used extensively in the literature (Hermes, Lensink and Murinde 2002: 2-3). This method measures capital flight indirectly by comparing the sources of capital inflows (that is net increases in external debt and the net inflow of foreign investment) with the uses of those inflows (that is, the current account deficit and additions to foreign reserves). The approach begins from the standard balance of payments framework. In principle, if the balance of payments statistics were to be used (reported by the International Monetary Fund Balance of Payments Statistics), the uses and sources of funds should be equal. However, given that these statistics may not accurately measure flows, and in particular private capital flows, World Bank statistics on the change in external debt are used instead. If the sources, calculated by using World Bank debt data, exceed the uses of capital inflows, the difference is termed capital flight. The residual method recognizes the challenges of separating abnormal from normal capital outflows and as such measures all unrecorded private capital outflows as being capital flight.

The residual method calculates capital flight as follows:

$$KF_r = \Delta ED + FI - CAD - \Delta FR \tag{2}$$

where: KFr is capital flight according to the residual method, ED is the stock of gross external debt reported in the World Bank data, FI is the net foreign investment inflows, CAD is the current account deficit and FR is the stock of official foreign reserves. A challenge with this measure is that revisions of foreign debt statistics or exchange rate changes on the level of debt reserves will influence the measure directly and introduce errors of measurement. In addition, the method also suffers from the challenges of trade misinvoicing thus making its net bias ambiguous (Fedderke and Liu, 2002).

The residual method has, however, been widely used in the literature, with some minor modifications in some cases. This standard approach described above has been used, for example, by the World Bank (1985) and Erbe (1985).

Morgan Guaranty (1986) incorporates an additional item which is the change in short-term foreign assets of the domestic banking system (ΔB). This modification is introduced to focus on non-bank capital flight. Thus capital flight according to the Morgan Guaranty variant of the residual method can be calculated as follows:

$$KF_m = \Delta ED + FI - CAD - \Delta FR - \Delta B \tag{3}$$

Dooley (1986), like Cuddington (1986), on the other hand distinguishes normal from abnormal or illegal capital flows. He considers capital flight as the total amount of externally held assets of the private sector that do not generate income recorded in the balance of payments statistics of a country. Capital flight in this context is refers to all capital outflows based on the desire to place wealth beyond the control of the domestic authorities.

Dooley measures capital flight by computing capital outflows as reported in balance of payments statistics and then makes a number of modifications. Firstly, errors and omissions are taken into account to measure the total capital outflows. Secondly, the difference between the World Bank data on change in the stock of external debt and the amount of external borrowing as reported in the balance of payments statistics. If the first is larger than the second, this difference is assumed to be part of capital flight. Thus the amount of total capital outflows is calculated as follows:

$$KF_d = \Delta ED + FI - CAD - \Delta FR - EO - \Delta WBIMF \qquad (4)$$

where: EO is net errors and omissions and WBIMF is the difference between the change in the stock of external debt reported by the World Bank and foreign borrowing reported in the balance of payments statistics published by the IMF.

Thirdly, the stock of external assets that correspond to the reported interest rate earnings in the balance of payments is computed by using a representative market interest rate. Thus the stock of external assets corresponding to reported interest earnings is:

$$ES = \frac{INTEAR}{r_{us}} \qquad (5)$$

where ES is external assets, rus is the US deposit rate (assumed to be representative international market interest rate) and INTEAR is reported interest earnings. The difference between total capital outflows and the change in the stock of external assets corresponding to reported interest income is measured as capital flight. Capital flight according to Dooley is then measured as follows:

$$KF_d = TKO - \Delta ES \qquad (6)$$

Although the Dooley method is conceptually different from the residual method, Claessens and Naude (1993) show that in practice capital flight measured according to the Dooley method and the residual method are fairly similar given that most of the data used for calculation are the same in both cases. It will be interesting to investigate whether these two methods given different results in the Kenyan context.

The amount of trade mis-invoicing has also been used by some authors as a measure of capital flight (Classens and Naude: 1993). Trade mis-invoicing is determined by undertaking a comparison of trade data from both the importing and exporting country. The method assumes that importers are involved in capital flight when they report higher values of the same commodities by exporters. In return, exporters are considered to be involved in capital flight when they report lower values of exported goods compared to the reported value of the same goods by importers. Advocates of this measure argue that abnormal capital outflows of residents may be included in export under-invoicing and/or import over-invoicing, since both these malpractices provide channels to siphon domestically accumulated wealth outside the country. A challenge with this method is, however that there is often poor quality of export and import figures arising from trade invoicing in many developing countries.

No previous capital flight studies have attempted to model volatility of capital flight under different measures.

Theoretical Framework

The paper will investigate capital flight as part of a portfolio allocation decision in the Kenyan context. Capital flight in the context of portfolio allocation is implicit in much of the theoretical and empirical literature on capital flight. The simple standard portfolio model developed by Sheets (1995) will provide a theoretical framework.

A simple portfolio model of capital flight from Sheets (1995)

Consider an agent who maximises a constant relative risk aversion utility function $U(W_t, \sigma_p^2)$. The agent invests a share of wealth α in the domestic asset which has expected return $\bar{r}$ and variance σ^2, and share (1-α) in the foreign asset which has expected return $\bar{r}_f$ and variance σ_f^2. Covariance between the two assets is σ_{12}.

End of period wealth is:

$$\bar{W}_{1}t = (1 + \bar{r}) + (1 - \alpha)(1 + \bar{r}_{1}f) \; W_{1}t$$

The variance of the portfolio is:

$$\sigma_p^2 = [\left(\alpha^2\sigma^2 + (1-\alpha)\right]^2 \quad \sigma_f^2 + 2\alpha\,(1-\alpha)\sigma_{12.}\right)$$

The agent's optimisation problem can be solved to yield the demand function for the domestic asset:

$$D_{it} = \left[\frac{\sigma_f^2 - \sigma_{12}}{\sigma_p^2} + \frac{(\overline{r} - \overline{r_f})}{\theta\sigma_p^2}\right] W_t$$

where θ is the coefficient of relative risk aversion. Demand for the home and asset increases linearly with wealth, decreases with risk aversion and increases with differential between the domestic interest and world interest rate.

If the expected return and variance of the domestic asset were equal to that of the foreign asset, the agent would diversify his portfolio and hold exact half of his wealth in each asset. When the expected returns and variances of the assets differ, however, we can express the home asset demand as follows (using a first order Taylor expansion around the foreign expected return and variance):

$$D_{it} \cong \overline{D_t}\left[1 + \frac{1}{\sigma_f^2 - \sigma_{12}}\left[\frac{(\overline{r} - \overline{r_f})}{\theta} - \frac{1}{2}\left(\sigma^2 - \sigma_f^2\right)\right]\right]$$

This expression highlights two channels which reduce the demand for the home asset and increase demand for the foreign asset. These are the types of factors which lead to capital flight:

Firstly, conditions of macroeconomic and political instability increase the risk of investing domestically relative to holding foreign assets. In the expression these effects operate through the third term $-\frac{1}{2}\left(\sigma^2 - \sigma_f^2\right)$

Secondly, the lowering of the expected domestic return relative to the foreign return. This operates through the second term which is $\frac{(\overline{r} - \overline{r_f})}{\theta}$

The standard portfolio model therefore suggests two key incentives for capital flight:

Firstly, after tax domestic returns adjusted for expected depreciation that are lower than foreign returns.

Secondly, domestic returns that have a higher volatility than or risk than foreign returns.

The model implies that in addition to the expected rate of return on an asset wealth holders must consider its implications for portfolio risk which is determined by the individual riskiness of the asset and its co-variance with the rest of the portfolio. Foreign assets can be regarded as a relatively safe asset with the absolute level of risk being similar for all asset holders, which the co-variance with domestic assets is usually low. Therefore the proportion of assets held abroad (1-α) depends both on the return of return on domestic assets $\overline{r}$ relative to foreign assets $\overline{r_f}$, and on their riskiness relative to foreign assets (Collier et. al. 1999). The literature on capital flight has identified a number of variables to correspond to the rate of return and risk variables in the standard portfolio model and has also proposed modifications to the standard model in certain situations.

Data Construction

The data for the measurement of capital flight are constructed using several sources: IMF Balance of payments Statistics Yearbooks are used, IMF international Financial Statistics, World Debt tables, and several Kenyan Economic Surveys compiled by the Kenya National Bureau of Statistics are used. All the data are in US dollar form and where data is in Kenya shillings, for example, in the Kenyan economic surveys or in some IMF international financial statistics the principal Ksh-dollar rate is used for the conversion.

Capital flight: the residual or indirect measure (KFr)

In this case the increase in external debt and net foreign direct investment is obtained from various issues of the World Debt Tables and Global Development Finance. The current account deficit and the increase in official reserves are obtained from Global Development Finance publications. Earlier data before 1975 are obtained from Economic surveys of the Kenya National Bureau of Statistics. Data on external debt, the current account deficit and the increase in official reserves for 2009 were obtained from the Economic Survey 2010 data compiled by the Kenyan National Bureau of Statistics and converted to US dollars using the IMF principal Ksh-dollar rate for 2009 (obtained from IMF Financial Statistics for 2010).

Capital flight: the Morgan Guaranty method (KFm)

This measure builds on the residual (World Bank) approach by deducting changes in bank foreign assets from the measure provided by the World Bank approach. Change in bank foreign assets are obtained from several issues of the IMF International Financial Statistics yearbooks so as to cover the sample period.

Capital flight: the hot money method (KFh)

Short-term capital outflows are computed from the IMF Balance of Payments yearbook by summing non-bank private short-term capital outflows and net errors and omissions (also obtained from the IMF balance of payments yearbooks). Short-term capital outflows are obtained by summing the following entries in the IMF balance of payments yearbooks:

Firstly, other investment: assets: currency and deposits: other sectors.

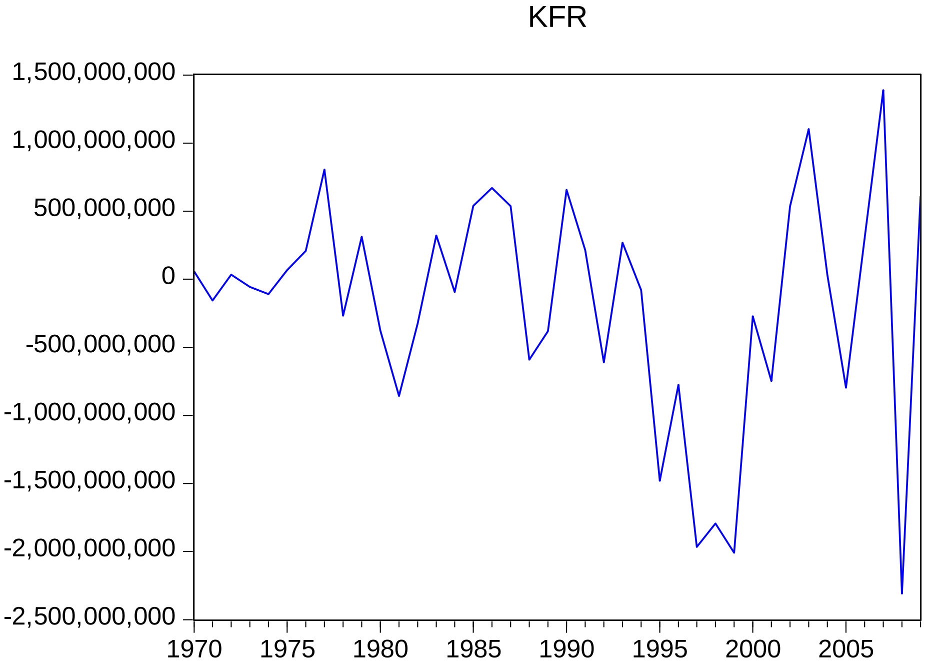
Secondly, other investment: assets: other assets: other sectors: short-term

Thirdly, other investment: liabilities: other sectors: short-term

Data Analysis of capital flight in Kenya using different measure

The data on capital flight in Kenya will now be analysed using the residual measure (World Bank), Morgan Guaranty, the Hot Money measure and the Dooley measure.

Capital flight in Kenya by the residual measure (World Bank), 1970-2009.



The diagram above suggests that capital flight measured by the residual approach (World Bank) over the sample period does not have a trend. The correlogram for the data is as follows:

Sample: 1970 2009
Included observations: 40

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.192	0.192	1.5864	0.208
. |*. |	. |*. |	2	0.182	0.150	3.0472	0.218
. |** |	. |*. |	3	0.215	0.166	5.1384	0.162
. | . |	. | . |	4	0.038	-0.050	5.2061	0.267
**| . |	***| . |	5	-0.261	-0.346	8.4790	0.132
.*| . |	.*| . |	6	-0.123	-0.096	9.2275	0.161
. | . |	. |*. |	7	0.018	0.183	9.2445	0.236
.*| . |	. | . |	8	-0.200	-0.057	11.341	0.183
. | . |	. | . |	9	-0.024	0.035	11.373	0.251
. | . |	.*| . |	10	-0.037	-0.150	11.451	0.323
. | . |	.*| . |	11	-0.054	-0.075	11.620	0.393
**| . |	.*| . |	12	-0.220	-0.177	14.537	0.268
. | . |	. |*. |	13	0.066	0.156	14.810	0.319
.*| . |	. | . |	14	-0.074	-0.009	15.165	0.367
.*| . |	. | . |	15	-0.084	-0.031	15.636	0.407
. |*. |	. |*. |	16	0.145	0.100	17.106	0.379
. |*. |	. | . |	17	0.142	0.048	18.575	0.353

.*| . |	.*| . |	18	-0.067	-0.176	18.917	0.397
. | . |	.*| . |	19	-0.010	-0.083	18.926	0.462
. | . |	.*| . |	20	-0.005	-0.140	18.927	0.527

The correlogram tends to suggest that the data is stationary since the ACF declines quickly to zero.

Tests for stationarity of data

ADF	Phillips-Perron	Ng-Perron
-4.929922	-5.033401	-18.5209
(-2.938987)	(-2.938987)	(-8.10000)

The ADF statistics suggest that capital flight by the residual approach is I(0). ADF statistics may be misleading since the flow variables may have been subject to structural breaks. The year 1993 coincides with a potential change in mean and increased variance because it saw a liberalisation of financial and foreign exchange markets in Kenya. ADF statistics tend to under-reject the null of a root. In our case, however, the ADF statistics reject the unit root and suggest that the series is stationary.

The non-parametric approach of the Phillips-Perron test allows for a very wide class of time series models in which there is a unit root and no generating model for the time series needs to be specified (Phillips Perron 1988). This includes ARIMA models

with heterogeneously as well as identically distributed innovations. The Phillips-Perron test seems to have significant advantages when there are moving average components in the time series and in this respect offers a promising alternative to the Dickey-Fuller procedures. The Phillips-Perron test uses nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms. This approach therefore allows for a very wide class of weakly dependent and possibly heterogeneously distributed data. The test accommodates models with a fitted drift and a time trend so that they may be used to discriminate between unit root non-stationarity and stationarity about a deterministic trend.
The Phillips-Perron test confirms that the data is stationary.

The Ng-Perron test

The Ng-Perron test is designed to address the problems of finite sample power and size that may potentially arise in the ADF and PP tests. The test allows for a structural break when the time of the break is unknown. This particular test allows for a one time structural change.

The Ng-Perron test provides further confirmation that the capital flight according to the residual measure is stationary.

Modelling the characteristics of the capital flight (World Bank) data

Since the series is stationary, we can model this stationarity using the Box-Jenkins methodology. Applying this methodology entails identification, estimation and diagnostic checking. An important aspect of the diagnostic checking is to test whether the residuals of the estimated model exhibit behaviour like white noise. Failure to find evidence of white-noise error terms indicates that the residuals still contain some useful information. This is tested using the Ljung-Box statistic applied to the residuals. The correlogram does not suggest a specific model we use. We therefore test several models using the Box Jenkins approach. Several models are tested and the AR(2) MA(2) is found to be appropriate.

Estimating the model as AR(2) MA(2) yields:

Dependent Variable: KFR
Method: Least Squares

Sample (adjusted): 1972 2009
Included observations: 38 after adjustments
Convergence achieved after 18 iterations
MA Backcast: 1970 1971

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	1.168360	0.130988	8.919589	0.0000
AR(2)	-0.633396	0.125833	-5.033615	0.0000
MA(1)	-1.117044	0.042449	-26.31472	0.0000
MA(2)	0.910550	0.032692	27.85256	0.0000

R-squared	0.233627	Mean dependent var	-1.92E+08
Adjusted R-squared	0.166006	S.D. dependent var	8.61E+08
S.E. of regression	7.86E+08	Akaike info criterion	43.90336
Sum squared resid	2.10E+19	Schwarz criterion	44.07574
Log likelihood	-830.1638	Hannan-Quinn criter.	43.96469
Durbin-Watson stat	1.978103		

Inverted AR Roots	.58-.54i	.58+.54i
Inverted MA Roots	.56+.77i	.56-.77i

The AR(1), AR(2), AR(3) and AR(4) terms are highly statistically significant. The inverses of the AR and MA roots of the characteristic equation are also shown. These can be used to check whether the process implied by the model is stationary and invertible. For the AR and MA processes to be stationary and invertible, respectively the invertible roots must be smaller than 1 in absolute value which they are in the above case.

The ACF and PACF functions under the AR(2) MA(2) model are provided below:

AR(2) MA(2)

Sample: 1972 2009
Included observations: 38
Q-statistic probabilities adjusted for 4 ARMA term(s)

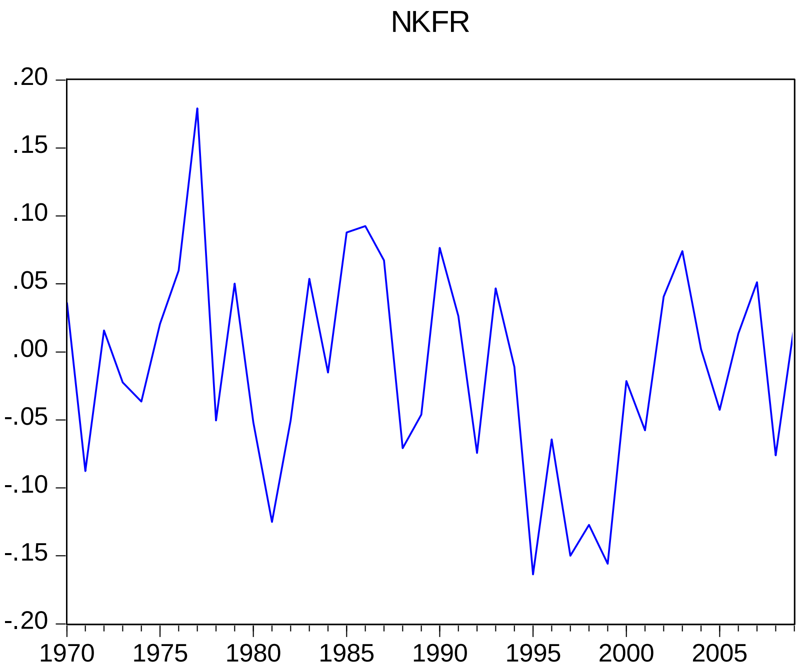
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	-0.013	-0.013	0.0064	
.*| . |	.*| . |	2	-0.083	-0.084	0.3008	
. |*. |	. |*. |	3	0.110	0.108	0.8252	
. | . |	. | . |	4	0.064	0.060	1.0080	
**| . |	**| . |	5	-0.223	-0.208	3.2888	0.070
. | . |	. | . |	6	-0.020	-0.026	3.3083	0.191
. |*. |	. | . |	7	0.103	0.066	3.8317	0.280
.*| . |	.*| . |	8	-0.184	-0.157	5.5470	0.236
. | . |	. |*. |	9	0.030	0.076	5.5936	0.348
. | . |	. | . |	10	0.067	-0.009	5.8353	0.442
. | . |	. | . |	11	0.037	0.054	5.9139	0.550
.*| . |	.*| . |	12	-0.192	-0.159	8.0656	0.427
. | . |	. | . |	13	0.069	0.006	8.3544	0.499
.*| . |	**| . |	14	-0.158	-0.207	9.9270	0.447
.*| . |	.*| . |	15	-0.167	-0.109	11.779	0.380
. |*. |	. |*. |	16	0.199	0.211	14.510	0.269

The Q-statistic shows no evidence of autocorrelation at 5% level of significance (we cannot reject the null hypothesis of no autocorrelation) indicating that the model is taking into account all the relevant information in the data and hence the model seems appropriate.

Normalising the data

The data can be normalised using GDP for the relevant year.

RESIDUAL MEASURE (NORMALISED DATA)



Correlogram

The correlogram tends to suggest that the data is stationary since the ACF declines quickly to zero.

Date: 03/31/11 Time: 23:46
Sample: 1970 2009
Included observations: 40

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |** |	. |** |	1	0.265	0.265	3.0158	0.082
. |*. |	. |*. |	2	0.162	0.099	4.1706	0.124
. |*. |	. |*. |	3	0.134	0.076	4.9885	0.173
. | . |	.*| . |	4	-0.058	-0.133	5.1442	0.273
**| . |	**| . |	5	-0.303	-0.315	9.5404	0.089
.*| . |	. | . |	6	-0.112	0.037	10.155	0.118
. |*. |	. |** |	7	0.109	0.283	10.765	0.149
.*| . |	.*| . |	8	-0.073	-0.074	11.046	0.199
. | . |	.*| . |	9	-0.043	-0.158	11.146	0.266
. | . |	.*| . |	10	0.027	-0.114	11.186	0.343
.*| . |	. | . |	11	-0.102	-0.058	11.792	0.380
**| . |	.*| . |	12	-0.325	-0.176	18.131	0.112
. | . |	. |*. |	13	0.017	0.207	18.150	0.152
. | . |	. | . |	14	-0.012	-0.001	18.160	0.200
. | . |	.*| . |	15	-0.062	-0.076	18.422	0.241

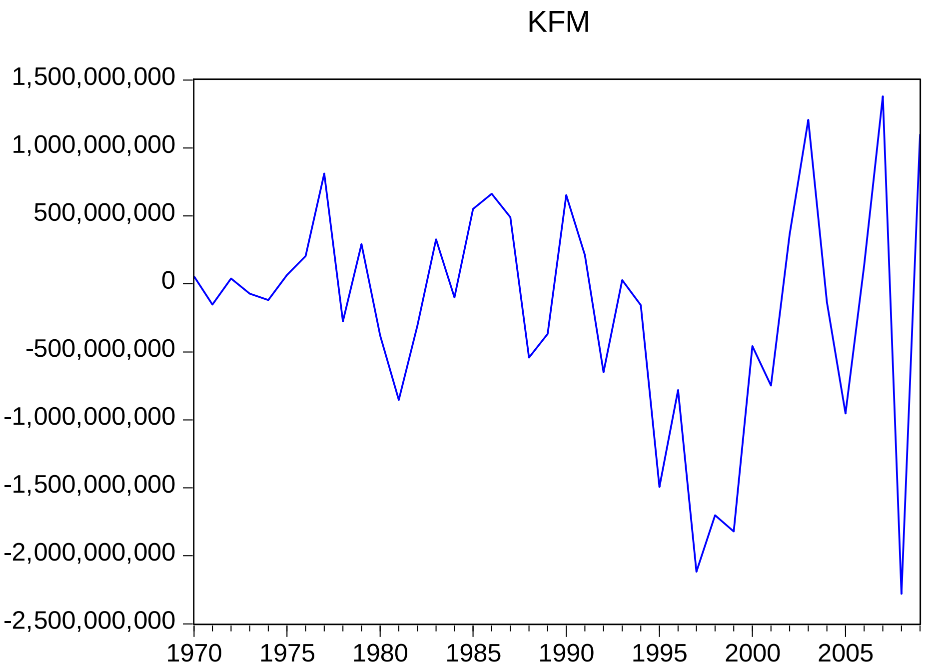
. |*. |	. | . |	16	0.111	0.022	19.288	0.254
. |** |	. |*. |	17	0.225	0.079	22.993	0.149
. | . |	.*| . |	18	-0.055	-0.128	23.226	0.182
.*| . |	. | . |	19	-0.077	-0.021	23.697	0.208
.*| . |	**| . |	20	-0.106	-0.233	24.638	0.216

Tests of Stationarity

ADF	Phillips-Perron	Ng-Perron
-4.647955	-4.730216	-17.4474
(-2.938987)	(-2.938987)	(-8.10000)

All three tests at 5% level of significance indicate that the data is stationary.

Capital flight in Kenya residual measure (Morgan Guaranty)



Tests of stationary

The correlogram of the Morgan Guaranty capital flight measure data is provided below:

Sample: 1970 2009
Included observations: 40

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>1</td><td>0.146</td><td>0.146</td><td>0.9213</td><td>0.337</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>2</td><td>0.189</td><td>0.171</td><td>2.4990</td><td>0.287</td></tr>
<tr><td>. |** |</td><td>. |*. |</td><td>3</td><td>0.232</td><td>0.194</td><td>4.9522</td><td>0.175</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>4</td><td>0.023</td><td>-0.059</td><td>4.9767</td><td>0.290</td></tr>
<tr><td>**| . |</td><td>***| . |</td><td>5</td><td>-0.250</td><td>-0.349</td><td>7.9767</td><td>0.158</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>6</td><td>-0.068</td><td>-0.071</td><td>8.2022</td><td>0.224</td></tr>
<tr><td>. | . |</td><td>. |** |</td><td>7</td><td>0.052</td><td>0.229</td><td>8.3374</td><td>0.304</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>8</td><td>-0.195</td><td>-0.045</td><td>10.324</td><td>0.243</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>9</td><td>-0.030</td><td>-0.057</td><td>10.371</td><td>0.321</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>10</td><td>-0.035</td><td>-0.171</td><td>10.439</td><td>0.403</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>11</td><td>-0.081</td><td>-0.043</td><td>10.815</td><td>0.459</td></tr>
<tr><td>**| . |</td><td>.*| . |</td><td>12</td><td>-0.259</td><td>-0.163</td><td>14.835</td><td>0.251</td></tr>
<tr><td>. | . |</td><td>. |*. |</td><td>13</td><td>0.047</td><td>0.129</td><td>14.972</td><td>0.309</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>14</td><td>-0.056</td><td>0.043</td><td>15.173</td><td>0.366</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>15</td><td>-0.121</td><td>-0.083</td><td>16.149</td><td>0.372</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>16</td><td>0.157</td><td>0.094</td><td>17.871</td><td>0.331</td></tr>
<tr><td>. |*. |</td><td>. | . |</td><td>17</td><td>0.122</td><td>0.036</td><td>18.966</td><td>0.330</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>18</td><td>-0.058</td><td>-0.123</td><td>19.224</td><td>0.378</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>19</td><td>-0.009</td><td>-0.091</td><td>19.230</td><td>0.442</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>20</td><td>-0.016</td><td>-0.162</td><td>19.252</td><td>0.506</td></tr>
</table>

The correlogram tends to suggest that the data is stationary since the ACF declines quickly to zero.

ADF	Phillips-Perron	Ng-Perron
-5.025566	-5.254304	-18.6884
(-2.938987)	(-2.938987)	(-8.10000)

All three tests reject the null hypothesis of a unit root implying that the series is I(0).

Modelling the characteristics of the Morgan Guaranty data

Since the series is stationary, we can model this stationarity using the Box-Jenkins methodology. Applying this methodology entails identification, estimation and diagnostic checking.

Dependent Variable: KFM
Method: Least Squares

Sample (adjusted): 1972 2009
Included observations: 38 after adjustments
Convergence achieved after 28 iterations
MA Backcast: 1970 1971

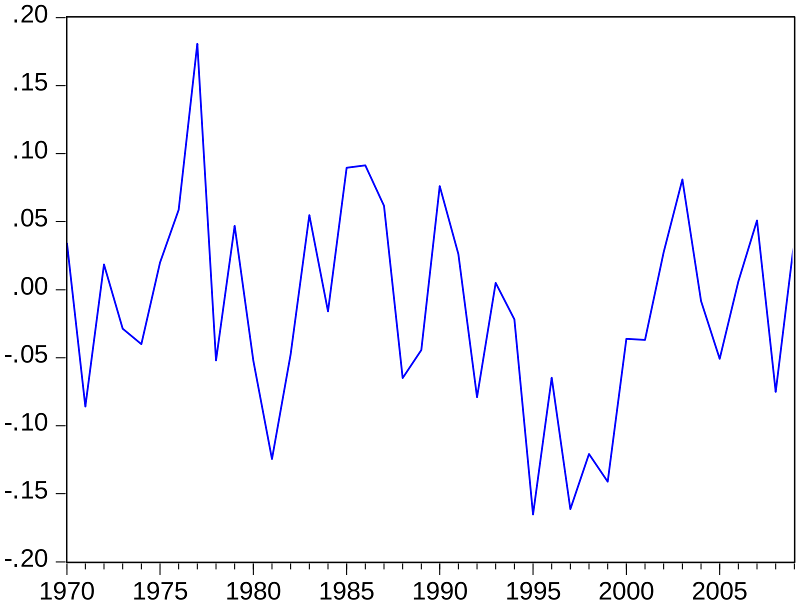
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.25E+08	1.83E+08	-1.227402	0.2284
AR(1)	0.386369	0.167754	2.303193	0.0277
AR(2)	-0.406472	0.158625	-2.562469	0.0151
MA(1)	-0.501606	0.072703	-6.899341	0.0000
MA(2)	0.915585	0.040083	22.84224	0.0000

R-squared	0.219851	Mean dependent var	-2.05E+08
Adjusted R-squared	0.125287	S.D. dependent var	8.68E+08
S.E. of regression	8.12E+08	Akaike info criterion	43.98887
Sum squared resid	2.17E+19	Schwarz criterion	44.20434
Log likelihood	-830.7886	Hannan-Quinn criter.	44.06554
F-statistic	2.324901	Durbin-Watson stat	1.753522
Prob(F-statistic)	0.076963		

Inverted AR Roots	.19+.61i	.19-.61i
Inverted MA Roots	.25+.92i	.25-.92i

An ARMA model with two lags seems to be appropriate as both the AR and MA terms are highly significant. Several models are tested and the AR(2) MA(2) is found to be appropriate.

NORMALISED CAPITAL FLIGHT MORGAN GUARANTY



Sample: 1970 2009
Included observations: 40

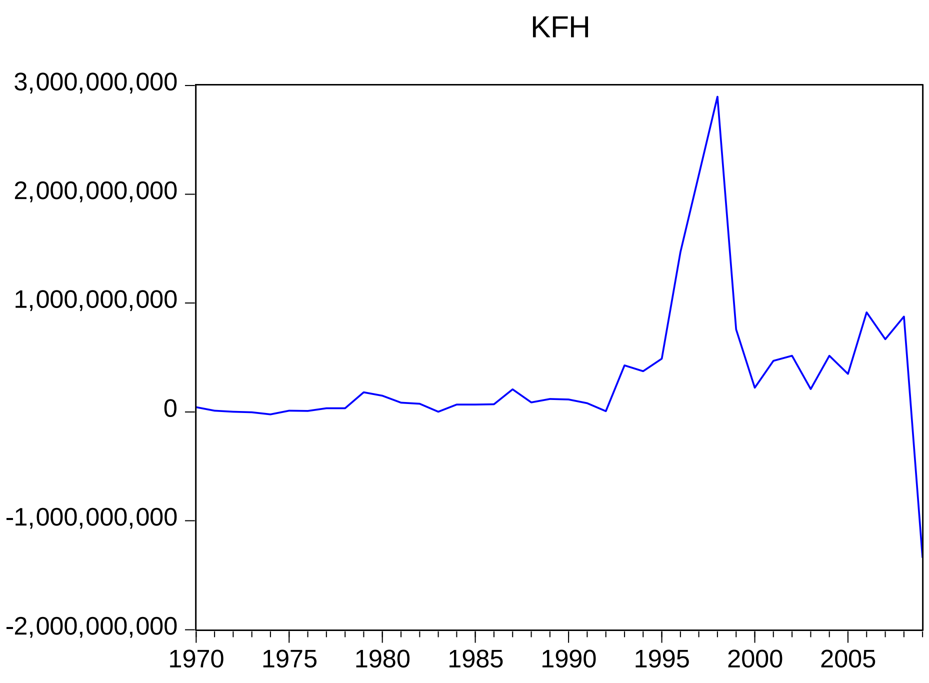
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |** |	. |** |	1	0.280	0.280	3.3779	0.066
. |*. |	. |*. |	2	0.193	0.124	5.0184	0.081
. |*. |	. | . |	3	0.133	0.056	5.8239	0.120
. | . |	.*| . |	4	-0.045	-0.126	5.9203	0.205
**| . |	**| . |	5	-0.236	-0.250	8.5932	0.126
.*| . |	. | . |	6	-0.095	0.034	9.0426	0.171
. |*. |	. |** |	7	0.087	0.237	9.4269	0.223
. | . |	.*| . |	8	-0.060	-0.072	9.6175	0.293
. | . |	.*| . |	9	-0.065	-0.159	9.8494	0.363
. | . |	.*| . |	10	-0.026	-0.102	9.8885	0.450
.*| . |	. | . |	11	-0.105	-0.033	10.528	0.484
**| . |	.*| . |	12	-0.317	-0.197	16.574	0.166
. | . |	. |** |	13	0.022	0.214	16.604	0.218
. | . |	. | . |	14	-0.039	-0.046	16.702	0.272
. | . |	.*| . |	15	-0.055	-0.073	16.903	0.325
. |*. |	. | . |	16	0.089	0.044	17.462	0.356
. |*. |	. |*. |	17	0.182	0.092	19.890	0.280
. | . |	.*| . |	18	-0.064	-0.153	20.204	0.321
.*| . |	. | . |	19	-0.073	-0.030	20.626	0.358
.*| . |	**| . |	20	-0.129	-0.241	22.014	0.340

The correlogram tends to suggest that the data is stationary since the ACF declines quickly to zero.

ADF	Phillips-Perron	Ng-Perron
-4.544607	-4.636101	-17.1507
(-2.938987)	(-2.938987)	(-8.10000)

The tests reveal that for the normalised Morgan Guaranty data capital flight is stationary.

Capital flight measurement under the Hot Money Method



Correlogram

Sample: 1970 2009
Included observations: 40

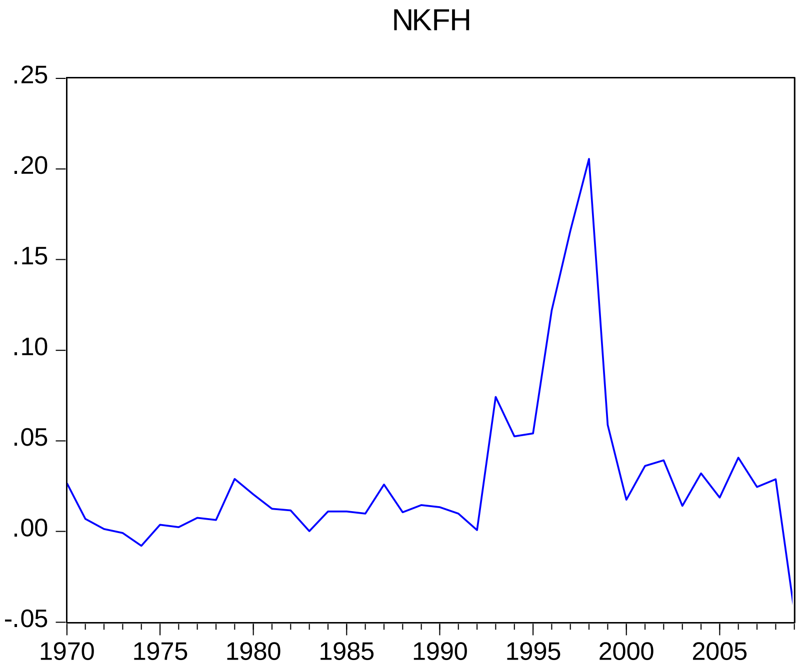
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |**** |	. |**** |	1	0.538	0.538	12.469	0.000
. |** |	. | . |	2	0.306	0.024	16.615	0.000
. |*. |	.*| . |	3	0.101	-0.102	17.081	0.001
. |*. |	. |*. |	4	0.113	0.129	17.678	0.001
. | . |	.*| . |	5	0.033	-0.076	17.730	0.003
. | . |	. | . |	6	0.024	0.007	17.758	0.007
. | . |	. | . |	7	-0.007	-0.000	17.761	0.013
. |*. |	. |*. |	8	0.076	0.104	18.066	0.021
. |*. |	. | . |	9	0.122	0.069	18.867	0.026
. |*. |	. | . |	10	0.087	-0.057	19.290	0.037
.*| . |	**| . |	11	-0.192	-0.343	21.424	0.029
.*| . |	. | . |	12	-0.193	0.063	23.662	0.023
.*| . |	. | . |	13	-0.166	0.021	25.385	0.021
.*| . |	. | . |	14	-0.089	-0.030	25.902	0.027
.*| . |	. | . |	15	-0.088	0.025	26.423	0.034
.*| . |	.*| . |	16	-0.096	-0.084	27.074	0.041
. | . |	. | . |	17	-0.043	0.056	27.208	0.055
. | . |	.*| . |	18	-0.051	-0.107	27.408	0.072
.*| . |	. | . |	19	-0.067	-0.028	27.764	0.088
.*| . |	. | . |	20	-0.097	0.065	28.555	0.097

The correlogram tends to suggest that the data is non-stationary since the ACF does not decline quickly to zero.

ADF	Phillips Perron	Ng-Perron
-2.426809	-2.397545	-10.3991
(-2.938987)	(-2.938987)	(-8.10000)

Two of the tests reveal that at a 5% level of significance we cannot reject the null hypothesis of a unit root in capital flight using the Hot Money method. For the Ng-Perron method which allows for one structural break, however, we reject the null hypothesis of non-stationarity. The Hot money measure becomes stationary after first differencing suggesting that it is I(1).

NORMALISED HOT MONEY METHOD



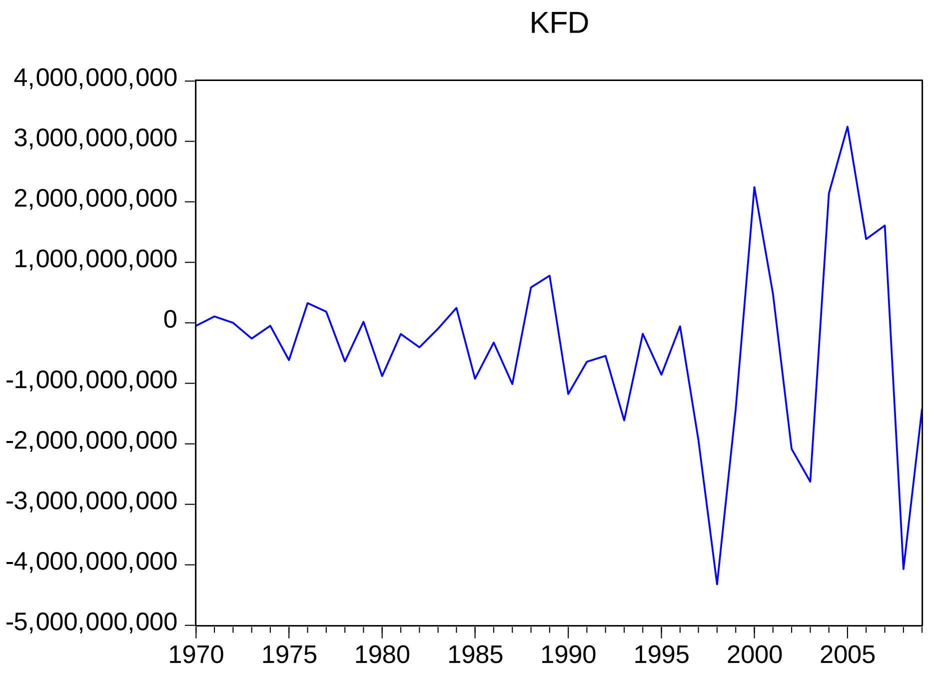
Tests of stationary

ADF	Phillips Perron	Ng-Perron
-2.285565	-2.311942	-9.36832

(-2.938987)	(-2.938987)	-8.10000

Two of the tests reveal that at a 5% level of significance we cannot reject the null hypothesis of a unit root in capital flight using the normalised hot Money method. For the Ng-Perron method which allows for a structural break, however, we reject the null hypothesis of non-stationarity. The normalised hot money measure becomes stationary after first differencing suggesting that it is I(1).

CAPITAL FLIGHT DOOLEY METHOD



Correlogram

Sample: 1970 2009

Included observations: 40

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |** |	. |** |	1	0.248	0.248	2.6495	0.104
**| . |	***| . |	2	-0.306	-0.391	6.7763	0.034

**| . |	.*| . |	3	-0.337	-0.169	11.930	0.008
. | . |	. | . |	4	-0.033	0.001	11.981	0.017
. |** |	. |** |	5	0.337	0.235	17.419	0.004
. |*. |	.*| . |	6	0.079	-0.183	17.726	0.007
.*| . |	. | . |	7	-0.189	-0.032	19.552	0.007
**| . |	.*| . |	8	-0.273	-0.154	23.474	0.003
.*| . |	.*| . |	9	-0.187	-0.192	25.366	0.003
. |*. |	. | . |	10	0.109	-0.032	26.036	0.004
. |*. |	. | . |	11	0.132	-0.048	27.046	0.005
. | . |	. | . |	12	0.042	0.011	27.154	0.007
. | . |	. |*. |	13	-0.007	0.077	27.157	0.012
.*| . |	.*| . |	14	-0.171	-0.168	29.047	0.010
. | . |	. | . |	15	0.001	0.045	29.047	0.016
. |*. |	.*| . |	16	0.088	-0.081	29.592	0.020
. | . |	. | . |	17	0.068	-0.048	29.927	0.027
. |*. |	. | . |	18	0.085	0.056	30.478	0.033
.*| . |	. | . |	19	-0.079	-0.014	30.973	0.041
.*| . |	.*| . |	20	-0.102	-0.077	31.846	0.045

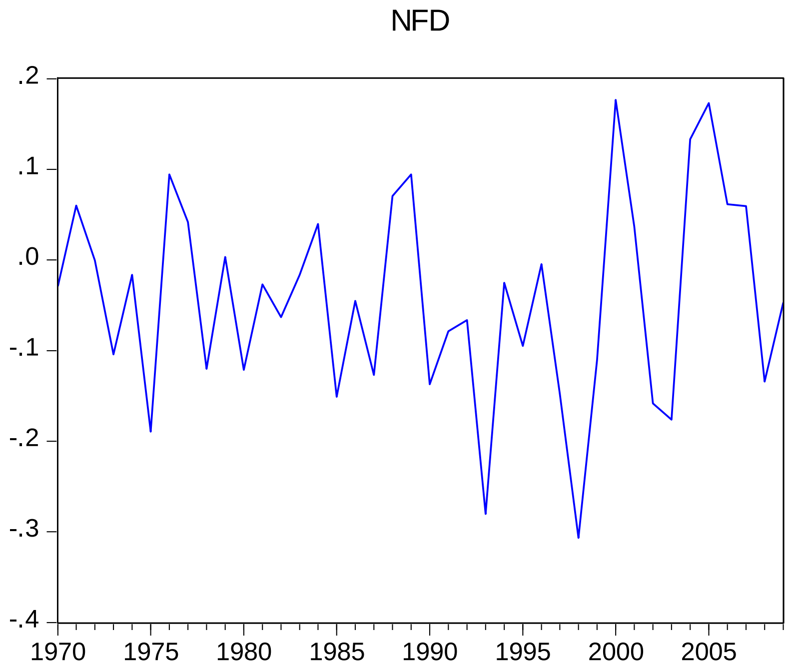
The correlogram tends to suggest that the data is stationary since the ACF declines quickly to zero.

Tests of stationarity

ADF	Phillips Perron	Ng-Perron
-3.370478	-5.947269	-19.2662
(-2.960411)	(-2.938987)	(-8.10000)

The tests reveal that at 5% level of significance the hypothesis of a unit root is rejected implying that capital flight under the Dooley method is stationary.

NORMALISED CAPITAL FLIGHT DOOLEY



Correlogram

Sample: 1970 2009
Included observations: 40

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.107	0.107	0.4907	0.484
**| . |	**| . |	2	-0.241	-0.255	3.0597	0.217
.*| . |	.*| . |	3	-0.182	-0.132	4.5602	0.207
. | . |	. | . |	4	-0.003	-0.031	4.5608	0.335
. |*** |	. |*** |	5	0.405	0.367	12.425	0.029
. | . |	.*| . |	6	0.024	-0.105	12.454	0.053
.*| . |	. | . |	7	-0.149	0.021	13.587	0.059
.*| . |	. | . |	8	-0.118	-0.042	14.312	0.074
**| . |	**| . |	9	-0.240	-0.293	17.446	0.042
. | . |	.*| . |	10	0.008	-0.158	17.449	0.065
. | . |	.*| . |	11	-0.021	-0.138	17.476	0.095
. |*. |	. |*. |	12	0.132	0.179	18.515	0.101
. | . |	. | . |	13	-0.007	-0.061	18.518	0.139
**| . |	.*| . |	14	-0.325	-0.131	25.359	0.031
. | . |	. |*. |	15	0.003	0.124	25.359	0.045
. | . |	.*| . |	16	0.046	-0.092	25.507	0.061
. |*. |	.*| . |	17	0.098	-0.122	26.205	0.071
. |*. |	. |*. |	18	0.157	0.139	28.088	0.061
.*| . |	. | . |	19	-0.124	0.027	29.319	0.061
. | . |	.*| . |	20	-0.031	-0.104	29.402	0.080

Tests of stationarity

ADF	Phillips-Perron	Ng-Perron
-5.465829	-5.465829	-53.0870
(-2.938987)	(-2.938987)	(8.10000)

The three tests reveal that at 5% level of significance the hypothesis of a unit root is rejected which implies that the normalised Dooley measure of capital flight is stationary.

Modelling volatility in the capital flight

The World Bank Capital flight data

The capital flight data, measured according to the residual (World Bank) and residual (Morgan Guaranty) suggests volatility clustering. The variance of the error term can be modelled. The graph of capital flight by the residual approach tends to suggest volatility clustering. This implies that large amounts of capital flight tend to be followed by large capital flight. Volatility therefore tends to appear in batches which is known as volatility clustering. We can model this volatility clustering of the World Bank and Morgan Guaranty methods using ARCH and GARCH models since both measures suggest that capital flight is stationary. We first test formally for ARCH effects in the capital flight data. We model the volatility for the time series of capital flight returns in the following way:

Firstly, we specify a mean equation for the return series.

Secondly, we use the residuals of the mean equation to test for ARCH effects.

Thirdly, we specify a volatility model using ARCH or GARCH, if ARCH effects are statistically significant.

Fourthly, we use maximum likelihood to estimate jointly the mean and volatility equations.

Fifthly, we interpret the estimates of the coefficient.

The sample autocorrelation function of KFr shows no signs of strong serial correlation and so we can specify a simple conditional mean equation of the following form:

$$KF_r = \mu + u_t$$

The table below shows the ACF of squared capital flight. It shows some evidence of linear dependence indicating the presence of ARCH effects.

Sample: 1970 2009
Included observations: 40

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*** |	. |*** |	1	0.356	0.356	5.4520	0.020
. |** |	. |*. |	2	0.252	0.144	8.2595	0.016
. | . |	.*| . |	3	0.019	-0.127	8.2764	0.041
. | . |	. |*. |	4	0.070	0.075	8.5035	0.075
. | . |	. | . |	5	-0.019	-0.041	8.5210	0.130
. | . |	.*| . |	6	-0.052	-0.074	8.6544	0.194
.*| . |	. | . |	7	-0.092	-0.038	9.0816	0.247
. | . |	. | . |	8	-0.000	0.071	9.0816	0.335
. |** |	. |** |	9	0.269	0.328	13.005	0.162
. |** |	. | . |	10	0.227	0.045	15.886	0.103
. |** |	. | . |	11	0.216	0.022	18.578	0.069

. | . |	.*| . |	12	0.007	-0.126	18.581	0.099
. |*. |	. | . |	13	0.092	0.058	19.104	0.120
.*| . |	.*| . |	14	-0.092	-0.146	19.655	0.141
.*| . |	.*| . |	15	-0.090	-0.067	20.199	0.164
. | . |	. |*. |	16	-0.048	0.186	20.364	0.204
.*| . |	. | . |	17	-0.070	-0.049	20.721	0.239
. | . |	.*| . |	18	-0.025	-0.076	20.769	0.291
.*| . |	.*| . |	19	-0.105	-0.202	21.658	0.302
. | . |	.*| . |	20	-0.064	-0.092	21.997	0.341

To test formally for ARCH effects, we use the squared residuals from the mean equation and regress them on their lagged values. The results are reported in the table that follows:

Heteroskedasticity Test: ARCH

F-statistic	5.985526	Prob. F(1,37)	0.0193
Obs*R-squared	5.430561	Prob. Chi-Square(1)	0.0198

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares

Sample (adjusted): 1971 2009
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.48E+17	1.94E+17	2.307657	0.0267
RESID^2(-1)	0.371492	0.151844	2.446534	0.0193

R-squared	0.139245	Mean dependent var	7.04E+17
Adjusted R-squared	0.115982	S.D. dependent var	1.09E+18
S.E. of regression	1.02E+18	Akaike info criterion	85.82121
Sum squared resid	3.85E+37	Schwarz criterion	85.90652
Log likelihood	-1671.514	Hannan-Quinn criter.	85.85182
F-statistic	5.985526	Durbin-Watson stat	1.986931
Prob(F-statistic)	0.019296		

Both the F-version and LM-statistic are significant at 5% level indicating the presence of ARCH in the capital flight residual (World Bank) measure.

The Morgan Guaranty capital flight data

We now test for ARCH effects in the Morgan Guaranty capital flight data.

Heteroskedasticity Test: ARCH

F-statistic	8.313599	Prob. F(1,37)	0.0065
Obs*R-squared	7.155255	Prob. Chi-Square(1)	0.0075

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/04/10 Time: 12:14
Sample (adjusted): 1971 2009
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.34E+17	1.90E+17	2.290327	0.0278
RESID^2(-1)	0.430548	0.149323	2.883331	0.0065

R-squared	0.183468	Mean dependent var	7.31E+17
Adjusted R-squared	0.161400	S.D. dependent var	1.08E+18
S.E. of regression	9.93E+17	Akaike info criterion	85.76684
Sum squared resid	3.65E+37	Schwarz criterion	85.85215
Log likelihood	-1670.453	Hannan-Quinn criter.	85.79745
F-statistic	8.313599	Durbin-Watson stat	2.079748
Prob(F-statistic)	0.006520		

Both the F-version and LM-statistic are significant at 5% level indicating the presence of ARCH in the capital flight residual (Morgan Guaranty) measure.

Policy implications

In the Kenyan context three of the measures of capital flight that are more inclusive indicate that it is stationary and hence mean-reverting. This implies that the effects of a shock to capital flight are transitory according to most measures and therefore do not require a strong policy response. On the other hand, the hot money measure which focuses on short-term capital flight is not mean-reverting**.**

Kenya experiences the typical macroeconomic trilemma since it does not allows free movement of capital and also pursues an independent monetary policy. It therefore cannot fix the exchange rate. This inability to fix the exchange rate has contributed to considerable volatility this year with the Kenya shilling depreciating by up to 30%

against the US dollar since the beginning of the year. This volatility only declined in the last two months when the Central Bank raised the Central Bank rate by more than 9% in two months.

In the Kenyan context the imposition of capital controls is not practical since alternative regional foreign investment destinations do not have capital controls. Attempts to reverse capital flight should therefore focus on institutional improvement to lower political and macroeconomic risk and also on interest rate policy to make Kenya a more attractive destination for foreign investments. Institutions, both informal and formal are the centrepiece of development because development, no matter how understood, is profoundly affected by them. Effective institutions for development should strive to promote the common good. This objective definitely partly entails striving to improve the ability of institutions to more adequately meet the basic needs of the citizens of a particular country (Mudida, 2011)

References

Collier, P., A. Hoeffler and C. Patillo (1999) “Flight Capital as a Portfolio Choice” Policy Research Working Paper 2066, World Bank Development Research Group and International Monetary Fund.

Cuddington J. (1987) *European Economic Review, Volume 31, Issues 1-2, February-March*

Dickey D.A. and W.A. Fuller, “Distribution of Estimators for Autoregressive Time Series with a Unit Root”, *Journal of the American Statistical Association*, Vol. 74, June 1979, pp. 427-431.

Dooley M.P. (1986) “Country-specific Risk Premiums, Capital Flight and Net Investment Income Payments in Selected Developing Countries” Washington D.C: International Monetary Fund, unpublished manuscript.

Dooley M.P. (1988) “Capital Flight: A Response to Differences in Financial Risk”, *International Monetary Fund Staff Papers*, Vol. 35, No. 3, pp. 422-436.

Engle R.F (2001) “Garch 101: The Use of ARCH/GARCH Models in Applied Econometrics” *Journal of Economic Perspectives*, Vol. 15, No. 4, Fall 2001, pp. 157-168.

Enders W (2004) *Applied Econometric Time Series*, Second Edition, New Jersey: John Wiley and Sons.

Erbe, S. (1985) “The Flight of Capital from Developing Countries” *Intereconomics*, No. 20, pp. 268-75.”

Fedderke J.W. and W. Liu (2002) “Modelling the Determinants of Capital Flows and Capital Flight: With an Application to South African Data from 1960 to 1995” *Economic Modelling*, Vol. 19, Issue 3, May, pp. 419-444.

Hermes N, R. Lensink and V. Murinde (2002) “Flight Capital and its Reversal for Development Financing”, World Institute for Development Economics Research, United Nations University, Discussion Paper No. 2002/99.

Ng’eno N.K (2000) “Capital Flight in Kenya” in I. Ijayi and M.S. Khan (eds), *External Debt and Capital Flight in Sub-Saharan Africa*, Washington D.C: The IMF Institute, pp. 300-321.

Mudida R (2011)“Effective Institutions as the Foundation of Development: A Conceptual and Empirical Discourse” in D. Lutz, P.M. Shimiyu and G. Osengo (eds) *Rethinking Integral Development in Africa* Nairobi: Consolata Institute of Philosophy Press, 2011.

Phillips P C B and P Perron (1988) “Testing for a Unit Root in Time Series Regression”, *Biometrika*, Vol. 75, No 2, pp. 335-346.

Perron P. (1994) "Trend, Unit Root and Structural Change in Macroeconomic Time Series" in B. Rao (ed) *Cointegration for the Applied Economist* (London: Macmillan, 1994).

Salisu M (2005) "Capital Flows and Current Account Sustainability in African Economies: The Role of Capital Flight and Remittances in Current Account Sustainability in Sub-Saharan Africa", Paper Presented at a Workshop organised by the United Nations Economic Commission for Africa, Economic and Social Policy Division, 21-22 September, 2005.

Sheets N. (1995) "Capital Flight from Countries in Transition: Some Theory and Empirical Evidence", International Finance Discussion Paper, No. 514 (Washington D.C: Board of Governors of the Federal Reserve System).

World Bank (1985) *World Development Report 1985*, New York: Oxford University Press.