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International Capital Mobility in African Countries: Do the legal origins matter?

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Abstract

This paper investigates the Feldstein-Horioka coefficients and legal origins for 37 African countries using the recently developed panel cointegration techniques. The empirical findings reported in the paper reveal that savings and investment are nonstationary and cointegrated series. The estimated coefficients using DOLS is 0.58 for the sample as a whole for the period 1970-2006. However, there are marked differences in retentions ratios in each country group with ratio lowest in common law countries (0.34) compared to French civil law countries (0.85). These results imply that in the countries with strong legal protections of investors, capital tends to be mobile internationally than in countries with worse protection.

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1. Introduction

The degree of international capital mobility determines the efficiency of capital allocation in the world economy. It is generally admitted that most of the African countries keep significant legal restrictions over capital movements and have limited financial market linkages with world economy. Such a situation has contributed to weak economic growth, a relatively low saving rate and capital flight from the region (Collier and Gunning, 1999). Therefore, understanding the extent to which domestic saving finances domestic investment in Africa is an important aspect for economic policy makers and firms.

There are several ways to investigate the degree of international capital mobility[1]. One test proposed by Feldstein and Horioka (1980, hereafter FH) for capital mobility is to examine the relationship between saving and investment. According to these authors, in the absence of capital mobility, domestic saving and investment are highly correlated since investment is financed by domestic saving. Since the work of FH, many economists have studied the relationship between savings and investment[2].

This paper investigates the relationship between the saving-investment taking into account legal origins in African countries. In the last decade, economists have produced a considerable body of research suggesting a strong link between finance and law. The idea is that a variety of legal rules (e.g., those governing both investor protection and legal procedure) can influence the protection of outside investors and hence financial markets. For example, La Porta and al. (1998) show that English common law countries have generally the strongest legal protections of investors while the civil law countries the weakest. Shleifer and Wolfenzon (2002) show that in countries with better investor protection, a larger fraction of the invested capital comes from the external market and a small fraction from internal funds (the funds of the entrepreneurs setting up). Subsequent research showed that the influence of legal origins on law and regulations is not restricted to finance (see Djankov et *al*. 2003, for example). Unfortunately, there has only been one paper that has examined the Feldstein-Horioka puzzle and legal origins. Gunji (2003) introduces a proxy of legal protection of investors, a dummy variable that indicate legal origins, into the Feldstein Horioka saving-investment regression for a sample of 20 OECD countries in 1970-2000. The estimation shows that the French-civil-law countries, which have the weakest investor protection, the domestic investment rates are generally less strongly correlated with the domestic saving rates.

Although the Gunji's study is interesting, it focuses however on cross section data. Saving and investment rates usually turn out to be nonstationary. In the unit-root literature, it is argued that the widespread failure of hypothesis testing in relatively short series may be accounted for by the low power of conventional univariate unit root tests against persistent alternatives, typically for sample sizes that occur in practice. Further, the traditional cointegration technique has also the problem of low power. In order to deal with these problems, we use recently developed panel cointegration technique and dynamic OLS (hereafter DOLS) methods in order to deal with heterogeneity problems and to conduct plausible tests. To the best of our knowledge, this is the first paper on FH using panel cointegration and legal origins in African context.

[1] The presence of capital mobility is tested alternatively by using the saving correlation, uncovered interest parity condition, and finally the consumption smoothing approach to the current account. See Obstfeld (1993) for more detail.

[2] See Coakley and *al.* (1998) for a survey.

The paper is organized as follows. The next section introduces the empirical methodology. The data and empirical results are presented and interpreted in section 3. Section 4 makes some concluding remarks.

2. Empirical methodology

Following Feldstein and Horioka (1980) we propose assessing the degree of capital mobility by analyzing the relation between saving and investment.

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta\left(\frac{S}{Y}\right)_i + \varepsilon_i, \quad (1)$$

where $\left(\frac{I}{Y}\right)_i$ and $\left(\frac{S}{Y}\right)_i$ are respectively the saving and investment rates of country i, β is the savings-retention coefficient and ε_i is the error term. For a small, open economy where capital is perfectly mobile internationally, β should be close to zero. If equals zero, β then there is no relationship between saving and investment. Feldstein and Horioka (1980) suppose that if β is large, however, capital is considered immobile internationally. For example, if β equals one, then all additional saving goes to finance domestic investment.

Most writers identify two main secular legal traditions: common law and civil law, and several sub-traditions- French, German, socialist and Scandinavian (see Laporta et *al*. 2008). In this study the commercial law is classified into two origins: Common law and French civil law because of our sample.

Following Shleifer and Wolfenzon (2002), our main hypothesis is that capital is relatively mobile in countries with stronger protection whereas in countries with worse protection domestic investment rates and domestic saving rates are strongly associated.

Our methodology departs from Gunji (2003). We make use of the new development in panel unit root tests and cointegration techniques to investigate the relationship between savings and investment in African countries for the period 1970-2006. We then break up our sample into French civil law and common law countries and examine whether, the saving ratio have change over time.

2.1 Panel unit root tests

Before proceeding to cointegration techniques, we need to verify that all variables are integrated to the same order. In doing so, we have used first generation tests of panel unit root due to Im, Pesaran and Shin (2003) and Maddala and Wu (1999)[3] and second generation test of panel unit root of Pesaran (2005). These tests are less restrictive and more powerful compared to the tests developed by Levin and Lin (1993, 2002)[4], which don't allow for heterogeneity in the autoregressive coefficient. The tests proposed by IPS permit to solve Levin and Lin's serial correlation problem by assuming heterogeneity between units in a

[3] Henceforth, IPS for Im, Pesaran and Shin, and MW for Maddala and Wu.
[4] For a useful survey on panel unit root tests, see Hurlin and Mignon (2005) and Banerjee (1999).

dynamic panel framework. The basic equation for the panel unit root tests for IPS is as follows:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p} \phi_{ij} \Delta y_{i,t-j} + \varepsilon_{i,t} \; ; \; i = 1,2,...,N; \; t = 1,2,...,T, \tag{2}$$

where $y_{i,t}$ stands for each variable under consideration in our model, α_i is the individual fixed effect and p is selected to make the residuals uncorrelated over time. The null hypothesis is that $\rho_i = 0$ for all i versus the alternative hypothesis is that $\rho_i < 0$ for some $i = 1,...,N_1$ and $\rho_i = 0$ for $i = N_1 + 1,...,N$.

The IPS statistic is based on averaging individual ADF statistics and can be written as follows:

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} (t_{iT}), \tag{3}$$

where t_{iT} is the ADF *t-statistic* for country *i* based on the country-specific ADF regression, as in Eq (1). IPS show that under the null hypothesis of non stationary, the $\bar{t}$ statistic follows the standard normal distribution asymptotically. The standardized statistic t_{IPS} is expressed as:

$$t_{IPS} = \frac{\sqrt{n}\left(\bar{t} - \frac{1}{N} \sum_{i=1}^{N} E\left[t_{iT} \mid \rho_i = 0 \right] \right)}{\sqrt{\frac{1}{N} \sum_{i=1}^{N} Var\left[t_{iT} \mid \rho_i = 0 \right]}}. \tag{4}$$

Maddala and Wu (1999) argue that while Im et al.'s tests relax the assumption of homogeneity of the root across the units, several difficulties still remain. They suggest the use of a Fisher type test which is based on combining the *p*-values, π_i of the test-statistic for a unit root in each cross-sectional unit. The MW test statistic λ is given by:

$$\lambda = -2 \sum_{i=1}^{N} \ln \pi_i. \tag{5}$$

The MW test statistic is distributed as Chi square with *2N* degrees of freedom under the hypothesis of cross-sectional independence.

According to Breitung (1999), IPS's test is not powerful when individual trends are included. This test is sensitive to the specification of deterministic trends compared to IPS's test. The MW test has the advantage that its value does not depend on different lag lengths in the individual ADF regressions. Furthermore, Maddala and Wu (1999) found that MW's test is superior compared to IPS's test.

Both the tests (IPS and MW) have the drawback to suppose that the cross-sections are independent; the same assumption is made in all first generation of panel unit root. However, it has been pointed out in the literature that cross section dependence arises due to unobserved common factors, externalities, regional and macroeconomic linkages, and unaccounted residual interdependence. Recently, some new panel unit root tests have emerged and address the question of the dependence and correlation given the prevalence of macroeconomic dynamics and linkages. These tests are called the second generation panel unit root tests. The well-known second generation test that is considered in this paper is the Pesaran's CIPS test (2005). In order to formulate a panel unit root test with cross-sectional dependence, Pesaran (2005) considers the following Cross-Sectional Augmented Dickey-Fuller (CADF) regression, estimated the OLS method for the i^{th} cross-section in the panel:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \delta_i \bar{y}_{t-1} + \sum_{j=0}^{k} \delta_{ij} \Delta \bar{y}_{i,t-j} + \sum_{j=0}^{k} \Delta y_{i,t-j} + \varepsilon_{it} \quad (6)$$

where, $\bar{y}_{t-1} = \left(\frac{1}{N}\right)\sum_{i=1}^{N} y_{i,t-1}$, $\Delta \bar{y}_t = \left(\frac{1}{N}\right)\sum_{i=1}^{N} y_{it}$, and $t_i(N,T)$ is the *t*-statistic of the estimate of ρ_i in the above equation used for computing the individual ADF statistics. More preciously, Pesaran proposed the following test CIPS statistic that is based on the average of individual CADF statistics as follows:

$$CIPS = \left(\frac{1}{N}\right)\sum_{i=1}^{N} t_i(N,T). \quad (7)$$

The critical values for CIPS for various deterministic terms are tabulated by Pesaran (2005).

2.2 Panel cointegration tests

Once the order of stationary has been defined, we would apply Predroni's cointegration test methodology. Indeed, like the IPS and MW panel unit root, the panel cointegration tests proposed by Pedroni (1999) also take in account heterogeneity by using specific parameters which are allowed to vary across individual members of the sample. Taking into account such heterogeneity constitutes an advantage because it is unrealistic to assume that the vectors of cointegration are identical from an individual to another for the panel.

The implementation of Pedroni's cointegration test requires estimating first the following long run relationship:

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1,it} + \beta_{2i} x_{2,it} + \ldots + \beta_{Mi} x_{M,it} + \varepsilon_{it} \quad (8)$$

for $i = 1,\ldots,N$; $t = 1,\ldots,T$; $m = 1,\ldots,M$

where *N* refers to the numbers of individual members in the panel; *T* refers to the number of observation over time; *M* refers to the number of exogenous variables. The structure of estimated residuals is follows:

$$\hat{\varepsilon}_{it} = \hat{\rho}_i \hat{\varepsilon}_{it-1} + \hat{u}_{it}. \quad (9)$$

Pedroni has proposed seven different statistics to test panel data cointegration. Out of these seven statistics, four are based on pooling, what is referred to as the "Within" dimension and the last three are based on the "Between" dimension. Both kinds of tests focus on the null hypothesis of no cointegration. However the distinction comes from the specification of the alternative hypothesis. For the tests based on "Within", the alternative hypothesis is $\rho_i = \rho < 1$ for all *i*, while concerning the last three test statistics which are based on the "Between" dimension, the alternative hypothesis is $\rho_i < 1$, for all *i*.

The finite sample distribution for the seven statistics has been tabulated by Pedroni via Monte Carlo simulations. The calculated statistic tests must be smaller than the tabulated critical value to reject the null hypothesis of absence of cointegration.

2.3 Panel cointegration estimation

Although Pedroni's methodology allows us to test the presence of cointegration, it could not provide estimation of long-run relationship. For panel framework, in presence of cointegration,

several estimators are proposed: OLS, Fully Modified OLS (FMOLS)[5], and dynamic OLS (DOLS).

In this paper, we use the dynamic ordinary least squares (DOLS) developed by Kao and Chiang (2001) to estimate the long-run vector between saving and investment. This estimator is designed for non stationary panels and corrects the standard pooled OLS for serial correlation and endogeneity of regressors that are normally present in long run economic relationships. Furthermore, Kao and Chiang (2001) showed that both the OLS and FMOLS exhibit small sample bias and the DOLS estimator appears to outperform both estimators.

The DOLS is an extension of Stock and Watson's (1993) estimator. In order to obtain an unbiased estimator of the long-run parameters, DOLS estimator uses parametric adjustment to the errors by including the past and the future values of the differenced I(1) regressors. The dynamic OLS estimator is obtained from the following equation:

$$y_{it} = \alpha_i + x_{it}^{'}\beta + \sum_{j=-q_1}^{j=q_2} c_{ij}\Delta x_{i,t+j} + v_{it}. \tag{10}$$

where c_{ij} is the coefficient of a lead or lag of first differenced explanatory variables. The estimated coefficient of DOLS is given by:

$$\hat{\beta}_{DOLS} = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} z_{it} z_{it}'\right)^{-1}\left(\sum_{t=1}^{T} z_{it}\hat{y}_{it}^{+}\right) \tag{11}$$

where $z_{it} = \left[x_{it} - \bar{x}_i, \Delta x_{i,t-q}, ..., \Delta x_{i,t+q}\right]$ is $2(q+1)\times 1$ vector of regressors.

3. Data and empirical results

3.1. Data

The data are taken from the World Development Indicators (WDI, 2008) CD-ROM for 37 African countries for the period 1970-2006. Following the original study of Feldstein and Horioka, savings is defined as gross domestic savings as a percentage of GDP while investment is measured by gross fixed capital formation divided by GDP[6]. The data are summarised in table 1 (in appendix) which shows marked differences between savings and investment ratios within and across countries.

3.2. The unit root tests

Table 2 reports the outcome for the global sample of three panel unit root tests: IPS (2003), MW (1999) and Pesaran (2003). It shows that the null hypothesis of the unit roots for the panel data for the investment and savings series cannot be rejected in level. However, this hypothesis is rejected when series are in first differences. These results strongly indicate that the variables in level are non-stationary and stationary in first-differences. The same issues

[5] The FMOLS is popular in conventional time series econometrics, for it is believed to eliminate endogeneity in the regressors and serial correlation in the errors.

[6] Bayoumi (1990) and Sinha and Sinha (2004) suggest the use of gross fixed capital formation, since it excludes the procyclical inventories component that may lead to spurious correlations with savings.

are obtained for the panels of country groups: civil law and common law countries (table 3) Therefore, we can implement a test for panel cointegration between savings and investment.

Table 2: Panel unit root for saving and investment ratios, 1970-2006 (global sample)

	Im et al. (2003)		Maddala and Wu (1999)		Pesaran (2005)	
	Statistic	P-values	Statistic	P-values	Statistic	P-values
All countries (37)						
$(I/Y)_{it}$	-1.547	0.148	59.477	0.890	-1.421	0.988
$\Delta(I/Y)_{it}$	-4.026	0.000	488.481	0.000	-3.913	0.000
$(S/Y)_{it}$	-1.384	0.489	63.166	0.811	-1.599	0.866
$\Delta(S/Y)_{it}$	-4.149	0.000	544.287	0.000	-3.766	0.000

Table 3: Panel unit root for saving and investment ratios, 1970-2006 (civil law vs common law countries)

	Im et al. (2003)		Maddala and Wu (1999)		Pesaran (2005)	
	Statistic	P-values	Statistic	P-values	Statistic	P-values
Civil law countries						
$(I/Y)_{it}$	-1.480	0.322	35.583	0.669	-1.610	0.776
$\Delta(I/Y)_{it}$	-4.052	0.000	273.646	0.000	-3.948	0.000
$(S/Y)_{it}$	-1.244	0.735	24.456	0.974	-1.434	0.945
$\Delta(S/Y)_{it}$	-4.300	0.000	320.241	0.000	-3.904	0.000
Common law countries						
$(I/Y)_{it}$	-1.671	0.115	19.893	0.953	-1.279	0.982
$\Delta(I/Y)_{it}$	-3.876	0.000	191.575	0.000	-3.871	0.000
$(S/Y)_{it}$	-1.509	0.297	29.348	0.601	-1.081	0.998
$\Delta(S/Y)_{it}$	-3.986	0.000	211.272	0.000	-3.792	0.000

3.3. Panel cointegration tests

Table 4 shows the outcomes of Pedroni's (1999) cointegration tests between the investment and savings rates. We use four within-group tests and three between-group tests to check whether the panel data are cointegrated. The columns labeled within-dimension contain the computed value of the statistics based on estimators that pool the autoregressive coefficient across different countries for the unit root tests on the estimated residuals. The columns labeled between-dimension report the computed value of the statistics based on estimators that average individually estimated coefficients for each country. Except the *v-statistic* test, the results of the within-group test and the between-group tests show that the null hypothesis of no cointegration can not be rejected at the 1% significant level. Therefore, the ratios of saving and investment are cointegrated for the panel of all countries and for the panels of country groups (common law and civil law countries)

The presence of a long-run relationship between investment and saving rate in the panel of African countries are economically meaningful in that it suggests that these countries meet the long-run solvency condition. Having found that there exists a cointegrating link between the two variables (ratios of saving and investment), it is convenient that the savings-retention

coefficient be estimated using a panel cointegrating estimator. In this paper, we choose to employ the Dynamic OLS (DOLS).

Table 4: Pedroni Panel cointegration test results, 1970-2006

	Within-dimension (panel)				Between-dimension (group)		
	v -Stat	ρ -Stat	PP-Stat	ADF-Stat	ρ -Stat	PP-Stat	ADF-Stat
All	0.538	-4.836***	-6.282***	-7.282***	-2.659***	-5.438***	-6.032***
French	1.564*	-5.093***	-6.274***	-7.623***	-2.389***	-4.686***	-5.835***
English	-0.533	-0.875	-1.375*	-1.731***	-0.415	-1.995**	-2.729***

Notes: Results with a trend and time-dummies. The test statistics are normalized so that the asymptotic distribution is standard normal. *, **, *** indicate rejection of the null hypothesis of non cointegration at the 10, 5, and 1 percent significance levels, based respectively on critical values of 1.281, 1.644 and 2.326.

3.4. Panel cointegration estimations

We estimate the cointegrating vector using panel DOLS method. The estimates results by period are reported in table 5. First, for the pool of all countries the FH coefficient for the full sample period (1970-2006) is 0.58 and broadly consistent with the work by Adedeji and Thornton (2006) which report a savings-retention coefficient of 0.51 for DOLS estimate. However, our result contrast with those of De Wet and Van Eyden (2005) which report a savings retention coefficient small (0.31, 0.34 and 0.28) respectively for Pooled, fixed effects and random effects models. Furthermore, we show that the FH coefficients declines over the sample period. Indeed, the FH coefficient is 0.62 for the period 1970-1987, whereas it is 0.52 in the second sub-period (1988-2006) implying that capital mobility increased in African countries over time.

There are striking results when considering panels of country groups according to their legal origins (French civil law versus common law countries). There are marked differences in retentions ratios between country groups. The estimates for French civil law countries indicate a saving retention coefficient relatively high, 0.85 compared to common law countries with 0.34 for the entire period (1970-2006). When we consider two sub-periods (1970-1987 and 1988-2006), the FH coefficient declines in French civil law countries but remains relatively high (from 0.98 to 0.70), while in common law countries the FH coefficient is broadly same about 0.30. These results indicate that capital has been relatively mobile internationally in common law countries while in civil law countries the FH puzzle is held although the coefficient declines over period. Our interpretation of the FH coefficient is different of Gunji (2003) because he takes into account a dummy variable, while our analysis centres directly on the coefficient of β.

What do the marked differences in retentions ratios between country groups (common law countries versus French civil law countries) means? According to La Porta and *al*. (1998), English common law countries have generally the strongest legal protections of investors while the civil law countries the weakest. Shleifer and Wolfenzon (2002) show that in countries with better investor protection, a larger fraction of the invested capital comes from the external market and a small fraction from internal funds (the funds of the entrepreneurs setting up). This fact combined to less formalism of judicial procedures and many reforms undertaken early 1980 in common law countries (privatization, rationalization of their publics sector, liberalization of exchange rate and financial systems) have contributed to relative capital mobility.

Table 5 : Panel cointegration vector: DOLS results

Countries	Period	Saving-retention ratio	t-ratio
All	1970-2006	0.582***	12.29
	1970-1987	0.620***	7.43
	1988-2006	0.526***	7.48
Common law	1970-2006	0.343***	3.92
	1970-1987	0.283**	2.25
	1988-2006	0.335***	2.70
French Civil law	1970-2006	0.859***	30.48
	1970-1987	0.982***	27.77
	1988-2006	0.708***	19.12

Notes: the value in parenthesis denotes the t-value for zero coefficients. *** significant at 1% and ** significant at 5%.

4. Concluding remarks

This paper has studied the international capital mobility of 37 African countries in terms of the FH coefficient and legal origins, applying recently developed panel cointegration methods. We apply panel cointegration test and used DOLS methods in order to deal with heterogeneity problems and to conduct plausible tests.

The empirical findings reported in the paper reveal that savings and investment are nonstationary and cointegrated series. Capital was relatively mobile in the African countries in the sample during 1970-2006, with estimated saving retention coefficients of 0.58 for the pool of all countries. When we consider panels of country groups (French civil law countries versus common law countries) there are marked differences in retentions ratios in each country group with ratio lowest in common law countries compared to French civil law countries. Our results show that capital tends to be mobile internationally in common law countries with strongest legal protection than in French civil law with the weakest. Some recent papers also suggest that in countries with better investor protection, a larger fraction of the invested capital comes from the external market and a small fraction from internal funds.

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Appendix

A. Legal origins (Source: Laporta et al., 2008)

French civil law countries: Algeria, Benin, Burkina, Cameroon, Central African Republic, Chad, Congo Democratic Republic, Congo, Côte d'Ivoire, Egypt, Gabon, Guinea-Bissau, Madagascar, Mali, Mauritania, Morocco, Niger, Senegal, Togo, Tunisia.

Common law countries: Botswana, Burundi, Gambia, Ghana, Kenya, Lesotho, Malawi, Nigeria, Rwanda, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe

B.

Table 1: Property of the data: descriptive statistics by country, 1970-2006

Country	**Investment rate**		**Saving rate**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
All countries	**19.212**	**9.128**	**11.160**	**17.213**
Algeria	30.439	6.527	35.008	8.490
Benin	16.053	3.374	1.631	4.206
Botswana	28.227	6.778	35.846	12.467
Burkina	18.901	3.324	2.765	5.509
Burundi	10.964	4.679	-2.019	7.563
Cameroon	19.767	7.322	19.919	4.281
Central African Rep.	11.346	3.707	2.259	4.631
Chad	15.637	11.926	2.941	14.052
Congo. Dem. Rep.	10.770	4.985	9.675	5.308
Congo. Republic of	27.720	8.546	30.232	17.376
Cote d'Ivoire	15.501	6.206	21.362	5.651
Egypt	21.432	5.848	13.925	3.076
Gabon	31.905	10.131	48.911	11.673
Gambia	17.939	6.036	6.186	4.397
Ghana	14.945	7.996	7.295	3.429
Guinea-Bissau	23.953	9.399	-2.492	6.810
Kenya	18.640	2.234	16.448	4.847
Lesotho	38.663	15.527	-45.914	21.343
Madagascar	12.368	4.578	4.975	3.721
Malawi	17.966	5.281	9.037	6.711
Mali	19.049	4.679	4.838	6.632
Mauritania	21.932	13.424	2.713	14.470
Morocco	22.813	4.335	17.591	4.065
Niger	13.344	5.163	5.679	4.711
Nigeria	20.538	4.773	24.307	8.808
Rwanda	14.528	3.333	1.746	9.474
Senegal	18.200	4.715	7.181	3.755
Sierra Leone	10.100	3.502	6.749	10.386
South Africa	20.833	4.979	24.290	5.642
Sudan	13.545	3.920	8.485	5.087
Swaziland	22.527	7.106	11.902	14.325
Tanzania	16.832	5.439	4.432	4.193
Togo	19.261	4.433	13.136	11.725
Tunisia	25.569	3.854	22.731	2.154
Uganda	13.014	5.220	5.839	4.461
Zambia	18.386	8.109	17.776	12.486
Zimbabwe	17.246	3.545	15.559	5.721