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PRIVATE INVESTMENT IN GUINEA, DOES MACRO-INSTABILITY MATTER? A COMPARATIVE ANALYSIS

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Abstract

This paper examines empirically the link between macro-instability and private investment rate in Guinea, in comparison with WAEMU countries[2]. Notwithstanding the caution imposed by data and methodological limitations in interpreting the results, the paper shows that macroeconomic instability is, in general, higher in Guinea than WAEMU countries. Consequently, macroeconomic uncertainties are cause of concern. Using a panel data approach, the findings suggest that the negative effects of relative price volatility (mainly inflation, real effective exchange rates) expected in theory, do not occur when small deviations are combined with competitiveness, resulting from a declining real effective exchange rate. In addition, the positive effect of foreign exchange reserves on the private investment rate supports the view that the availability of foreign exchange reserves is critical in a fixed exchange rate regime as that of WAEMU, as well as in an imperfect floating exchange rate regime as that of Guinea.

While the panel data approach shows no evidence of negative impact of macroeconomic uncertainties, it suggests further analysis to explore the robustness of this result. A time series approach is carried out for Guinea, with regard to this purpose. As mentioned above, Guinea registers higher level of macroeconomic instability, compared to WAEMU countries. Using a single error correction model, the counter-intuitive impact of macroeconomic instability variables (measured by the real effective exchange rate, inflation rate and the terms of trade) persists. Given the dominant share of the mining sector in the private investment figures, the findings may be misleading as this sector may be protected from the wrong market signals resulting from the increasing macro-instability. However, capturing such an 'enclave-effect' is unfortunately limited by the lack of disaggregated investment data by sector.

Finally, the results indicate a negative (indirect) impact of macroeconomic instability (measured by the real lending rate and the flow of credit to the economy) on the private sector investment. They suggest additional efforts to improve the overall macroeconomic context and especially, an in-depth openness of the financial sector, to diversify credit instruments to the private sector in Guinea.

[1] The preliminary draft of this paper was issued in 2005 when the former author was an associate lecturer at the Social Research Centre of Côte d'Ivoire (CIRES/GPE) and economist at the World Bank Country Office in Guinea/Conakry and the latter one was a postgraduate student at CIRES/GPE. We are grateful to Dennis Jones (IMF) and Boubacar-Sid Barry (World Bank) and the postgraduate students of CIRES/GPE for their insightful comments. Many thanks to Faye Harbottle for her highly appreciated editorial assistance. The views expressed in this article do not reflect those of any organization. The authors are solely responsible for any remaining errors.
[2] West African Economic and Monetary Union.

I. INTRODUCTION

A Brief Overview of Policies and Macro-economic Performance in Guinea

Guinea voted against Charles de Gaulle's proposed French community in 1958 and then declared independence. As a result, it was shunned by France and other western nations. In this relative isolation, Guinea developed a strong national identity ruled by a dictatorial power, a centralized economic policy and lack of private initiatives. Since the end of this first political regime in 1984, a process of economic liberalization has been underway in Guinea[1]. The policy measures embedded in the first economic reform program of 1986 focused on private sector promotion for the purpose of attracting foreign direct investment (FDI). In this context, the first investment code of 1984 was reviewed, successively, in 1987, 1991, 1995 and 1997.

However, overall performance (and in particular the private sector) remained mixed in a changing macro-economic environment. Although GDP growth reached 4 percent (annual average) over the 1986-2002 period, the gross national income per capita declined by 0.5 percent per year, compared to a 0.4 percent annual average increase in the WAEMU. Performance in the fiscal sector was mixed. From 1986 to 1992, fiscal deficit (including current grants) varied between 4.4 percent and 8.7 percent of current GDP, while it declined over the 1992-2000 period and increased from 4.4 percent in 2001 to 5.9 percent in 2003. In contrast with many WAEMU countries that delegated their monetary policy to the regional central bank (BCEAO), the government of Guinea implemented macroeconomic policies by adapting the monetary policy of the national central bank (BCRG) to the fiscal policy. As a result, the 20 percent ceiling (set as a percentage of the previous year's tax revenues) of BCRG's credit to the government was rarely met. BCRG's credit to the government reached 61.8 percent in 2002, up from 15.7 percent in 1998. Over the 1987-2002 period, the monetary financing of the budget deficit led to a two-digit inflation rate : 25.5 percent on average over 1987-1992, less than 5 percent over 1993-2002 and about 13 percent in 2003, while the end of year 2004 annual average is estimated at about 17.5 percent.

In the external sector, the current account balance has been negative since 1986. The deficit (excluding grants) reached 9.3 percent, 7.3 percent, 7.8 percent and 5.9 percent of GDP in 1986, 1993, 2002 and 2003, respectively. The decline of the external deficit in 2003 is due to a slowdown in imports of equipment, resulting from about a 22 percent decline of investment volumes. This deficit was financed by the accumulation of new arrears and the use of foreign

[1] The first economic and financial reform program, launched in 1986, focused on privatization of economic sectors.

reserves, which subsequently dropped to only 1.5 months of imports. Since 1986, Guinea has attempted to open up its markets to internal and external trade. In 2001, international trade openness (measured by the ratio of trade volume to GDP) was estimated at 24 percent of GDP (as compared with its neighbors, e.g., 60.5 percent of GDP in Côte d'Ivoire and only 15-18 percent in Senegal)[1]. This openness was concentrated in the mining sector (more than 80 percent of export value of goods). On imports, the openness was dominantly driven by final consumption of goods and services [2].

As for the private sector, expectations of continuing high investment levels turned out to be disappointing over the 1986-2002 period[3]. In 1986 the private investment volume (1994 constant prices) stood at 15.3 percent of GDP, then declined year by year, from 12.9 percent in 1987 to 11.1 percent of GDP in 1994. Successive investment code revisions in 1987, 1991, 1995 and 1997 failed to circumvent this declining trend, due to weak implementation. The private investment rate reached only 9.5 percent, 8.9 percent and 6.1 percent in 2001, 2002 and 2003, respectively, while FDI remained below 1 percent of GDP over the whole period, with a decline of inflows since 1999.

The long-term economic underperformance has been a major impediment for growth and economic and social development prospects. This paper analyzes the potential role of macro-economic instability on private investment performance in Guinea, in comparison to WAEMU countries. This comparison is important with regard to convergence issues that Guinea is expected to fulfill as part of the West African Monetary Zone (WAMZ) which is expected to converge toward the WAEMU zone[4]. It is expected that this study would fill the lack of a specific study on the relationship between volatile macro-economic indicators and the private investment rate in Guinea. Although policy difference (different monetary, fiscal and exchange policies, major devaluation in WAEMU in 1994, etc.) and data limitations suggest caution in interpreting results, recent developments support this research.

[1] IMF's trade restrictiveness index is repeatedly rated at 3 on a 10-points scale (with 1 indicating complete openness and 10 indicating complete restrictiveness). The un-weighted average tariff rate is 16.4 percent (World Bank/CPIA, 2003).

[2] Imports of food products increased from $USD8 million (constant price of 1987) in 1986 to $USD68,3 million in 2000, or an equivalent of $USD1,2 per capita to $USD8,4 per capita. Rice import amounted $USD54,5 million (constant price of 1987) in 2000, while there were no rice import in 1986.

[3] A review of the investment office (OPIP, 2001) showed that the number of settlement demands and investment projects (both in projection and realization) declined year after year.

[4] The WAMZ, that is expected to converge towards the WAEMU zone, comprises Gambia, Ghana, Guinea, Nigeria, Sierra Leone, Liberia and Cape Verde. The macroeconomic conditions of the creation of a single currency in West Africa are the following: inflation should be less than 5 percent; budget deficit, commitment basis (before grants) should be less than 5 percent of GDP; Central Bank financing of the budget deficit should be less than 10 percent of the previous year's fiscal revenue and gross external reserves should cover at least 3 months of imports.

The remainder of this paper is organized as follows. Section 2 will compare Guinea's macro-economic performance with WAEMU countries in relation to private investment -the WAEMU zone is assumed to be a stable economic zone compared to Guinea[1]. Finally, Section 3 will estimate both a panel data model and an error correction model of the flexible accelerator to identify relevant macro-economic determinants for Guinea.

II. PRIVATE INVESTMENT AND MACRO-ECONOMIC INSTABILITY

An Outlook

Conceptually, macroeconomic instability refers to phenomena that decrease the predictability of the domestic macroeconomic environment, leading to resource-allocation distortion and hampering investment and growth (Montiel and Serven, 2004). The empirical evidence suggests that a competitive and stable macroeconomic environment characterized by low and stable internal and external deficits, low inflation and real depreciation of the exchange rate is conducive to higher growth led by significant private investment (Easterly and Schmidt-Hebbel, 1991). This section examines the volatility of key macroeconomic outcome variables such as the rate of growth of real output and the rate of inflation, the changes in the macroeconomic policy environment (i.e. fiscal, monetary and exchange rate policies) captured by the real effective exchange rate and the real interest rate, as well as the changes of exogenous shocks such as the terms of trade, by comparing Guinea with WAEMU countries.

2.1 Growth and Investment Performance

Over the last two decades, Guinea recorded, on average, an annual growth rate of GDP above the average of WAEMU countries (3.9 percent against 2.8 percent). However, comparing investment figures among developing countries can be misleading (Box 1), due to a lack of accurate data on investment trends. The estimates generally rest on different assumptions and different data sources, limiting comparison between countries and suggesting prudent interpretation of performance.

Box 1: Measurement Problems of Private Investment in Guinea

In many developing countries, the methodologies to measure the private investment rates are limited by past trend dynamics and errors on the major components of the private sector. In general, the private investment rate is estimated on the basis of the performance of its main components such as private formal enterprises, households and a residual including informal sector. In Guinea, the estimate of private investment takes account of three major components : mining companies, other enterprises (including public enterprises) and households. The mining sector's investment corresponds to their value-added, weighted by an average of past investment rates. Since 2002 this estimate is augmented by foreign direct investment (FDI). This approach assumes a stable trend of investment rate while the inclusion of FDI admits that all FDI takes place in the mining sector, with a risk of over-estimating. The level of investment of other enterprises corresponds to the value-added in the secondary sector (except mining

[1] The convergence pact of stability and economic growth signed by WEAMU countries in 1994, rests on fiscal discipline, monetary and price stability. Central bank (BCEAO) budget deficit financing was limited to 20 percent of previous year tax revenues. Since January 2003, monetary financing of budget deficit is forbidden.

companies), augmented by value-added of trade and transport, weighted by a given investment rate. Public enterprises are included in other enterprises, assuming that they have autonomy in terms of investment. However government ownership of the capital can lead to some interference in investment decision making, though the privatization of the core enterprises reduces somehow this constraint. In addition, including trade and transport corresponds to an effort to measure the informal sector's investment by its major contributors and is therefore under-estimating the reality of this elusive sector. Overall, the weighted value-added, as an estimate of the investment level does not take fully into account, organizational, restructuring and operational strategies that may result in an increase of value-added without any additional investment. Finally, households investment corresponds to a share of gross domestic product (GDP) and behaves therefore as a residual on the demand side. In general, methodologies differ between countries so that comparisons should be interpreted cautiously.

Although Guinea's private investment performance is driven by private capital formation, economic growth is not followed by an increase of gross national income (GNI) per capita. The GNI per capita declined by 0.5 percent a year, while it increased by 0.4 percent (on average) in WAEMU countries over the 1987-2002 period (Table 1). Only Niger and Côte d'Ivoire experienced a decline of this indicator over the period. *Guinea's weak performance could be detrimental to investment, given the fact that, in theory, an increase of GNI per capita releases additional resource to augment salaries and profits of economic agents.* The demand effect of this distribution process leads to an increase of demand for goods and services. As a result, new investment decisions can be made to meet demand, provided that production capacities are over-run.

Table 1. Some Basic Macro-economic Indicators

	Average 1987-2002				
	GNI per capita *(i)* (USD)	GNI per capita (% growth)	GDP *(ii)* (% growth)	GFCF *(iii)* (% of GDP)	Private Investment (% of GDP)
Benin	348.8	1.8	3.9	15.0	7.9
Burkina Faso	263.5	0.7	3.5	19.5	11.1
Côte d'Ivoire	711.8	-0.8	1.6	10.9	6.9
Guinea Bissau	192.9	0.3	1.9	25.1	7.3
Mali	242.4	1.8	4.0	21.1	12.2
Niger	226.5	-1.8	2.2	9.6	3.6
Senegal	562.9	0.9	3.0	14.5	9.4
Togo	336.5	0.3	1.8	15.8	11.9
Guinea	**494.7**	**-0.5**	**3.9**	**17.3**	**10.7**
Average WAEMU *(iv)*	**495.8**	**0.4**	**2.8**	**14.2**	**8.4**

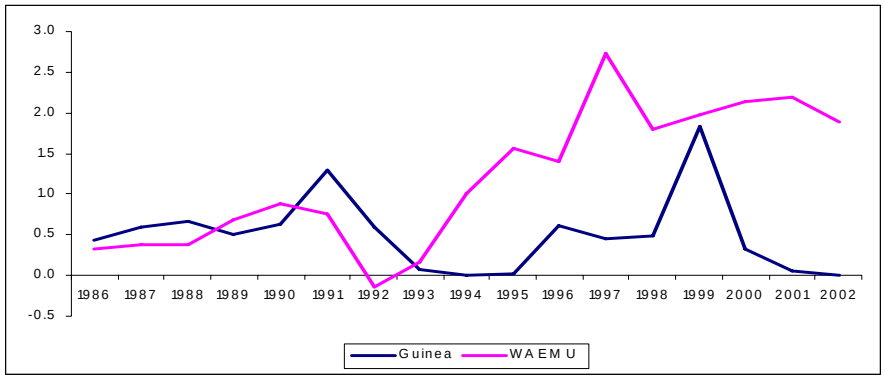
Source: World Bank/African Development Indicators and Live Database, 2003, Author's Estimates.
(i) : Gross National Income (GNI), Atlas Method *(ii) : Gross Domestic Product (GDP)*
(iii) : Gross Fixed Capital Formation (GFCF) *(iv) : WAEMU: West African Economic Monetary Union*

Until 2001, Guinea's private investment rate (as a percent of GDP) was among the highest in the sub-region, in comparison with WAEMU countries. It reached almost 12 percent of GDP on average over the 1997-2001 period, while the WAEMU zone was characterized by weak and unstable rates, except in Togo which performed better than Guinea.

Since then, Guinea's private investment rate declined sharply from 9.5 percent of GDP to 8.9 percent in 2002 and 6.1 percent in 2003. The plunging investment rate in 2003 is due to a 35 percent decline of private investment values (4.3 percent in terms of volume). The same trend is observed in WAEMU countries, except in Benin, Côte d'Ivoire and Guinea-Bissau, but on a smaller scale.

Over the 1986-2002 period, foreign direct investment (FDI) represented only 0.5 percent of GDP, on annual average in Guinea, while the weighted average of WAEMU zone was at least twice higher (1.2 percent of GDP), with higher rates in Benin (1.9 percent), Togo (1.6 percent), Mali (1.3 percent) and Côte d'Ivoire (1.3 percent). The net flows of FDI in Guinea became negative in 2000 and 2001 (respectively, US$–47.2 and US$-58 million) and nil in 2002 and 2003, because of a wait-and-see behaviour adopted by foreign investors with regard to the decline of the terms of trade in mining sector, the conflicting relationship between the government and mining companies and the worsening macro-economic performance.

Figure 1. Trends of Foreign Direct Investment (as a percentage of GDP), 1986-2002



Source: Author's Estimates

The correlation between the public and private investment rates is ambiguous, according to the figures below, although the trend is clearly negative for Guinea. In theory, an increase of public demand, notably public investments, is an important sign for private investment decision making. Indeed, public investments that support production are positively correlated to private investment[1]. The magnitude of the correlation is higher in the absence of distortionary taxes (Devarajan, Swaroop and Zou, 1995) and congestion effects of infrastructure. By contrast, public expenditures oriented to current consumption crowd out private investment.

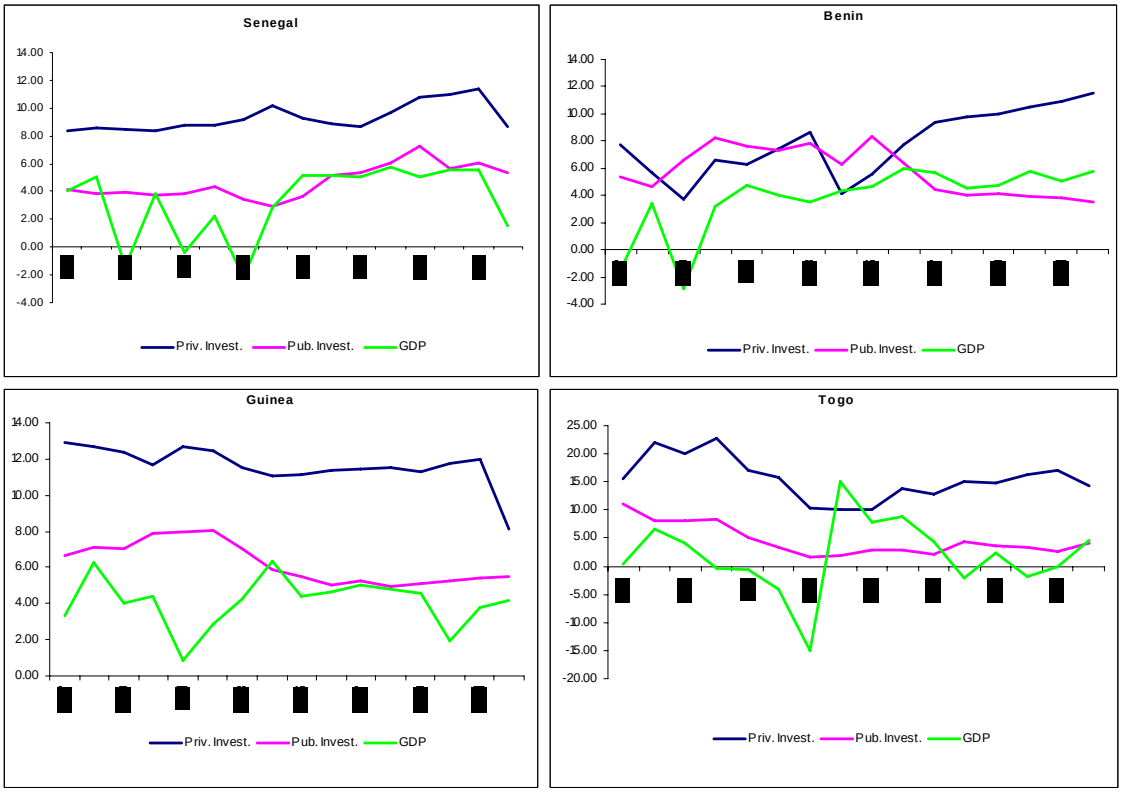
Figure 2 shows a different relationship between private investment and public investment in each country. Trends of both private and public investment rates declined in Guinea from 1987 to 2002, in contrast with Senegal. However, they diverged in Benin, from 1997 to 2002, with an upward trend of private investment over the whole period. Up to 1996, the Benin public investment rate was as high as its private investment rate, in contrast with other countries where the private investment rate remained higher than the public investment rate during this period. Togo is characterized by a declining trend from 1987 to 1994 and an increasing trend over the 1994-2002 period.

Overall, the comparison carried out above over the 1987-2002 period shows that Togo and Mali performed better in terms of private investment rate, despite their weak economic growth

[1] Many authors contributed to this debate during the 90's (see the forthcoming paper of Bogetic Z. and I. Sanogo, 2005, for a review of the literature).

performance. By contrast, Senegal and Benin recorded higher economic growth rates with moderate and low private investment performance respectively. Guinea is a middle performer among these countries, with private investment and economic growth rates close to the sub-regional averages, though slightly above. Consequently, the remainder of the paper may demonstrate better understanding of contrasting private investment performance, comparing Guinea with less and best performers, respectively Benin (private investment rate below the average of WAEMU) and Senegal and Togo (private investment rates above the average of WAEMU).

Figure 2. Private, Public Investment and GDP Growth Rates (percent), 1987-2002



Source: Author's Estimates

2.2 Macro-Economic Instability in Prospect

The volatility of macro-economic indicators (real effective exchange rate -REER, terms of trade and inflation rate) does not show any big difference between Guinea and WAEMU countries over the 1987-2002 period, while the 1987-1994 and 1994-2002 sub-periods reveal higher volatility in Guinea. In practice, assessing macro-economic stability raises the question of the thresholds of macro-economic imbalances that lead to instability. In general, the thresholds are defined a priori. Hence, the comparison is based on the convergence, stability and economic growth pact of the WAEMU adopted in 2002. Key criteria are a balanced fiscal budget (commitment basis) and an external account deficit (excluding grants) less than 5 percent of GDP. As a member of the second monetary zone (West African Monetary Zone - WAMZ),

which was inspired by the WAEMU, Guinea is therefore comparable to WAEMU country members.

Until 2002, the convergence, stability and economic growth criteria were not met. In general, fiscal deficits were above 5 percent of GDP. In Guinea high deficits were associated with high inflation and broad money growth, low private investment rates and a decline of foreign exchange reserves over the 1986-2002 period. Between 1999 and 2003, the monetary fiscal deficit financing policy did not meet the regulatory ceiling of 20 percent of the previous year's tax revenues, as authorized by the June 1994 law which created the BCRG (Doumbouya, 2004). Fiscal deficit financing through monetary policy resulted in high inflation rates, as analyzed by Blavy (2004).

Breaking the period 1987-2002 in two sub-periods (1987-1993 and 1994-2002), it appears that all three variables (REER, terms of trade and inflation rate) are more volatile in Guinea over the 1987-1994 sub-period (Table 2). Using a GARCH(1,1) method as in Serven (1998)[1], it appeared that Togo's inflation rates were more volatile in 1994 and 1998, respectively (Figure 3). Taking into account the devaluation effect and assuming a normal inflation rate of 3 percent, the volatility of inflation turned out to be higher in Guinea than the WAEMU countries over the 1987-2002 period.

Before 1994, the volatility (measured by standard deviations) of the inflation rate is lower in WAEMU countries than in Guinea, due to the pegged exchange rate regime, supported by more disciplined budgetary policies. The reform program adopted in Guinea after the 1984 coup, resulted in a surge of inflation, culminating in an annual average rate of 65 percent in 1986 when the national currency was devalued by 92 percent, trade was liberalized and prices control (except those of fuel and rice) were removed (Blavy, 2004). As for WAEMU countries, trade was also liberalized and price control were removed during the same sub-period but no inflation occurred due to a disciplined monetary policy and the delayed devaluation of the CFA franc.

After 1994, volatility remained higher in Guinea than in WAEMU countries, except for the inflation rate over the 1994-2002 sub-period. During this sub-period, Guinea was characterized by a relative stability, with inflation rate averaging less than 5 percent. However, external competitiveness remained weak due to a more volatile REER and terms of trade. Although the REER depreciated annually by an average of 5 percent throughout 1997 to 2002, the declining terms of trade of the same period counter-balanced the gains in competitiveness through its negative effect on revenues and put pressure on investment (both private and public) which kept on declining as shown by figure 2.

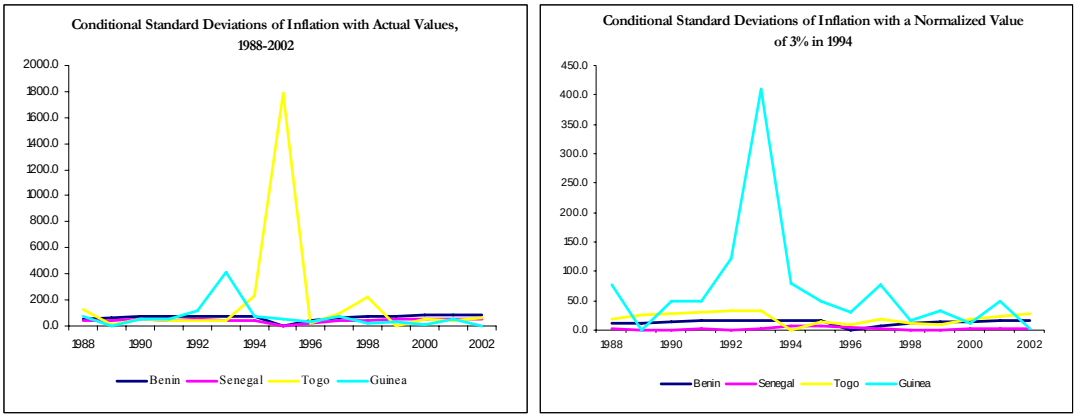
[1] See Box 2 for details.

Table 2. Standard Deviation (percent) of the REER (z), The Terms of Trade (tde) and Inflation Rate (π), 1987-2002

	Senegal	Benin	Togo	Guinea
From 1987-2002				
z	18.1	9.6	19.3	10.5
tde	18.4	8.7	15.2	16.7
π	8.0	9.5	9.8	9.8
Before 1994				
z	5.8	1.5	7.3	9.3
tde	1.3	8.3	14.1	15.2
π	1.5	2.6	0.8	12.8
After 1994				
z	2.9	4.0	3.1	5.7
tde	16.0	3.0	7.1	10.5
π	2.2	3.9	5.0	1.5

Source: Author's Estimates

Figure 3. Volatility of inflation rates measured as standard deviations



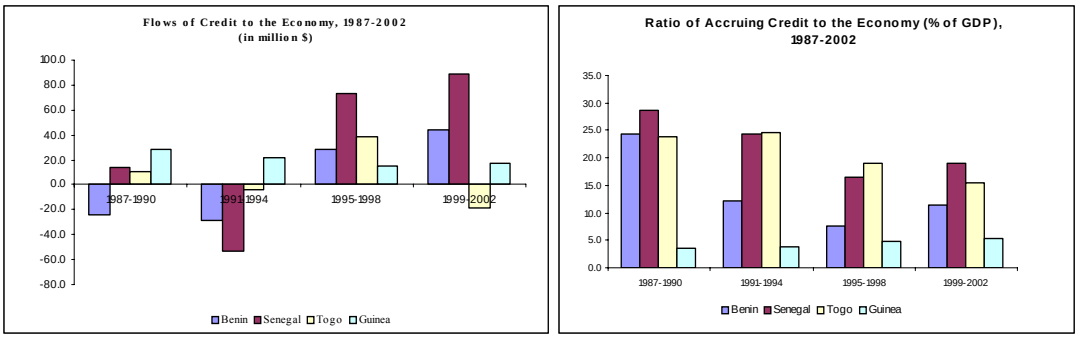
Source: Author's Estimates

Since 1993 WAEMU countries, as well as Guinea, adopted a favourable real interest rate policy, which resulted in an increase of credit flows to the private sector but accrued credit remained marginal in Guinea. During the 1986-1992 period, the nominal discount rate of the BCEAO fluctuated between 8.5 percent and 12.5 percent, against 9 percent and 19 percent for the BCRG. While the inflation rate of Benin, Senegal and Togo was below 4 percent, it was high in Guinea, between 15.4 percent and 33.8 percent, over the 1986-1992 period. As a result, real interest rate was positive at about 8 percent in WAEMU countries while it was negative in Guinea. The BCEAO reduced further its nominal discount rate to 6 percent in 1993, in view of contributing to the overall economic recovery policy adopted by its members since the CFA Franc was devalued in January 1994. By contrast, the BCRG kept its nominal discount rate at a high level of about 16.5 percent, to counter-balance the negative effect of inflation on the real interest rate. As a result, its real interest rate became positive, as opposed to the previous period of financial

repression. However, the surge of inflation in 2003 could undermined the effect of this positive real interest rate policy.

Figure 4 suggests that the low nominal discount rate policy of the BCEAO and the positive real interest rate policy of the BCRG resulted in an increase of credit flows to the private sector over the 1995-2002 period. However, accrued credit to the private sector in Guinea was marginal (less than 5 percent of GDP), compared to Benin, Senegal and Togo (more than 15 percent of GDP).

Figure 4. Trends of Flows and Total Outstanding Credit to the Economy



Source: Author's Estimates

Guinea's foreign exchange reserves remained relatively low over the 1990s, compounded by weak mobilization of external resources, with regard to its high debt service ratio. Foreign exchange availability is a key factor of private investment decision making, more in a fixed exchange rate regime than in a floating exchange rate regime. It reduces vulnerability to external shocks and international transaction costs of imports. However, the CFA Franc Zone has more credibility because of the French Treasury's guarantee and the pegging of the CFA Franc to the Euro. Therefore, availability of foreign currency could be less constraining in WAEMU countries. By contrast, in Guinea, where the monetary and exchange rate policies accommodate fiscal policy and the exchange rate regime is not entirely liberalized, the need for higher levels of foreign exchange reserves could constrain private investment capacities.

In practice, Senegal, Benin and Togo detained more foreign exchange than Guinea over the 1991-2002 period[1]. Their gross foreign reserves covered on annual average, 1.85, 5.17 and 4.31 months of imports, respectively. While Guinea's reserves were only 1.56 months of imports, Senegal had recorded an increasing trend of foreign reserves since 1994, from 1.36 months of imports in 1994 to 3.39 in 2002. Guinea's low level of foreign reserves over the last two decades, combined with a higher debt service ratio (on average 17.6 percent of exports of goods and services, compared to 9.3 percent in Togo and 7.5 percent in Benin), could result in a higher external vulnerability, in the absence of external resources, as in the past few years (2002-2004).

Overall, the statistical description showed that private investment performance was weak in Guinea and suggests that this weak performance could be explained by volatile macro-economic

[1] Data are not available before 1991 in Guinea.

indicators. Indeed, this section showed that the real effective exchange rate, the terms of trade and the inflation rate are more volatile in Guinea than in Senegal, Benin and Togo, especially when the series are broken in two sub-periods (1987-1993 and 1994-2002). In addition, monetary and exchange rate policies indicators such as real interest rates, credits and gross foreign reserves recorded a weaker performance in Guinea, compared to Senegal, Benin and Togo. The next section aims at testing a potential correlation between private investment rates and macro-economic indicators.

III. DOES MACRO-ECONOMIC INSTABILITY MATTER?

An Empirical Analysis

3.1 Reduced Form of the Private Investment Function

This section uses a simple accelerator econometric model-type (see annex 1), from Agénor (2000), where *Timp* is the private investment rate (I_n/Y)[1]. The investment function is therefore, defined by :

$Timp = f(\Delta Y, C_k, CE, R, I_{GI}, I_{GO}, z, \sigma_z, n, \sigma_n, RDE)$.

In this equation, the accelerator effect of income is captured by the changes of the production (ΔY), approximated by g, the real growth rate of GDP. The cost of using the capital, measured by C_k is approximated by the real interest rate (*TIR*). Commercial banks' credit to the economy *(CE)* is captured by the ratio of credit to the economy as a percentage of GDP (*RCE*). Foreign exchange availability for external transactions (*R*) is measured by gross foreign exchange reserves expressed in months of imports (*Rim*). Public investment is broken into a productive component I_{GI} which is expected to be positively correlated to private investment, and a non-productive component, I_{GO}, which behaves like final consumption and could have an ambiguous effect on private investment. However, the reduced form of the private investment function will retain a unique public investment rate (*TIG*), as a proxy. The real effective exchange rate (REER), defined as the profitability of tradable goods relative to non-tradable goods, is measured by z, with an ambiguous effect. Macro-economic instability is captured through the standard deviations of the REER (σ_z), the inflation rate (n), and its standard deviations (σ_n). While inflation rate is expected to have an ambiguous effect, the standard deviations of inflation and the REER are expected to be negatively correlated to private investment. The external debt service ratio (as a percentage of exports of goods and services), *RDE*, measures the effect of indebtedness on private investment, which can be threatened by anticipations of increasing taxes to reimburse debt (crowding-out effect of debt).

According to the literature on private investment function in developing countries, terms of trade (*TDE*) and trade openness (*RO*) are additional key determinants (Serven, 1998). Trade openness

[1] The rationale of the choice of this reduced form is discussed in Annex 1.

is captured by the ratio of exports and imports to GDP. A high trade openness could be beneficial to firms that operate in the tradable goods sector in terms of market (external and domestic) accessibility, provided that competitiveness (quality and price) is not incriminated. The terms of trade reflect profitability of goods on the external market (exports) relative to the internal market (imports). Therefore, the terms of trade are expected to be positively correlated to private investment.

In addition, we included two dummy variables to capture the long-run effect of structural reforms implemented in the aftermath of the CFA Franc devaluation and the short-term effect of this devaluation, respectively, *mue1 and mue2*. The former (*mue1*) is equal to zero before 1994 and is equal to 1 after 1994, while the later is equal to 1 in 1994 and zero for other years. Both dummies are equal to zero for Guinea. The short-term effect of devaluation captured by *mue2* is generally negative in developing countries because of the increase of capital cost on equipment which is predominantly imported [Branson (1986) and Buffie (1986)]. By contrast, the long-run effect (*mue1)* associated with structural reforms such as economic liberalization (cancellation of non-tariff barriers, tariff reduction, financial liberalization, disciplined fiscal policy, etc.) is expected to have a positive correlation with private investment.

Taking into account these proxies, the reduced form is written as follows :

$$Tinvp_{it}=\beta_1 g_{it}+\beta_2 TIR_{it}+\beta_3 RCE_{it}+\beta_4 Rim_{it}+\beta_5 TIG_{it}+\beta_6 z_{it}+\beta_7 \sigma_{zit}+\beta_8 n_{it}+\beta_9 \sigma_{nit}+ \beta_{10} TDE_{it}+\beta_{11} RDE_{it}+\beta_{12} RO_{it}+ \beta_{13} mue_{1it}+\beta_{14} mue_{2it}+ a_i+\mu_{it}$$

$\beta_i s$ are coefficients ; $Tinvp_{it}$ is the dependant variable ; μ_{it} represents the error term which is assumed to have a zero mean and a constant standard deviation ; and α_i represents unobserved individual characteristics of each country.

The expected signs of each variable are as follows :

$\beta_1>0$, $\beta_2<0$, $\beta_3>0$, $\beta_4>0$, $\beta_5\pm$, $\beta_6\pm$, $\beta_7<0$, $\beta_8\pm$, $\beta_9<0$, $\beta_{10}>0$, $\beta_{11}<0$, $\beta_{12}>0$, $\beta_{13}<0$, $\beta_{14}>0$.

3.2 Data and Sources

Data limitations are stringent and call therefore for caution in interpreting the results. The empirical analysis is conducted using a panel data approach. The individual dimension of data includes four countries (Benin, Guinea, Senegal and Togo) to fit with previous descriptive analyses. The temporal dimension covers the 1987-2002 period (16 years). The unbalanced panel data consists of 57 observations instead of 64 because of missing data. Data are extracted from the World Development Indicators and Country Live Database. Some variables are approximated as follows :

- $TIR= \{[1+ (i/100)]/ [(n/n_{-1})]-1\}*100$ as in the World Bank Africa Database (2004), with *i* representing the nominal discount rate ;

- (σ_n) and (σ_z) are approximated by the conditional standard deviations of the inflation rate and the REER, using a GARCH (1,1) method (see Box 2) on Eviews ;

- *RCE* is the ratio of nominal credit flows to the economy as a percentage of nominal GDP.

Box 2. Measuring Uncertainty

The notion of uncertainty is given by the conditional variance of the innovation to a variable of interest (Serven, 1998). The approach to measure uncertainty (rather than just sample variability), is based on the generalized autoregressive conditional heteroskedasticity (GARCH) specification proposed by Serven (1998, 2002). The GARCH(1,1) method is a simple equation in which the variable of interest, say *Y*, follows an AR(1) process with trend, as bellow:

$$y_{it} = \alpha_0 + \alpha_1 t + \beta_1 y_{i,t-1} + \varepsilon_{it} \; ; \; t = 1, \ldots, T; \qquad (1)$$

$$\sigma^2_{it} = \gamma_{i0} + \gamma_{i1} \varepsilon^2_{it-1} + \delta \sigma^2_{it-1} \qquad (2)$$

Where σ^2_t denotes the variance of ε_t conditional on information up to period t for each country *i*. For each of the variables of interest, we estimate the two-equation model (1)-(2) *separately*. The fitted σ^2_{it} drawn from equation (2) are taken as the measure of uncertainty of y_{it}.

The conditional variance drawn from the GARCH procedure is included in the private investment equation, controlling for conventional determinants.

3.3 Econometric Estimation: Methodological Issues, Tests and Results

Two necessary conditions need to be met while using a panel data model[1]. The first one is the Lagrangian multiplier test of Breusch-Pagan (LM-test), which tests the absence of specific effects (the null hypothesis of uniform characteristics of countries or pooled model) against the presence of specific effects (alternative hypothesis of mixed/diversed characteristics of countries). The second one is the specification test of Hausman, which tests exogeneity of independent variables with regard to the random component of residuals (null hypothesis). When the temporal dimension of the panel data is small, the Hausman test consists of testing random specific effects (null hypothesis) against fixed specific effects (alternative hypothesis).

The required tests are held through Stata 6.0 (see annex 3). The LM-test of Breusch-Pagan does not reject the alternative hypothesis of existence of specific characteristics by country, given the high value of the Chi-square (low probability). However, the additional test of Chow (F-test), does not reject the homogeneity of these specific characteristics within each country. The specification test of Hausman does not reject the alternative hypothesis of endogeneity of independent variables, given the high value of the Chi-square (low probability) (Table 3). The results of these tests suggest therefore a WITHIN method to estimate the reduced form of the private investment model. This method estimates the reduced form, using a first-differencing of each variable to its average value. Therefore, it removes the time-invariant disturbance of the panel. However, it does not solve effectively the endogeneity issue raised above (Hausman and

[1] Given the small temporal dimension of the panel, we assume that tests that discriminate between Seemingly Unrelated Regression (SUR) models and Pooled models are not relevant.

Taylor, 1981). A standard approach to fix the endogeneity problem consists of using a GMM method (Serven, 1998), provided that the time dimension of the data is long enough to satisfy identification conditions, due to the use of 2-lagged variables as instruments. Notwithstanding the superiority of the GMM estimator on the WITHIN estimator, we kept the latter, given the small time dimension of the data.

Overall, the model performs well in explaining the private investment rate at 79 percent, with a broad significance level of independent variables at 1 percent (F-test). Only variables that are statistically significant at levels of 1 percent, 5 percent and 10 percent are reported in the Table 3 below. While the ratio of debt service and the real interest rate are negatively correlated to the private investment rate, public investment rate, the ratio of credit to the economy, inflation rate and terms of trade have positive relationships but none of these variables is significantly different from zero. This finding may suggest that, as neither the inflation rate nor its volatility threaten the private investment rate, it may be because of predominance of WAEMU countries in our sample.

Table 3. Determinants of the Private Investment Rate (*Timp,* dependent variable)

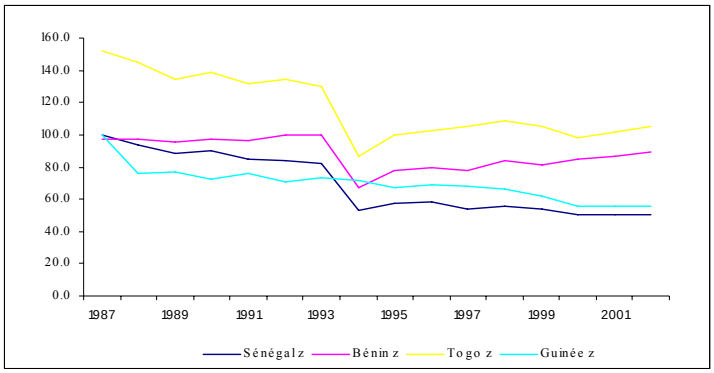
Independent Variables	Coefficients (Significance)
Real Growth rate (g)	0,0998 (0.062) [a]
Gross Foreign Exchange Reserves (Rim)	0,444 (0.001)
Real Effective Exchange Rate (Z)	0,1751 (0.000)
Standard Deviation of Z (σ_z)	0,032 (0.000)
Trade Openess (RO)	0,164 (0.000)
Dummy for Structural Reforms After 1994 (mue_1)	3,222 (0.003)
Dummy for Devaluation Effect in 1994 (mue_2)	-1,486 (0.094) [a]
Individual Constant (α_1-Guinea)	-9,33 (0.000)
Individual Constant (α_2-Benin)	-20,927 (0.000)
Individual Constant (α_3-Senegal)	-17,006 (0.000)
Individual Constant (α_4-Togo)	-24,315 (0.000)
F statistic	435,11 (0.000)
R^2	0,788
Adjusted-R^2	0,775
Breusch-Pagan (Chi2)	26,25 (0.000)
Hausman test (Chi2)	254,08 (0,000)
Chow test (F-test)	34,31 (0.000)

Source: Author's Estimates
( ) Numbers between brackets correspond to significance levels associated with t-Student values;
(a) Indicates significance at 10 percent level.

All the variables of the model have expected signs, except the standard deviation of the REER. The effect of a change in GDP on the private investment rate is positive and statistically significant, and reflects the accelerator effect. The availability of foreign exchange reserves has a positive effect on the private investment rate. This may suggest that low levels of foreign exchange reserves are detrimental to private investment. This interpretation is supported by the Guinea's experience over the 1987-2002 period, as seen in section 1. Although there is still a

debate about the effect of trade openness on growth and investment, the model's findings show a positive effect on the private investment rate. This result is supported by the countries concerned, which rest heavily on imports of equipment and export of raw materials. In this context, investment decision-making in these countries would depend on the profitability of domestic markets, measured by the REER. The positive effect of this variable reflects the competitiveness achieved by the countries, notably after 1994. However, the positive effect of the standard deviation of the REER is counterintuitive, suggesting that external competitiveness is stable and persistent over time, as shown by Figure 5. The stability of the REER could therefore be interpreted as a positive sign of the profitability of domestic markets to private investment. The expected results of the dummies are in line with the model's findings, suggesting that devaluation combined with structural reforms has a positive effect on the private investment rate in the medium and long term.

Figure 5. Evolution of the Real Effective Exchange Rate, 1987-2002



Source: Author's Estimates

Finally, individual country characteristics captured by α1 (Guinea), α2 (Benin), α3 (Senegal) and α4 (Togo) suggest the existence of strong negative unobserved factors at different levels (low for Guinea and high for Togo). This finding may suggest that a country case by case approach is worth to be considered. For instance, the lack of variables capturing economic potential attractiveness (availability of natural resources), corruption, governance and political instability could put severe limitations on the findings of the model.

The availability of natural resources is potentially more favorable to Guinea's attractiveness of foreign investors, as it may be reflected by the lowest negative effects of its characteristics (α1). However, corruption has significant macroeconomic effects on the Guinean economy as it significantly taints the general business environment and raises the cost of doing business (World Bank, 2004). On the macro-economic side, it reduces the effectiveness of policy changes, and severely reduces fiscal revenues. On the business side, it increases transaction costs. According to the Bank Group's "Doing business in 2005", transaction costs of starting a business, regulations of ongoing business, and regulations of factor markets (land and labor) and financial markets (access to credit and quality of information) are higher in Guinea than the sub-regional

averages. Hence, improvement of the business climate, combined with macro-stability, is necessary to create an environment conducive to private investment, given the strong economic potential of Guinea.

3.4 An Error Correction Model Approach for Guinea

The mining sector led investment rate may create some data limitations and methodological issues in interpreting the results. A time-series data set, covering the period 1987-2003, is built to explore the empirical relation between investment and macroeconomic uncertainty. The results should be interpreted with caution, given some data limitations, notably the private investment rate figures (see Box 1). For instance, the results can be limited by the dominance of the mining sector in the private investment figures in Guinea, because this sector may react as an enclave, benefiting from various incentives embedded in the investment code, the environment code and the mining code which may therefore externalize the sensitivity of the mining sector to macroeconomic uncertainties (Campbell, 2004)[1].

Notwithstanding the measurement problems and eventual bias, the empirical specification consists of using the (log of the) private fixed investment/GDP ratio as dependent variable. The explanatory variables include the conditional variances of the innovations to the variables of interest as obtained from the GARCH(1,1) procedure described in Box 2. In addition to these variables, the conventional accelerator effect is captured by the current and lagged levels of (the log of) real GDP. Given the small size of the sample, the conventional approach to the estimation is based on a single equation error correction model, which reduced further the sample size to 14 observations (1990-2003). Additional tests of Serial Correlation and Homoskedasticity Test resulted in a non-rejection of serial independence of residuals and their related constant variances (homoskedasticity) (see Annex 4). The final estimates are shown in Table 4.

The increasing volatility of real effective exchange rate, inflation rate and the terms of trade have not threaten directly the private investment ratio, during the last fifteen years, in contrast with the negative impact of financial sector's variables. Indeed, the 1990-2003 period covered by the estimation, is characterized by moderate inflation rates (less than 5 percent on average, except 2003), low (but increasing) level of the volatility of real effective exchange rate and declining terms of trade. Although these indicators create uncertainties for private investors in terms of profitability and the cost of investment, the estimates show no evidence of direct negative impact on private investment ratio. In other words, the level of volatility is not high enough to threaten

[1] Campbell argued that the 1990s policy reforms in the mining sector in Guinea, occurred in an increasing externalisation of the policy process in the area of natural resource management, in which foreign technology, training, and finance are called upon to assume a more active and even decisive role. As a result, the developments in the Guinean mining sector illustrate the country's difficulty in negotiating financial terms for the conditions of extraction of its key resources (bauxite and alumina), in order to maintain minimally stable resources from this critical sector.

private investment rates, but this result draws the attention on their potential negative impact if the reversed situation observed since 2003 is maintained in medium and long terms.

In addition, the volatility indicators reduce the incentives of the financial sector to offer credit to the private sector, as reflected by the negative impacts of the real lending rate and the credit flow to the economy. According to the Creditor and Borrower Legal Rights Index (World Bank, 2004), which measures how well collateral and bankruptcy laws facilitate lending, Guinea has a very low score of 2, compared with a regional average of 4.6[1]. With respect to credit reporting systems, Guinea has a score of 2 in the Credit Information Index, compared with a regional average of 2.1 and an OECD average of 5.0[2]. Hence, one can argue that the legal and judiciary systems are not favorable to efficient financial intermediation, including the use of collateral. Banks are generally risk averse and prefer to finance trade, and short term lending at high interest rates, leaving few amount of capital to finance the development needs of the private sector.

Table 4. Impact of Macroeconomic Uncertainties on Private Investment Ratio in Guinea

Dependent Variable: D(Log of Gross Private Investment Ratio)*
Method: Least Squares
Sample(adjusted): 1990 2003
Included observations: 14 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-2.487	0.502	-4.957	0.016
D(Real Lend. Rate)	-0.003	0.001	-2.759	0.070
D(Real Eff. Exch. Rate Uncertainty)	0.047	0.009	4.982	0.016
D(Log of Ratio of Priv. Inv. Defl. to GDP Defl.)	0.941	0.154	6.097	0.009
D(1-lagged Log of Gross Private Invest. Ratio)	-1.514	0.161	-9.423	0.003
1-lagged Credit Flow to the Economy	-0.033	0.009	-3.575	0.037
1-lagged Terms of Trade Uncertainty	0.002	0.001	4.172	0.025
2-lagged Inflation Rate	0.017	0.005	3.132	0.052
1-lagged Real Eff. Exch. Rate Uncertainty	0.049	0.017	2.796	0.068
2-lagged (Log of Ratio of Priv. Inv. Defl. to GDP Defl.)	0.823	0.198	4.162	0.025
2-lagged Real Lending Rate	0.007	0.003	2.399	0.096
R-squared	0.986	Mean dependent var		-0.006
Adjusted R-squared	0.938	S.D. dependent var		0.097
S.E. of regression	0.024	Akaike info criterion		-4.582
Sum squared resid	0.002	Schwarz criterion		-4.080
Log likelihood	43.077	F-statistic		20.628
Durbin-Watson stat	2.088	Prob(F-statistic)		0.015

* D = First Difference

[1] The Legal Rights Index ranges from 0-10, with higher scores indicating that those laws are better designed to expand access to credit.
[2] The Credit Information Index measures the scope, access and quality of credit information available through public registries or private bureaus. The index ranges from 0-6, with higher values indicating that more credit information is available from a public registry or a private bureau.

IV. CONCLUDING REMARKS

Using a comparative approach between Guinea and WAEMU countries, this paper explored the relationship between macro-instability and the private investment rate, controlling for macro-economic classical determinants. The findings support the view that the negative relationship between macro-economic instability and private investment occurs only when the volatility of macro-economic variables is high enough to transmit negative signals to private investors. While the volatility of inflation and the terms of trade are found to be statistically insignificant, the volatility of the real effective exchange rate is found to be significantly different from zero with a rather counterintuitive positive effect on the private investment ratio. This finding may suggest that the countries concerned by this empirical analysis are not yet facing the negative effects of macro-instability. In the specific case of Guinea, built on a single error correction model, it may also suggest some evidence of 'enclave effect' of the mining sector. Given the scope of incentives offered to the mining sector and its leading role in Guinea, the private investment rate may not react negatively to the wrong market signals created by the macro-instability indicators. However, this assumption could not be explored because of the lack of detailed data by sector of investment.

On a policy perspective, this counter-intuitive impact draws the attention on the current increasing volatility of macro-economic indicators. This is an important issue, with regard to the surge of double-digit inflation since 2003, driven by combined effects of monetary financing of fiscal deficit and the official and un-official Guinean franc depreciations. Unless it is quickly and effectively managed, recent acceleration of inflation could have a negative effect on domestic prices and hence on competitiveness and foreign exchange reserves. Finally, the negative indirect impact of macroeconomic instability (measured by the real lending rate and the flow of credit to the economy) on the private sector investment suggests additional efforts to improve the overall macroeconomic context and especially, an in-depth openness of the financial sector, to diversify the variables of credit to the private sector.

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ANNEX 1

THEORETICAL FRAMEWORK AND EMPIRICAL REVIEW

The Private Investment Function in Theory

The analysis of macro-economic determinants of private investment is generally based on the flexible accelerator model. The pioneer simple accelerator model assumed a long-term relationship between investment (I_n) and income (Y) (Abraham-Frois, 1991). The net investment rate (I_n/Y) is defined as an increasing function of the growth rate $((Y-Y_{-1})/Y)$ plus a constant term, assuming a full utilization of capital :

$$I_n/Y=k(Y-Y_{-1})/Y+ak \qquad (1)$$

Where k is the ICOR (Incremental Capital Output Ratio) and a the depreciation rate of capital.

Equation 1 was extended to the flexible accelerator model by taking into account anticipative behaviours and delayed adjustments of capital to the growth of income. As a result, net investment was set as a function of the growth of income, following an adapting anticipation process :

$$I_n=k(Y^a_{+1}-Y^a) \qquad (2)$$

Where $Y^a_{+1}=\lambda Y+(1-\lambda)Y^a \quad (0<\lambda<1)$ is the anticipated income in t for next period $(t+1)$ and λ is the adjustment coefficient. Using a Koyck process, equation 2 is derived as :

$$I_n=\lambda k(Y-Y_{-1})+(1-\lambda)I_{-1} \qquad (3)$$

And the investment rate is defined by :

$$(I_n/Y)=\lambda k[(Y-Y_{-1})/\ Y_{-1}]+(1-\lambda)(\ I_{n-1}/\ Y_{-1}) \qquad (4)$$

λk and $(1-\lambda)$ are positive.

Other authors emphasized the negative effect of the capital cost on private investment. Pioneer economists such as Keynes and Fisher approximated the capital cost by using nominal and real interest rates, respectively. Jorgensen (1963)[1], defined capital cost as the opportunity cost of investing instead of saving. This opportunity cost (C_k) is set as a function of the price of capital goods (P_k), the real interest rate ($i-\Delta P_k/P_k$), where i is the nominal interest rate and ($\Delta P_k/P_k$) is the inflation rate, measured in terms of P_k and δ, the depreciation rate of capital :

$$C_k=P_k(i+\delta-\Delta P_k/P_k) \qquad (5)$$

Then Jorgensen derived a simple accelerator model, augmented by the impact of the capital cost (known as the accelerator-cost of capital model) :

$$I_n=f(\Delta Y,\ \Delta(C_k/P_k)) \qquad (6)$$

ΔY and C_k/P_k are assumed to correlate, respectively, positively and negatively to I_n. Although generalized, this model faces three main limits (Villieu, 2000) : it assumes that income is exogenous, in contrast with the neoclassical investment function based on profit maximization. In profit maximization, demand for factors and supply of goods are derived simultaneously, so that private investment is a function of the relative cost of factors (capital and labour). Therefore equation 6 becomes :

$$I_n=f(\Delta(C_k/P_k),\ \Delta(W/P_k)) \qquad (7)$$

where W and P_k represent, respectively, the cost of labour and the unit price of capital, set equal to the price of goods.

[1] In Villieu P. (2000) : *Macroéconomie : l'investissement*,. Paris, La Découverte, Repères, pp.23-27.

In addition, Jorgensen's model is weakened by the introduction of an *ex post* cost of installed investment, assuming that anticipations are myopic. And finally, capital cost is derived, assuming that capital demand follows a decreasing return to scale as in the neoclassical model. However, for technical reasons, researchers may use a constant return to scale function.

In regard to these limits, the neo-classical model was amended by taking into account an exogenous market opportunity constraint, which gives Keynesian foundation to the model. It also allows the derivation of factor demand and goods supply, even in the presence of a constant return to scale. This improvement resulted in the accelerator-relative cost of factor model :

$$I_n = f(\Delta Y, \Delta(W_k / C_k)) \qquad (8)$$

However, this model does not explain private investment behaviour when uncertainty and irreversibility issues are questioned, as in Dixit and Pindyck (1994). In the context of irreversibility, the investor adopts a wait-and-see behaviour, due to uncertainties. According to Arrow (1968)[1], he will postpone the decision to invest as long as the expected return on his investment is lower than the capital cost. Consequently, uncertainties are a major disincentive to private investment, mainly in developing countries.

Review of Empirical Studies in Developing Countries

Recent economic literature emphasized the impact that uncertainties and macro-economic instability have on private investment in developing countries. Serven (1998) identified 5 macro-economic determinants of private investment: the economic growth rate, inflation rate, relative price of equipment goods, terms of trade and real exchange rate. Combining uncertainties, irreversibility and macro-economic volatility, he found a negative impact on private investment in sub-Saharan African countries over the 1980s and 1990s, in particular, when uncertainties are captured by the volatility of the exchange rate (Serven, 2002). Other authors [Pattillo (1997), Aizenman and Marion (1999)], achieved the same results in Ghana.

In addition to the variables mentioned above, some authors (Oshikoya, 1994, and Hadjimichael and Ghura, 1995) showed that private investment decisions in developing countries depend mainly on the country's access to credit and foreign exchange (positive correlation), public investment rate (ambiguous correlation), burden of external debt (negative correlation), terms of trade and trade openness or restrictiveness. Oshikoya used a simple accelerator model, focusing on 4 middle-income and 4 low-income countries in Sub-Saharan Africa over the 1970s and 1980s. He found a positive and significant acceleration effect on income only for the low-income countries of his sample and explained this correlation by myopic anticipations or short-term decision-making of investors; however, the complementary effect of public investment was more significant in middle-income countries. More importantly, he found that macro-economic indicators such as the exchange rate and inflation rate have a positive and significant effect in the middle-income countries, in contrast with low-income countries. However, macro-instability measured by the standard deviation of the exchange rate has a negative impact in both types of countries over the 80's.

Beside macro-economic variables, the business climate, governance and corruption issues have been constantly on the rise in the past few years as key determinants of the sources of growth and investment in developing countries Studies that focused on this aspect generally assume that corruption is a measure of the impact of quality of governance on economic efficiency. Mauro (1993) found that countries with a high CPI (corruption perception index) recorded the lowest investment rates (including private investment rates). Moreover, Mauro (1995) showed that corruption and the business climate, notably the judiciary environment and property rights, are negatively correlated with economic growth. North (1990) emphasized the strong correlation between the efficiency of a country's judiciary system and its economic performance. Overall, uncertainties on property rights, profits and licences could reduce private incentives and the decision to invest, innovate and attract foreign direct investment.

However, recent literature on corruption and governance issues is in contradiction with previous research findings. Leff (1964) and Huntington (1968), argued that economic growth can be driven by corruption through two mechanisms. Bribes could : (i) accelerate administrative procedures and ; (ii) encourage civil servants to work faster on cumbersome and complex procedures. Rose-Ackerman (1978) warned that it is difficult to contain corruption where it is economically desired, while Shleifer and Vishny (1993) argued that corruption is detrimental to economic growth.

Notwithstanding the relevance of the debate, this paper does not take into account the governance and corruption issues because of a lack of a temporal series for the countries of our sample. Nor does it deal with the theoretical

[1] In Villieu P. (2000), Op. Cit. p.41

debate between simple accelerator and flexible accelerator models, notably when it goes along with private investment behavior in developing countries. However, taking stock of empirical studies, Agénor (2000) found that the simple accelerator model makes more sense in developing countries, assuming a zero capital depreciation rate and no anticipation process (expected income is equal to current income). The rationale of this approach rests on the lack of transparent markets and the prevailing financial repression which limit the use of the flexible accelerator model of investment in most of the developing countries.

ANNEX 2

Benin Series

	Tinvp	g	TIG	Tir	RCE	z	σ_z	Rim	π	σ_π	RDE	TDE	Ro
1987	7,7	-1,5	5,4	9,3	-1,7	97,3		0,2	3,0		7,8	73,6	46,2
1988	5,7	3,4	4,7	10,7	2,7	97,3	56,6	0,2	-0,6	61,3	7,5	81,1	45,9
1989	3,8	-2,9	6,6	14,2	-7,3	95,9	68,4	0,2	2,2	71,9	6,9	77,4	38,3
1990	6,6	3,2	8,2	11,9	-0,2	97,5	75,7	1,7	1,6	80,9	8,2	100,0	40,6
1991	6,3	4,7	7,7	14,5	-3,0	96,3	76,6	2,6	0,7	85,0	4,6	88,5	43,6
1992	7,4	4,0	7,3	8,2	-2,9	100,0	78,9	3,9	3,4	86,8	4,2	80,1	43,4
1993	8,6	3,5	7,8	5,0	-0,3	99,8	71,4	3,9	1,2	89,4	4,7	77,3	41,9
1994	4,2	4,4	6,3	-23,1	0,9	67,3	69,7	4,8	33,5	89,2	6,4	75,9	50,1
1995	5,5	4,6	8,4	-7,4	0,5	77,5	0,3	2,6	15,4	0,4	6,8	100,0	53,2
1996	7,7	6,0	6,3	1,0	1,9	79,5	38,7	3,9	6,7	41,6	6,0	88,2	45,3
1997	9,4	5,7	4,4	2,4	0,5	78,0	59,7	3,8	5,0	63,8	8,7	93,3	45,0
1998	9,8	4,6	4,0	0,3	2,1	83,9	70,3	3,9	4,7	76,6	9,1	93,3	44,6
1999	10,0	4,7	4,1	5,6	3,6	81,0	76,3	5,4	1,9	83,7	10,1	94,1	45,0
2000	10,5	5,8	4,0	1,8	2,5	84,6	81,1	7,3	3,3	86,2	11,0	94,1	43,3
2001	10,9	5,0	3,8	2,0	0,0	86,3	81,7	8,8	3,1	88,9	7,9	94,2	43,1
2002	11,6	5,8	3,5	3,3	1,4	89,6	80,7	8,8	1,9	90,2	9,6	96,0	40,4

Benin, Correlation Matrix

	TINVP	G	π	RCE	RDE	Rim	Ro	TDE	TIG	Tir	σ_π	σ_z	Z
TINVP	1.000	0.611	-0.425	0.513	0.562	0.794	-0.271	0.517	-0.682	0.071	0.337	0.385	-0.052
G	0.611	1.000	0.117	0.744	0.231	0.607	0.410	0.481	-0.326	-0.374	-0.038	-0.060	-0.424
π	-0.425	0.117	1.000	0.110	-0.139	0.062	0.693	-0.216	0.182	-0.916	-0.199	-0.322	-0.746
RCE	0.513	0.744	0.110	1.000	0.552	0.402	0.428	0.419	-0.508	-0.396	-0.098	-0.117	-0.471
RDE	0.562	0.231	-0.139	0.552	1.000	0.435	-0.100	0.603	-0.751	-0.074	0.103	0.189	-0.343
Rim	0.794	0.607	0.062	0.402	0.435	1.000	-0.063	0.344	-0.593	-0.343	0.386	0.375	-0.332
Ro	-0.271	0.410	0.693	0.428	-0.100	-0.063	1.000	0.097	0.152	-0.717	-0.621	-0.698	-0.676
TDE	0.517	0.481	-0.216	0.419	0.603	0.344	0.097	1.000	-0.230	0.048	-0.285	-0.188	-0.220
TIG	-0.682	-0.326	0.182	-0.508	-0.751	-0.593	0.152	-0.230	1.000	0.080	-0.322	-0.384	0.291
Tir	0.071	-0.374	-0.916	-0.396	-0.074	-0.343	-0.717	0.048	0.080	1.000	0.188	0.309	0.841
σ_π	0.337	-0.038	-0.199	-0.098	0.103	0.386	-0.621	-0.285	-0.322	0.188	1.000	0.982	0.316
σ_z	0.385	-0.060	-0.322	-0.117	0.189	0.375	-0.698	-0.188	-0.384	0.309	0.982	1.000	0.367
Z	-0.052	-0.424	-0.746	-0.471	-0.343	-0.332	-0.676	-0.220	0.291	0.841	0.316	0.367	1.000

Guinea Series

	Tinvp	g	TIG	Tir	RCE	z	σ_z	Rim	π	σ_π	RDE	TDE	Ro
1987	12,9	3,3	6,6	-20,7	1,5	100,0			38,7		27,2	135,9	58,4
1988	12,7	6,3	7,1	-4,3	1,7	75,6	2,7		15,0	77,5	21,1	121,3	58,0
1989	12,4	4,0	7,0	-5,6	0,6	77,2	3,7		18,6	1,1	16,4	133,3	60,9
1990	11,7	4,4	7,9	-8,3	1,0	72,5	5,5		23,3	48,7	20,0	135,0	61,5
1991	12,7	0,8	7,9	-6,1	0,4	75,8	3,9	0,8	25,1	49,4	16,0	130,0	46,2
1992	12,5	2,9	8,0	-13,4	0,8	70,3	4,7	1,0	32,4	121,4	12,7	103,4	45,0
1993	11,5	4,2	7,0	21,2	0,4	73,0	5,2	1,6	-4,2	409,1	11,1	95,4	45,7
1994	11,1	6,3	5,9	16,8	1,1	71,4	6,1	0,9	4,2	78,8	14,3	111,2	47,7
1995	11,1	4,4	5,5	13,4	0,8	67,3	6,5	0,9	5,6	50,0	25,0	100,0	45,3
1996	11,4	4,6	5,0	12,0	0,2	69,0	9,8	1,0	3,0	31,4	14,7	86,8	43,3
1997	11,5	5,0	5,3	10,1	0,0	68,5	11,4	1,5	1,9	78,3	20,7	97,2	43,0
1998	11,5	4,8	4,9	6,9	0,7	65,9	8,9	2,6	5,1	17,1	19,5	88,5	46,6
1999	11,3	4,6	5,1	9,4	0,7	62,0	8,3	2,3	4,6	33,8	16,4	85,7	48,6
2000	11,7	1,9	5,3	8,2	0,4	55,6	12,4	1,8	6,8	10,6	20,4	111,1	52,3
2001	12,0	3,8	5,4	10,6	0,4	55,4	8,5	2,4	5,4	48,7	12,3	111,1	56,0
2002	8,1	4,2	5,5	14,0	0,5	55,3	5,8	1,9	3,0	1,8	13,6	111,1	54,0

Guinea, Correlation Matrix

	TINVP	G	π	RCE	RDE	Rim	Ro	TDE	TIG	Tir	σ_π	σ_z	Z
TINVP	1.000	-0.401	0.480	-0.002	0.040	-0.222	-0.372	0.073	0.427	-0.513	0.203	0.028	0.473
G	-0.401	1.000	-0.635	0.244	0.006	0.157	-0.166	-0.591	-0.546	0.646	0.078	0.146	0.022
π	0.480	-0.635	1.000	0.242	-0.108	-0.419	-0.147	0.463	0.725	-0.961	-0.186	-0.442	0.296
RCE	-0.002	0.244	0.242	1.000	0.028	-0.061	0.107	0.024	0.110	-0.103	-0.106	-0.409	0.055
RDE	0.040	0.006	-0.108	0.028	1.000	-0.029	-0.251	-0.132	-0.418	0.033	-0.438	0.448	-0.063
Rim	-0.222	0.157	-0.419	-0.061	-0.029	1.000	0.571	-0.333	-0.554	0.247	-0.157	0.425	-0.682
Ro	-0.372	-0.166	-0.147	0.107	-0.251	0.571	1.000	0.390	-0.246	0.171	-0.289	0.092	-0.838
TDE	0.073	-0.591	0.463	0.024	-0.132	-0.333	0.390	1.000	0.513	-0.326	-0.140	-0.382	0.003
TIG	0.427	-0.546	0.725	0.110	-0.418	-0.554	-0.246	0.513	1.000	-0.601	0.478	-0.750	0.591
Tir	-0.513	0.646	-0.961	-0.103	0.033	0.247	0.171	-0.326	-0.601	1.000	0.260	0.253	-0.218
σ_π	0.203	0.078	-0.186	-0.106	-0.438	-0.157	-0.289	-0.140	0.478	0.260	1.000	-0.373	0.471
σ_z	0.028	0.146	-0.442	-0.409	0.448	0.425	0.092	-0.382	-0.750	0.253	-0.373	1.000	-0.487
Z	0.473	0.022	0.296	0.055	-0.063	-0.682	-0.838	0.003	0.591	-0.218	0.471	-0.487	1.000

Senegal, Series

	Tinvp	g	TIG	Tir	RCE	z	σ_z	Rim	π	σ_π	RDE	TDE	Ro
1987	8,3	4,0	4,1	13,1	0,9	100,0		0,2	2,0		32,4	108,0	55,5
1988	8,5	5,1	3,8	11,5	1,9	93,8	39,5	0,2	2,1	41,8	31,4	106,6	51,9
1989	8,5	-1,4	4,0	10,5	0,7	88,5	46,8	0,2	0,9	52,9	28,7	110,0	58,8
1990	8,3	3,9	3,8	10,7	-2,0	90,3	51,4	0,1	1,2	58,8	20,0	110,0	55,8
1991	8,7	-0,4	3,9	13,0	-1,0	84,6	45,8	0,1	0,4	62,3	20,9	109,2	54,6
1992	8,8	2,2	4,4	12,7	1,5	84,3	49,8	0,1	0,6	63,9	13,5	109,5	50,8
1993	9,2	-2,2	3,5	6,5	0,4	82,2	46,3	0,1	-1,4	64,9	9,1	106,9	50,3
1994	10,2	2,9	2,9	-19,8	-7,5	53,1	44,2	1,4	27,8	63,7	17,1	85,0	76,5
1995	9,3	5,2	3,6	-1,7	0,4	57,6	0,1	1,6	5,0	0,2	16,7	100,0	74,6
1996	8,9	5,1	5,1	3,1	2,6	58,0	25,8	1,9	1,0	29,2	18,9	105,8	65,3
1997	8,6	5,0	5,3	4,4	1,9	54,1	40,1	2,7	2,5	45,1	17,2	80,4	65,0
1998	9,7	5,7	6,0	4,8	1,6	55,3	47,6	2,7	1,7	54,9	20,6	83,5	67,4
1999	10,8	5,0	7,3	5,1	1,6	54,0	51,2	2,4	1,4	60,3	14,3	73,3	68,8
2000	10,9	5,6	5,7	5,3	4,5	50,8	53,2	2,4	0,8	63,3	13,8	63,9	69,7
2001	11,4	5,6	6,0	2,7	0,9	50,5	54,8	2,7	2,8	64,6	12,0	61,6	70,3
2002	8,6	1,5	5,3	3,7	0,9	50,2	52,7	3,4	2,7	66,2	12,6	61,7	72,2

Senegal, Correlation Matrix

	TINVP	G	π	RCE	RDE	Rim	Ro	TDE	TIG	Tir	σ_π	σ_z	Z
TINVP	1.000	0.428	0.240	0.050	-0.461	0.495	0.569	-0.696	0.544	-0.422	0.230	0.223	-0.641
G	0.428	1.000	0.082	0.276	0.013	0.561	0.496	-0.439	0.513	-0.217	-0.360	-0.215	-0.535
π	0.240	0.082	1.000	-0.814	-0.010	0.078	0.523	-0.159	-0.363	-0.896	0.038	-0.094	-0.313
RCE	0.050	0.276	-0.814	1.000	-0.025	0.278	-0.165	-0.176	0.586	0.619	-0.168	-0.007	-0.085
RDE	-0.461	0.013	-0.010	-0.025	1.000	-0.401	-0.290	0.483	-0.287	0.265	-0.285	-0.156	0.526
Rim	0.495	0.561	0.078	0.278	-0.401	1.000	0.793	-0.878	0.735	-0.372	-0.023	0.041	-0.927
Ro	0.569	0.496	0.523	-0.165	-0.290	0.793	1.000	-0.718	0.357	-0.752	-0.217	-0.229	-0.899
TDE	-0.696	-0.439	-0.159	-0.176	0.483	-0.878	-0.718	1.000	-0.686	0.365	-0.303	-0.346	0.833
TIG	0.544	0.513	-0.363	0.586	-0.287	0.735	0.357	-0.686	1.000	0.147	0.184	0.326	-0.588
Tir	-0.422	-0.217	-0.896	0.619	0.265	-0.372	-0.752	0.365	0.147	1.000	0.116	0.245	0.620
σ_π	0.230	-0.360	0.038	-0.168	-0.285	-0.023	-0.217	-0.303	0.184	0.116	1.000	0.962	0.077
σ_z	0.223	-0.215	-0.094	-0.007	-0.156	0.041	-0.229	-0.346	0.326	0.245	0.962	1.000	0.087
Z	-0.641	-0.535	-0.313	-0.085	0.526	-0.927	-0.899	0.833	-0.588	0.620	0.077	0.087	1.000

Togo, Series

	Tinvp	g	TIG	Tir	RCE	z	σ_z	Rim	π	σ_π	RDE	TDE	Ro
1987	15,5	0,5	11,1	8,4	1,3	151,9		6,2	1,7		16,3	130,8	92,1
1988	22,1	6,6	8,1	9,7	0,9	144,5	100,9	3,7	2,6	128,5	22,6	134,2	96,3
1989	20,1	4,1	8,1	11,9	-0,8	134,3	119,1	4,8	1,0	15,6	15,6	131,5	88,5
1990	22,7	-0,2	8,5	9,9	1,5	138,9	133,2	4,7	3,0	50,2	11,9	133,4	78,8
1991	17,0	-0,7	5,2	10,6	2,6	132,0	127,1	4,9	2,7	38,5	7,7	126,4	75,0
1992	15,8	-4,0	3,3	11,0	-1,2	134,1	136,1	4,1	3,2	42,1	6,1	127,8	63,1
1993	10,3	-15,1	1,7	7,1	-2,5	129,5	130,3	3,7	-8,2	42,6	6,8	91,1	56,5
1994	10,1	15,0	1,9	-23,8	-0,4	86,2	134,8	2,2	35,8	231,9	5,4	95,6	64,8
1995	10,0	7,8	2,8	-9,0	4,1	100,0	0,5	2,2	11,1	1784,7	6,0	100,0	69,8
1996	13,9	8,8	2,8	1,3	3,8	102,4	68,2	1,3	5,4	23,0	9,5	93,4	77,4
1997	12,9	4,3	2,1	-2,1	1,1	104,8	104,7	1,9	11,9	92,8	10,1	99,7	73,8
1998	15,2	-2,1	4,4	5,0	2,0	109,0	125,2	1,8	-2,4	222,2	7,5	114,8	81,8
1999	14,9	2,4	3,7	6,1	-5,3	104,9	132,7	2,1	2,3	1,1	8,9	114,8	75,3
2000	16,3	-1,9	3,3	4,0	0,1	98,5	140,4	2,8	1,3	54,3	6,3	100,6	81,9
2001	17,0	-0,2	2,6	2,0	-1,1	101,7	144,5	2,2	6,4	38,9	6,4	106,8	82,4
2002	14,4	4,6	4,1	2,8	-0,9	105,4	143,1	3,3	-0,1	67,8	2,5	104,0	83,1

Togo, Correlation Matrix

	TINVP	G	π	RCE	RDE	Rim	Ro	TDE	TIG	Tir	σ_π	σ_z	Z
TINVP	1.000	-0.051	0.895	0.678	0.019	0.674	0.309	0.572	-0.355	-0.414	0.677	0.852	0.728
G	-0.051	1.000	0.059	-0.617	0.336	-0.434	-0.385	-0.365	0.749	0.286	0.159	-0.063	0.314
π	0.895	0.059	1.000	0.578	0.118	0.725	0.102	0.663	-0.305	-0.184	0.725	0.866	0.673
RCE	0.678	-0.617	0.578	1.000	-0.166	0.777	0.291	0.595	-0.870	-0.442	0.394	0.645	0.351
RDE	0.019	0.336	0.118	-0.166	1.000	-0.020	-0.638	-0.105	0.152	0.469	0.099	-0.027	0.164
Rim	0.674	-0.434	0.725	0.777	-0.020	1.000	0.150	0.827	-0.538	-0.271	0.617	0.778	0.191
Ro	0.309	-0.385	0.102	0.291	-0.638	0.150	1.000	0.321	-0.152	-0.835	-0.128	0.221	0.047
TDE	0.572	-0.365	0.663	0.595	-0.105	0.827	0.321	1.000	-0.345	-0.239	0.297	0.702	0.080
TIG	-0.355	0.749	-0.305	-0.870	0.152	-0.538	-0.152	-0.345	1.000	0.246	-0.147	-0.273	-0.223
Tir	-0.414	0.286	-0.184	-0.442	0.469	-0.271	-0.835	-0.239	0.246	1.000	-0.164	-0.225	-0.181
σ_π	0.677	0.159	0.725	0.394	0.099	0.617	-0.128	0.297	-0.147	-0.164	1.000	0.600	0.600
σ_z	0.852	-0.063	0.866	0.645	-0.027	0.778	0.221	0.702	-0.273	-0.225	0.600	1.000	0.479
Z	0.728	0.314	0.673	0.351	0.164	0.191	0.047	0.080	-0.223	-0.181	0.600	0.479	1.000

ANNEX 3

Tests and Result of the Panel Data Estimation

Breusch and Pagan Lagrangian Multiplier Test for Random Effects

tinvp[id,t] = Xb + u[id] + e[id,t]
Estimated results:

	Var	sd = sqrt(Var)
tinvp	14.75115	3.840722
e	1.599784	1.2648257
u	0	0
Test: Var(u) = 0	chi2(1) = 26.25	
	Prob>chi2 = 0.0000	

Hausman Specification Test of Exogeneity of Variables

	Coefficients		
tinvp	Fixed Effects	Random Effects	Difference
σ_z	.032211	.0060287	.0261824
g	.0998048	.1182218	-.018417
z	.1750776	.007552	.1675256
Rim	.4438041	.7166859	-.2728818
RO	.1639668	.2038777	-.0399109
mue1	3.222702	-3.502229	6.724932
mue2	-1.486485	-2.861004	1.374519
Test: H_0: difference in coefficients not systematic	chi2(7) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re) = 254.08		
	Prob>chi2 = 0.0000		

Chow Test of Homogeneity (Stability) of Coefficients

```
Fixed-effects (within) regression               Number of obs      =        57
Group variable (i) : id                         Number of groups   =         4
R-sq:  within  = 0.7789                         Obs per group: min =        12
       between = 0.4043                                        avg =      14.2
       overall = 0.4351                                        max =        15
                                                F(7,46)            =     23.15
corr(u_i, Xb)  = -0.8717                        Prob > F           =    0.0000

------------------------------------------------------------------------------
       tinvp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          σz |    .032211   .008539     3.772   0.000     .0150228    .0493992
           g |   .0998048   .0522614     1.910   0.062    -.005392    .2050016
           z |   .1750776   .0308553     5.674   0.000     .1129692     .237186
         Rim |   .4438041   .1285111     3.453   0.001     .1851247    .7024835
          RO |   .1639668   .026031      6.299   0.000     .1115691    .2163645
        mue1 |   3.222702   1.00995      3.191   0.003     1.189779    5.255626
        mue2 |  -1.486485   .8701774    -1.708   0.094    -3.238061    .2650912
       _cons |  -18.34571   3.466455    -5.292   0.000    -25.32332   -11.3681
------------------------------------------------------------------------------
     sigma_u |  6.4437169
     sigma_e |  1.2648257
         rho |  .96290035   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(3,46) =    34.31                 Prob > F = 0.0000
```

Estimation of the Private Investment Ratio

```
. reg tinvp  volz1 gr    tcer rim   ro mue1 mue2 id1 id2 id3 id4, nocons

Source |       SS           df       MS                 Number of obs =      57
-------+------------------------------------------------ F( 11,    46) =  435.11
Model  |  7656.82711        11  696.075192               Prob > F      =  0.0000
Residual |  73.5900584        46  1.59978388             R-squared     =  0.7880
-------+------------------------------------------------ Adj R-squared =  0.7750
Total  |  7730.41717        57  135.621354               Root MSE      =  1.2648

------------------------------------------------------------------------------
tinvp  |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------+----------------------------------------------------------------------
σz     |    .032211   .008539     3.772   0.000     .0150228    .0493992
g      |    .0998048  .0522614    1.910   0.062     -.005392    .2050016
z      |    .1750776  .0308553    5.674   0.000     .1129692    .237186
Rim    |    .4438041  .1285111    3.453   0.001     .1851248    .7024835
RO     |    .1639668  .026031     6.299   0.000     .1115691    .2163645
mue1   |    3.222702  1.009949    3.191   0.003     1.189779    5.255625
mue2   |   -1.486485  .8701773   -1.708   0.094    -3.238061    .2650913
id1    |   -9.330281  2.424666   -3.848   0.000    -14.21088   -4.449681
id2    |   -20.92721  3.446423   -6.072   0.000    -27.8645   -13.98992
id3    |   -17.00647  3.1811     -5.346   0.000    -23.40969   -10.60325
id4    |   -24.31577  4.738343   -5.132   0.000    -33.85356   -14.77798
------------------------------------------------------------------------------
```

ANNEX 4
Tests and Result of the Single Equation Error Correction Model

Unit Root Test

	ADF (parametric test)			PP (non-parametric test)		
	Value	Sig. level	I (n)	Value	Sig. level	I (n)
GPIR	-5.146[b/]	1%	I (2)	-3.191[a/]	5%	I (1)
LGPIR	-5.240[b/]	1%	I (2)	-3.008[c/]	1%	I (1)
INFL	-3.700[a/]	5%	I (1)	-3.264[a/]	5%	I (0)
INFLSQ	-3.789[a/]	5%	I (1)	-4.477[b/]	5%	I (0)
REERU	-4.013[b/]	5%	I (1)	-3.394[a/]	5%	I (1)
REERUSQ	-4.721[b/]	5%	I (1)	-4.133[b/]	5%	I (1)
RLR	-2.880[c/]	1%	I (1)	-3.149[a/]	5%	I (0)
TOTU	-4.839[b/]	1%	I (1)	-3.677[b/]	10%	I (0)
TOTUSQ	-7.279[b/]	1%	I (1)	-6.627[b/]	1%	I (1)
CFE	-2.854[c/]	1%	I (0)	-3.127[c/]	1%	I (0)
GDP	-3.019[c/]	1%	I (1)	-3.071[a/]	5%	I (0)
LRGDP	-2.809[c/]	1%	I (2)	-4.529[b/]	1%	I (2)
LDEF	-2.290[c/]	5%	I (1)	-3.130[a/]	5%	I (1)

Note : ADF: Augmented Dickey-Fuller PP: Phillips-Perron
Sig.level : Significance level (in%) I (n): Integration order
a/ with intercept b/ with intercept and trend
c/ no intercept no trend

Small Sample Cointegration Test

Dependent Variable: DLGPIR2
Method: Least Squares
Date: 06/07/05 Time: 09:17
Sample(adjusted): 1990 2003
Included observations: 14 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.526659	2.023162	0.754591	0.5885
DINFL	0.038318	0.03096	1.237691	0.4326
DREERU	0.046096	0.02539	1.815492	0.3205
DRLR	0.037345	0.03009	1.241114	0.4318
DTOTU	-0.002852	0.002414	-1.181356	0.4472
DCFE	0.074768	0.061941	1.207091	0.4404
DLRGDP2	8.570138	9.457038	0.906218	0.5313
DLDEF	2.287723	1.153044	1.984072	0.2972
DLGPIR(-1)	-1.279192	0.391911	-3.263986	0.1893
CFE(-1)	0.058505	0.052824	1.107538	0.4675
TOTU(-1)	-0.002843	0.002588	-1.098462	0.4702
DLRGDP(-1)	2.380851	8.810052	0.270243	0.832
LDEF(-1)	-0.684471	0.977172	-0.700461	0.611

R-squared	0.96502	Mean dependent var	-0.006493
Adjusted R-squared	0.545257	S.D. dependent var	0.096685
S.E. of regression	0.065199	Akaike info criterion	-3.404653
Sum squared resid	0.004251	Schwarz criterion	-2.811243
Log likelihood	36.83257	F-statistic	2.298964
Durbin-Watson stat	2.141909	Prob(F-statistic)	0.477987

Estimated Coefficents	Alpha	Gamma
		1.279192
CFE	-0.0457359	
TOTU	0.0022225	
DLRGDP	-1.86121474	
LDEF	0.53508074	
C	1.19345571	

Phillips-Perron Cointegration Test on the Residual

PP Test Statistic	-3.870207	1% Critical Value*	-4.7315
		5% Critical Value	-3.7611
		10% Critical Value	-3.3228

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 2 (Newey-West suggests: 2)

Residual variance with no correction	0.017689
Residual variance with correction	0.013292

Phillips-Perron Test Equation
Dependent Variable: D(RES1)
Method: Least Squares
Date: 06/07/05 Time: 09:42
Sample(adjusted): 1989 2003
Included observations: 15 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RES1(-1)	-1.160889	0.300998	-3.856797	0.0023
C	-2.964984	0.776018	-3.820766	0.0024
@TREND(1987)	0.015977	0.010037	1.591757	0.1374

R-squared	0.554346	Mean dependent var	-0.009868
Adjusted R-squared	0.48007	S.D. dependent var	0.206221
S.E. of regression	0.148698	Akaike info criterion	-0.796937
Sum squared resid	0.265335	Schwarz criterion	-0.655326
Log likelihood	8.977024	F-statistic	7.463351
Durbin-Watson stat	1.860681	Prob(F-statistic)	0.007834

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.141067	Probability	0.551978
Obs*R-squared	9.734482	Probability	0.007695

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 06/07/05 Time: 16:24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.602992	0.624456	0.965628	0.5111
DRLR	0.001556	0.001726	0.901229	0.533
DREERU	0.000896	0.00904	0.099101	0.9371
DLDEF	-0.132058	0.212981	-0.620046	0.6467
DLGPIR(-1)	-0.019392	0.154158	-0.125792	0.9203
CFE(-1)	0.002456	0.008897	0.276068	0.8285
TOTU(-1)	-0.000303	0.000605	-0.501133	0.7043
INFL(-2)	0.000291	0.00546	0.053366	0.9661
REERU(-1)	0.003584	0.016847	0.212719	0.8666
LDEF(-2)	-0.311953	0.282694	-1.103498	0.4687
RLR(-2)	0.00099	0.003201	0.309437	0.809
RESID(-1)	-0.853414	1.025664	-0.832061	0.5582
RESID(-2)	-1.576074	1.073734	-1.467844	0.3807

R-squared	0.69532	Mean dependent var	-3.12E-16
Adjusted R-squared	-2.960838	S.D. dependent var	0.011576
S.E. of regression	0.023038	Akaike info criterion	-5.485216
Sum squared resid	0.000531	Schwarz criterion	-4.891806
Log likelihood	51.39651	F-statistic	0.190178
Durbin-Watson stat	1.937515	Prob(F-statistic)	0.959296

Ramsey RESET Test:

F-statistic	2.273099	Probability	0.424622
Log likelihood ratio	23.98358	Probability	0.000006

Test Equation:
Dependent Variable: DLGPIR2
Method: Least Squares
Date: 06/28/05 Time: 15:56
Sample: 1990 2003
Included observations: 14

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.483489	1.644316	-0.294036	0.8179
DRLR	0.001168	0.003674	0.317895	0.8041
DREERU	0.018949	0.023936	0.791684	0.5737
DLDEF	0.368107	0.424122	0.867925	0.5449
DLGPIR(-1)	-0.62285	0.67323	-0.925166	0.5247
CFE(-1)	-0.00544	0.022804	-0.238547	0.8509
TOTU(-1)	0.000182	0.001842	0.098998	0.9372
INFL(-2)	-0.002342	0.01436	-0.163069	0.8971
REERU(-1)	0.007495	0.034018	0.220309	0.862
LDEF(-2)	0.238726	0.510714	0.467436	0.7216
RLR(-2)	-0.004587	0.008141	-0.563494	0.6733
FITTED^2	3.378224	1.723019	1.960642	0.3003
FITTED^3	29.77406	19.98362	1.489923	0.3763

R-squared	0.997415	Mean dependent var	-0.006493
Adjusted R-squared	0.966399	S.D. dependent var	0.096685
S.E. of regression	0.017723	Akaike info criterion	-6.009835
Sum squared resid	0.000314	Schwarz criterion	-5.416425
Log likelihood	55.06885	F-statistic	32.15793
Durbin-Watson stat	3.109121	Prob(F-statistic)	0.137034

ARCH Test:

F-statistic	0.189601	Probability	0.67167
Obs*R-squared	0.220277	Probability	0.638829

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 06/29/05 Time: 10:25
Sample(adjusted): 1991 2003
Included observations: 13 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000133	6.75E-05	1.974811	0.0739
RESID^2(-1)	-0.130546	0.299807	-0.435432	0.6717

R-squared	0.016944	Mean dependent var	0.000116
Adjusted R-squared	-0.072424	S.D. dependent var	0.000189
S.E. of regression	0.000196	Akaike info criterion	-14.09977
Sum squared resid	4.21E-07	Schwarz criterion	-14.01285
Log likelihood	93.64848	F-statistic	0.189601
Durbin-Watson stat	1.947076	Prob(F-statistic)	0.67167