

Reserves Accumulation in African Countries: Sources, Motivations, and Effects*

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Abstract

African countries have accumulated substantial foreign currency reserves in recent years, mostly from higher commodity exports as well as aid flows. In the context of macroeconomic stabilisation, which remains at the forefront of national economic policymaking and aid conditionality, African countries are induced to hold reserves to allow monetary authorities to intervene in markets to control the exchange rate and inflation. Adequate reserves also allow the country to borrow from abroad and to hedge against instability and uncertainty of external capital flows. However, reserve accumulation can have high economic and social costs, including a high opportunity cost emanating from low returns on reserve assets, losses due to reserve currency depreciation, and forgone gains from investment and social expenditures that could be financed by these reserves.

African countries therefore need to have a better understanding of the determinants and economic costs of reserve accumulation and to design optimal reserve management strategies to minimise these costs and maximise the gains from resource inflows. This study uses panel data from 21 African countries to examine the sources, motivation and economic implications of reserve accumulation with a focus on the impact on the exchange rate, inflation, and public and private investment. While the level of reserves remains adequate on average, some countries have accumulated excessive reserves especially in recent years. The empirical analysis in this paper shows

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that the recent reserve accumulation cannot be justified by portfolio choice motives (in terms of returns to assets) or stabilisation objectives. At the same time, it has resulted in exchange rate appreciation, while it has yielded little benefits in terms of public and private investment. The evidence suggests that African countries, especially those endowed with natural resources, need to adopt a more pro-growth approach to reserve management.

1. Introduction

The build-up of foreign currency reserves in Africa and emerging economies has accelerated over the last decade, the bulk of the increase being experienced in oil-exporting countries. The accumulation of these reserves has occurred at a time of generally stable or slightly appreciating exchange rates, particularly against the US dollar. Countries generally maintain such reserves in order to effectively manage their exchange rate and to reduce adjustment costs associated with fluctuations in international payments. Accordingly, demand for international reserves increases with global trade. Most countries would maintain reserves equivalent to at least three months of imports (Mendoza 2004).

The recent accumulation of reserves in developing countries has been largely interpreted as a form of self-insurance against the high level of global economic and financial instability, and the absence of an adequate international system for crisis management. Moreover, many countries see reserve accumulation not only as a means for effective exchange rate management, but also as a tool for maintaining low exchange rates in order to promote trade and international competitiveness. This rationale is referred to as the mercantilist motive (Aizenman and Lee 2005).

Maintaining adequate reserves can also boost investors' confidence and enhance investment and growth. This can be seen more clearly in the case of Asian countries that recorded the highest rate of increase in international reserves following the 1997 financial crisis coupled with high growth in external trade and output. A 2003 study by the IMF showed that reserve build-up in emerging Asia between 1997 and 2002 was large, both in absolute terms and relative to imports and short-term external debt. The study also noted that the reserve build-up in emerging Asia had been similar across exchange rate regimes, including countries with limited exchange rate flexibility and those with managed floating exchange rates. More importantly, the reserve build-up was in excess of that warranted by the economic fundamentals of the region.

Increases in international reserves in Latin America have been largely in line with the rise in imports and commercial transactions in general. They were only partially driven by demand for insurance against financial shocks (Eichengreen 2006). The import cover notion of reserves appeared inade-

quate, with high capital mobility and costly financial crisis caused by sudden reversals in capital flows during the last two decades.

Higher reserves reduce both the likelihood of a crisis and the depth of a crisis, should one occur. "A ratio of reserves to short-term external debt above one marks an important reduction in crisis vulnerability, as long as the current account is not out of line and the exchange rate is not misaligned" (IMF 2003). At the global level, there is still a need for a more effective global insurance framework or an international monetary system that can help prevent financial shocks and mitigate their costs.

For Africa, recent commodity price hikes have allowed reserves accumulation among exporters and drained the same among importers. Meanwhile, macroeconomic stabilisation remains at the forefront of national economic policymaking and aid conditionality in Africa (see Lapavitsas 2007; Mckinley 2007; Weeks 2007). This induces countries to hold reserves to allow monetary authorities to intervene in markets to influence the exchange rate and inflation. Adequate reserves may also allow African countries to borrow abroad, attract foreign capital, and promote domestic private investment as a result of strengthened external position and reduced vulnerability to external shocks.

These benefits should be carefully weighed against potentially high economic and social costs. The costs of maintaining reserves comprise the opportunity cost of foregone domestic consumption and investment. It also comprises financial costs and the strain on monetary policy arising from efforts to sterilise the effects of excessive monetary expansion through higher domestic interest rates.¹ This can increase fiscal pressure (control of government spending and deficits) and make reserve accumulation inconsistent with fiscal policy objectives.

In addition, reserve build-up can pose challenges to the macroeconomic policy framework. It is impossible for monetary authorities to reconcile policy objectives in relation to exchange rate stability through a fixed exchange rate, monetary independence, and free capital mobility. While it is possible to combine selective capital controls with occasional interventions in the exchange rate market, still, inconsistencies may arise. For example, if the economy is overheating, accumulating reserves and keeping domestic currency from appreciating might be inconsistent with a tight monetary policy. Higher domestic interest rates resulting from sterilisation may also be inconsistent with a tight fiscal policy (as higher interest payments put pressure on the fiscal balance) (UN-DESA 2007).

1. Developing countries earn one to two percent in real return on their \$3 trillion reserves. They could invest these reserves locally with returns up to 10 to 15 percent. Assuming a difference of 10 percent between domestic and foreign returns, the opportunity cost of holding reserves is quite high, well in excess of \$300 billion per year, which is more than two percent of GDP (Stiglitz 2006). According to Stiglitz (2006), the total opportunity cost of reserves is roughly equal to the amount of funds needed by developing countries to finance necessary investments to meet the MDGs.

More importantly, reserve accumulation in developing countries is related to build-up of deficits in reserve asset countries, especially the US. Thus, adjustments in the US might have important costs for reserve-accumulating countries.² The question of how to manage large foreign exchange reserves effectively also arises because available reserve assets may not provide an optimal risk-return mix. In the long run, there is a need for an alternative reserve system. Furthermore, governments need to stimulate domestic demand along with growth in exports and real GDP, and strengthen domestic financial markets and integrate them into the global market in order to reduce precautionary demand for reserves.

To effectively manage foreign exchange reserves, policy makers need to understand the major determinants of reserves in a globalised world. This is essential in determining the optimal reserves level that provides them with the necessary security at minimum cost. In this context, some slowdown in the rate of reserve accumulation is likely to be justifiable for commodity-rich African countries that need to finance high-yield domestic investments instead of locking up the reserves in low-yield foreign assets. Designing a successful reserve management system for African countries requires important institutional and policy reforms at the national and regional levels. These include policies to enhance domestic demand and intra-African trade, improved exchange rate management and above all, a new regional or global reserve system.

This paper uses panel data for 21 African countries for the 1979-2005 period³ to examine the motivation and sources of reserves accumulation in African countries, and its economic implications in terms of the exchange rate, inflation, and public as well as private investment (*see table A1 for list of countries and selected economic indicators*). In contrast to the case of emerging economies, the results confirm that to some extent, the reserve build-up contributes to appreciation of the national currency. The evidence further indicates that countries have reaped little gains from the trade-driven reserve accumulation in terms of public and private investment. On the basis of the empirical analysis, the paper assesses policy options at the national, regional, and global levels for African countries to effectively manage reserves so as to maximise the gains from higher foreign exchange inflows, while minimising their adverse effects on the economy.

The next section examines the trend of reserve accumulation in Africa in absolute terms and relative to imports, output and money supply. The section also identifies the main sources of reserves build up. Section 3 presents the analytical framework of the study by specifying a reserve demand equation and econometric models for assessing the economic consequences of reserve

2. For example, the recent depreciation of the dollar relative to the Euro meant an opportunity cost of more than 30 percent for dollar-dominated asset holders (Stiglitz 2006). This highlights some of the weaknesses of the global reserves system and indicates the need for central banks to diversify reserves.

3. The choice of this period was dictated by data availability.

accumulation on the exchange rate, inflation, and domestic public and private investment. The econometric estimation methodology and the discussion of results are presented in Section 4. Section 5 concludes with policy recommendations.

2. Reserves Build-up in Africa: Trends and Motivation

2.1. Sources of reserves: Key balance of payments (BoP) identities

Evidence indicates that the origins of reserve accumulation differ across countries. In Latin America, a persistent current account deficit was balanced by a capital account surplus for most of the last decade. Larger capital account surpluses helped some countries such as Brazil and Venezuela to accumulate reserves. Since the 1997 crisis, East Asia has run capital account deficits and continuous current account surpluses, except for China, which maintained twin surpluses (UN-DESA 2007).

The first task in our study involves a careful examination of the sources of reserves accumulation and the determinants of reserves accumulation in African countries. This exercise allows us to investigate the extent to which reserve accumulation is the outcome of explicit decisions by the monetary authorities, rather than a result of exogenous events such as commodity prices, debt forgiveness, or external factors such as foreign investors' appetite for domestic assets.

The analysis will be based on the following standard Balance of Payments (BoP) identities:

$$CA + KFA + \Delta RES = 0 \quad (1)$$

Or:

$$CA + KFA = -\Delta RES \quad (2)$$

CA is the current account balance, KFA the capital and financial account balance, and ΔRES change in reserves. Net errors and omissions are generally added on the left-hand side to account for statistical discrepancies.

The current account balance may also be defined as:

$$CA = GSA + IA + TA \quad (3)$$

GSA stands for the balance on goods and services, IA the balance on income, and TA the balance on transfers.

For African countries, most of the movement is in the GSA (imports and exports). But TA also has gained increasing importance due to, among other things, worker remittances. The capital and financial account balance is given by:

$$KFA = KA + FA \quad (4)$$

KA represents the capital account balance, which includes debt forgiveness, and FA the financial account, which is equal to the sum of FDI plus portfolio investment and other investments.

Reserves include gold, SDRs (Special Drawing Rights), the reserve position in the IMF, and foreign exchange. The foreign exchange component of reserves includes currency (mainly US dollars) plus deposits with monetary authorities, and banks plus securities (US/foreign government securities, equity, bonds and notes, money market instruments and derivatives).

2.2/ Trends and motivation for reserve build-up in Africa

Accumulation of foreign exchange reserves by African countries may best be understood in the context of general reserves behaviour in developing regions. Global official foreign exchange reserves rose from US\$1.2 trillion in January 1995 to US\$5.04 trillion in December 2006, and the share of developing countries in world reserves increased from 50 to 72 percent over the same period. This large share needs explanation, especially in view of the fact that developing countries accounted for only 41 percent of world trade in 2005. The question here is why developing countries need to accumulate relatively more reserves than developed countries, and how such reserve accumulation relates to foreign trade and output growth.

The regional breakdown of reserves build-up suggests a positive correlation between reserves build-up on the one hand, and trade and output on the other. On average, the East Asia and Pacific region has accumulated more foreign exchange reserves than other developing regions over the last decade (figure 1).

However, in addition to relatively high trade-driven growth, the East Asia and Pacific region witnessed the severest financial crisis in the last two decades. In this context, analysts identify three factors (beside high oil prices) for the build-up of reserves in developing countries (ECB 2006). The first factor is the need for insurance against future crisis. The second factor relates to the strong export-led growth in Asia following large exchange rate depreciation in the region as a result of the financial crisis. Finally, certain features of the domestic financial markets of emerging economies in general and the Asian markets in particular, have stimulated the unprecedented accumulation of reserves. These include weak financial intermediation between domestic

savers and investors, and inefficient hedging markets; the tendency towards dollarisation of international assets; and excess domestic savings over investment.

The accumulation of official reserves as an outcome and a means of integration into global financial market is a common factor behind the recent reserve build-up in emerging markets (ECB 2006). Emerging economies, especially in Asia, have had to accumulate reserves to protect their economies against financial market fluctuations because while they are major players in international trade, they still lag behind in terms of financial market development.

However, the build-up of reserves creates new risks. As the bulk of foreign exchange reserves is held in US assets and used to finance current account deficits in developed countries, reserve holding countries become susceptible to risks and costs emanating from adjustments in reserve currency countries. These risks and costs include inflationary pressures, over-investment, asset bubbles, complications in the management of monetary policy, potentially sizable capital losses on monetary authorities' balance sheets, sterilisation costs, segmentation of the public debt market, and misallocation of domestic banks' lending (ECB 2006).

To mitigate these risks and costs, developing countries must exercise active reserve management and diversification. This is a major challenge in Africa, especially for resource-rich countries. Ultimately these countries need policies to slowdown reserves accumulation, given the high opportunity costs in terms of returns. These policies may include adoption of a more expansionary fiscal policy emphasising productive public investments, macroeconomic measures to enhance domestic and regional demands, domestic and regional financial market development, including bond market development, increased exchange rate flexibility together with money market reforms, and regional economic and monetary co-operation (ECB 2006, p. 3).

The trend of foreign currency reserves relative to imports and external short-term debt clearly illustrates the strong influence of the factors discussed above in relation to reserves accumulation in Africa. In all the developing regions, reserves have generally increased as a ratio of imports of goods and services during the last ten years (Figure 2). This ratio is an indicator of the country's current account vulnerability. It is generally held that a ratio of 3-4 months is adequate for the country to finance its imports. On average, official reserves in Africa rose from the equivalent of about two months of imports in 1990 to about 5 months in 2004. This suggests that on average, reserve holdings of African countries are just adequate.

But the average reserve-import ratio masks huge variations across African countries. For example, Algeria had total reserves, excluding gold, of \$66.1 billion (the equivalent of 32 months of imports) in 2006 compared to \$56.3 billion (34.5 months of imports) in 2005. Morocco had \$17.7 billion (10.1 months of imports) in 2006 and \$16.2 billion (10.3 months of imports) in 2005 (UNECA 2008). For Chad and Eritrea, foreign exchange reserves

represented only two months of imports in 2006. For the 40 African countries with available data, reserves represented 10 months of imports in 2006. The respective import cover for oil-exporting and oil-importing countries was 15 months and 5 months. Since around 2004, the ratio of reserves to Africa's external short-term debt has risen above 2, exceeding that of all other developing regions with the exception of South Asia (figure 3). The higher ratios for relatively poorer developing regions may reflect greater desire for self-insurance against external shocks.

Oil-exporting African countries have accounted for about 75 percent of total African reserves in 2005-2006 (figure 4). Tables A2 to A5 in the appendix present the statistics on reserve accumulation and composition, distinguishing between oil-rich and non-oil-rich countries. Oil-exporting countries are also the main recipients of private capital flows, especially FDI. Noting that none of the top 10 countries in terms of reserve-GDP ratio is a high aid recipient county, it is clear that commodity revenue, especially oil revenue, and related private capital inflows are the key source of reserve build-up in Africa.

Reserve accumulation could also be the result as well as an instrument of attracting aid flows when donors perceive reserves as a signal of sound macroeconomic management. Both private and official capital flows to Africa increased, particularly since 2002, but at a rate far less than the rate of reserve growth (Figure 5). In fact official flows have levelled off in the last three years.

2.3. Sources and composition of African foreign exchange reserves

The figures in Table 1 show that the 21 African countries for which detailed data exist have recorded very high rates of growth of foreign exchange reserves since the turn of this century. Reserve flow is the sum of the current account balance and the capital and financial account balance. This group of countries recorded current account surpluses for most of the period under review, mainly because of high current account surplus in resource-rich countries and net transfers. The income balance has always been in deficit.

Regarding the capital and financial account balance, while the capital account switched between surplus and deficit over the years, the financial account balance has shown net financial inflows to Africa since 1990. These financial flows, including ODA and increasing remittances by African nationals working abroad, contributed to the high rate of reserves accumulation during this period. Overall, sustained current and capital account surpluses in mainly resource-rich countries are behind the high growth in reserves in Africa. However, exchange rate policies that favour overvalued currencies are perhaps the root cause of the general trend in the continent. Large reserve holding countries in Africa need to carefully assess the risks relating to the security of their reserves as well as the opportunity costs in terms of investment and growth. In fact, maintaining large stocks of reserve and overvalued

exchange rates at a time of low trade capacity encourages imports of consumer goods and retards investment, economic diversification, and growth.

The composition of African reserves highlights high exposure of reserve holders to global financial risks. Over the last few years, more than 95 percent of African non-gold reserves were held in foreign exchanges, including currency (mainly the US dollar) and deposits with monetary authorities and banks, and securities (US/foreign government securities, equity, bonds and notes, money markets, derivatives). Thus, the value of African reserves is subject to change with fluctuations in the reserve currency (especially the US dollar) or wider global financial market shifts. The safest reserve asset, treasury bills, pays the lowest rates of return. Again, this makes efficient reserve management a top priority for reserve holders.

3. Empirical Analysis

3.1. *The demand for reserves*

Having examined the sources of reserve accumulation from balance of payments data in the previous section, the paper uses econometric analysis to investigate the determinants of the demand for reserves.

The literature suggests that reserves are held for both transaction and precautionary motives (Mendoza 2004). In principle, countries hold reserves in order to meet unexpected and temporary fluctuations in international payments. In this context, the optimal size of reserves depends on the balance between the macroeconomic adjustment costs arising from reserves depletion, and the opportunity cost of holding reserves (Heller 1966). Thus, a country's demand for reserves will increase with its risk aversion and output volatility (Gosselin and Parent 2005).

According to Gosselin and Parent (2005), there is a relatively stable long run reserve demand function that depends on five categories of explanatory variables. They are economic size, current account vulnerability, capital account vulnerability, exchange rate flexibility, and the opportunity cost. Reserve holding is expected to increase with economic size and the volume of international transactions. Thus, in view of the nature of commodity-based production and exports in Africa, both the level and growth rate of output are expected to influence reserve accumulation. Increased current and capital account vulnerability should motivate central banks to hold more reserves, while exchange rate flexibility reduces the demand for reserves. Economic theory predicts that the higher the opportunity cost of holding reserves, the lower would be the demand for reserves.

To investigate these motives for reserve holdings, we specify a simple long-run reserve demand equation as follows:

$$RR_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 CAAV_{it} + \beta_3 CUAV_{it} + \beta_4 ER_{it} + \beta_5 OC_{it} + \varepsilon_{it} \quad (5)$$

RR is real reserves, CAAV is capital account vulnerability, CUAV is current account variability, ER is nominal exchange rate, and OC is the opportunity cost of holding reserves. Capital account vulnerability may be measured by the ratio of short-term debt to total debt, while current account volatility can be represented by the trade variability. The opportunity cost (OC) is measured by the difference between the real return on reserves and the real return to domestic investments (real US treasury bill rate minus real domestic interest rate).⁴ An alternative proxy for OC is the difference between (real) US Treasury bills rate and individual country real GDP growth rate, an indicator of the rate of profitability of domestic investment.

3.2. The impact of reserve accumulation

Next, the study investigates the linkages between movements in foreign exchange reserves (accumulation or depletion) and economic variables of interest. The paper explores the following empirical questions:

(i) Does accumulation of reserves crowd out public investment?

The hoarding of reserves can prevent governments from spending on public investment. We investigate this question through the analysis of a model based on the assumption of a quantity constraint on public investment. It is further assumed that public investment depends on real GDP growth and domestic credit to the public sector (*PUCRED*), total public debt (*PubDebt*) and foreign exchange reserves. GDP growth and credit, as opposed to reserves, are expected to stimulate public investment. The effect of public debt on public investment can be positive to the extent that debt is a means of financing public investment. It can be negative, reflecting the fact that debt service drains public resources away from investment.

The public investment equation is specified as follows:

$$PuI_{it} = \beta_0 + \beta_1 Y_{it} + \beta_2 PUCRED_{it} + \beta_3 RR_{it} + \beta_4 PubDebt_{it} + \varepsilon_{it} \quad (6)$$

Y is the growth rate of real. All other variables are as earlier defined. We also explore the role of ODA in alternative specifications.

(ii) What are the linkages between reserves and private investment?

There are two possible channels of the linkages between reserves and private investment. The first is a quantity channel, whereby the availability of reserves makes it possible to import capital goods, thus facilitating increased domestic private investment. The second is the rate of return channel, which works through the interest rate parity relationship:

$$i_t = i_t^f + E(\dot{\varepsilon}_t); E(\dot{\varepsilon}_t) = \frac{E(\Delta \varepsilon_t)}{\varepsilon_t} \quad (7)$$

4. We used the deposit rate rather than the lending rate as the former is better reported.

In this equation, i , i^f , and $E(\hat{\epsilon}_t)$ are the domestic interest rate, the world interest rate, and the expected appreciation/depreciation of the exchange rate, respectively. For a given world interest rate, expectations of domestic currency appreciation (due to expectations of higher reserves, among other things) encourage domestic investment because the domestic return is higher. Expectations of depreciation induce investment abroad (capital outflow). We investigate the relationship between foreign exchange reserves and private investment behaviour in a model that includes an accelerator variable (real GDP growth), public investment (PuI), and bank credit to the private sector (PRCRED). While growth and financial development (PRCRED) are expected to stimulate private investment, the effect of public investment may be positive or negative depending on whether public investment crowds in or crowds out private investment.

The private investment equation is specified as follows:

$$Pr I_{it} = \beta_0 + \beta_1 \dot{Y}_{it} + \beta_3 PRCRED_{it} + \beta_4 PuI_{it} + \beta_5 R R_{it} + \epsilon_{it} \quad (8)$$

All the variables are the same as defined above.

(iii) What is the linkage between reserve accumulation and the exchange rate? Adequate stock of foreign exchanges allows monetary authorities to intervene in the market to protect the exchange rate (e.g., injecting foreign exchange in case of pressures towards appreciation). However, excessive inflows of reserves can cause the currency to appreciate. Moreover, high volatility of reserves can cause instability in the exchange rate. This paper examines the role of reserves in exchange rate movements. It uses a conventional exchange rate equation with the price and interest rate differentials as the two key explanatory variables besides foreign exchange reserves. A rise in the domestic interest rate relative to the foreign rate is expected to attract increased foreign capital flows, resulting in exchange rate appreciation. The impact will greatly depend on the degree of domestic financial market development and integration into the global market. Conversely, an increase in domestic prices relative to foreign prices would lead to a shift in demand in favour of foreign goods, causing the exchange rate to depreciate.

The exchange rate equation to be estimated is the following:

$$ER_{it} = \beta_0 + \beta_1 (r_{it-1}^d - r_{it-1}^f) t - 1 + \beta_2 (\hat{p}_{it-1}^d - \hat{p}_{it-1}^f) + \beta_3 RR_{it} + \epsilon_{it} \quad (9)$$

Where \hat{p}^d is domestic inflation, P_f is foreign inflation, r^f is nominal foreign interest rate, and r^d is nominal domestic interest rate. Other determinants of the exchange rate that may be examined include capital flows (including ODA), current account balance (CAB) and money supply.

(iv) **What are the linkages between reserves and inflation?**

We explore two possible channels. The first is the exchange rate expectations channel. With high reserves, agents expect the national currency to appreciate, which reduces (expected) inflation. The second is the liquidity/money market effect. The spending of reserves increases the stock of money (e.g., when government converts aid into domestic currency to spend it), which may fuel inflation. We investigate whether the data supports this prediction, i.e., whether inflation has increased in this sample of countries, following the large inflows of foreign exchange.

The inflation equation is the following:

$$\hat{p}_{it} = \beta_0 + \beta_1 \hat{p}_{it-1} + \beta_2 RR_{it} + \varepsilon_{it} \quad (10)$$

In alternative specification, we also explore the effect of money supply growth and the expected exchange rate on inflation.

4. Estimation and Discussion of Results

The empirical analysis starts with the investigation of the time series characteristics of the regression variables. The tests show that all the macroeconomic variables used in each equation are integrated of order 1, i.e. I(1), or non-stationary in logs, while the differenced variables (inflation and interest rate differentials) are I(0). We also used (Kao and Pedroni) cointegration tests to inform the specification of the equations so as to avoid spurious regressions. The results of the panel unit root and cointegration tests are reported in tables A6 and A7 in the appendix.

The regression equations were estimated for the sample of 21 African countries for the 1979-2005 period. The estimation results for level, first-differenced, and two-step error correction models are presented in tables 3-7 for reserve demand, public investment, private investment, the exchange rate, and inflation.

Three dummy variables were included in the equations to assess differences in the behaviour and effects of reserves across different groups of countries and over time: One for oil-exporting countries (DUMOIL), another for middle income countries (DUMMIY) and a third one for the period 2003-05, representing the recent oil price hike (DU305).⁵ The results show theoretically consistent signs for the dummy variables, but their coefficients are mostly insignificant. Reserves build-up as well as public and private investments were slightly (but insignificantly) higher in middle-income countries and during the recent oil price hike, but exchange rate changes were slightly

5. Respectively, DUMOIL, DMMIY and DUM0305 take the value of one in the case of oil-exporting countries, middle income countries and for the period 2003-2005, and zero otherwise. The middle income African countries included in the sample are: Botswana, Egypt, Gabon, Mauritius, Morocco, Seychelles, South Africa, Swaziland, and Tunisia.

lower. The only significant results are: (i) Public investment is strongly greater in oil-exporting countries; and (ii) average inflation edged up during the time of higher oil prices. These and other results are discussed below.

The determinants of the demand for reserves

The long-run (level) regression results show that the demand for international reserves in Africa is driven mainly by exports and GDP growth (table 3). These two variables have positive and statistically significant coefficients. The sizes of coefficients (elasticity) indicate that the real exports effect is greater than the GDP growth effect, underscoring the role of commodity exports in reserve build-up in African countries. On the other hand, both the opportunity cost of holding reserves (measured by the difference between domestic and foreign interest rates) and short-term debt have negative but insignificant effects on demand for reserves. Continued reserve build-up despite the weak return effect is another indication that reserve accumulation in Africa is not motivated by returns.

Though weak, the negative coefficient on short-term debt indicates a burden rather than hedging effect, as African countries with more short-term debt are the ones that have less reserve. These countries are less likely to accumulate reserves due to high debt service. Thus, they might be unable to hedge against risks associated with short-term debt. Conversely, relatively rich African countries continue to build-up reserves even though they do not face notable short-term debt risks.

The results with the first-differenced equation confirm the long run results regarding the positive and strong effects of GDP and exports on reserve demand. However, short-term debt and the return or opportunity cost variable continue to have no significant impact on reserve demand in the short-run. These results are consistent with the observation that poor African countries are unable to build-up reserves to hedge against short-term debt risks and that reserve accumulation is not motivated by returns to assets. The two-step error correction results largely confirm the results with the first-differenced specification.

The dummy variable suggests that oil-exporting and middle-income countries tend to have more but not significantly higher reserves than other countries. Reserves build-up also increased (though weakly) during the recent oil price hike, reflecting higher export revenues for oil exporting countries.

Public investment

The determinants of public investment remain largely the same in the short-term and the long-term (table 4). The results show that while there is a positive and significant long-run relationship between reserves and public investment, no such relationship exists in the short-run. The evidence suggests that short-term movements in reserves such as the build-up observed in recent years, have not been used to increase public investment. This may be

due to the pursuit of restrictive macroeconomic policy by African states and their excessive aversion to financial crisis. This approach prevents countries in the continent from reaping full benefits of the resource boom as well as the increase in external capital inflows.

Real public investment declines with real GDP, indicating the inability of governments to sustain high public investment. Public credit has a theoretically consistent positive impact on public investment. This result indicates that government borrowing constitutes an important source of financing for public investment.

Similarly, the finding that ODA stimulates public investment strongly supports the call for scaling up ODA and debt relief to assist African countries to increase public investment and accelerate progress towards achieving the Millennium Development Goals (MDGs). Public investment appears to be higher in oil-exporting countries, consistent with the higher level of government revenues in this group of countries.

Private investment

Accumulation of reserves strongly stimulates private investment in Africa in the long run, but this effect is weak in the short-run (table 5). This finding is consistent with the fact that reserves build-up signals improvements in macroeconomic management, but private investors only respond to this signal when it is seen as permanent. It is worthy to note that public investment compliments private investment in Africa in the long run. This result is consistent with our *a priori* expectation as most African countries suffer from poor infrastructure and weak institutional environment. Increased public investment in infrastructure is therefore a factor that stimulates private investment, especially when these changes are seen as permanent.

It is also important to note that increased availability of bank credit to the private sector fosters private investment in the sampled African countries. Thus, higher domestic credit stimulates both public and private investments⁶, which are positively correlated over the long run. This suggests that although increased public borrowing can raise domestic interest, making it unprofitable for the private sector to borrow to finance investment, the credit effect tends to dominate the interest rate or cost effect.

The results show a negative relationship between real GDP and private investment in both the long run and short-run. Indeed, plotting average GDP against average private investment for each of the sample countries shows that with the exception of a few countries (such as Sudan), private investment lags behind GDP growth. Again this underscores the fact that GDP growth in Africa is largely driven by developments in the primary commodity sector, with little direct effect on private investment. The results also illustrate the fact that growth in African countries has not been sustained

6. See Ndikumana (2000; 2005) for further evidence on the role of credit for domestic investment.

over a long period. This undermines incentives to invest. Indeed, volatility of GDP growth implies high volatility of returns to capital, which discourages private investment.

The exchange rate

The nominal exchange rate strongly responds to changes in international reserves over both the short-run and the long-run (Table 6). As theory suggests, a rise in reserves causes the nominal exchange rate to immediately appreciate, and if the increase in reserves is permanent, the appreciation is also permanent. Thus, unlike the case in other developing regions, accumulation of reserves has not allowed African countries to keep exchange rates low and promote international trade and competitiveness.

The results show that increases in the domestic price level relative to foreign prices leads to nominal exchange depreciation over both the short and long term. But the nominal exchange rate appreciates as the domestic interest rate rises relative to the foreign interest rate. This finding is consistent with standard economic theory, which suggests that increased domestic return on assets attracts increased private capital inflows. The evidence also indicates that current exchange rate level appears to be a good predictor of its future level, underscoring the relative stability and predictability of African nominal exchange rates. Country group dummy variables suggest that exchange rate variability was slightly lower in middle-income African countries and during the recent commodity boom. The result underscores the classic problem posed by resource booms for the management of the exchange rate.

Inflation and reserves

The paper has estimated the determinants of the domestic price level as well as inflation. The results are largely the same as regards the signs and significance of coefficients (Table 7). Accumulation of international reserves has no significant effect on inflation, but induces higher price levels in the long run. However, changes in money supply have no significant impact on current inflation.

One interpretation of these results is that monetary authorities have been able to sterilise foreign exchange inflows and avoid the inflationary effects that would arise through money supply. At the same time, the expected or actual spending of the inflows has put pressure on prices. This is especially because a large part of the spending is on non-tradable goods and services. The results suggest that monetary authorities have succeeded in containing the inflationary impact of foreign exchange inflows by hoarding the reserves, thus minimising their effects on money supply. This certainly serves the narrow objective of monetary policy, namely controlling inflation. But such "success" comes at the expense of the forgone gains from resource inflows in terms of public infrastructure and demand-led growth in general.

Lagged inflation is the main determinant of current inflation. There is evidence that inflationary pressure rises as real GDP growth increases, indicating that there may be a risk of overheating as a result of GDP growth. This effect is particularly important for oil-rich countries, where increased oil revenues fuel government and private consumption that creates excess demand, while the economy does not have the adequate supply capacity to respond (see UNECA 2008). Inflation rates seem to be relatively lower in middle-income African countries, but increase strongly in all countries as a result of the oil price hike.

5. Conclusions and Policy Recommendations

This paper has provided quantitative evidence on the recent increase in foreign exchange reserves in African countries, as driven mainly by the primary commodity export boom. The trend of reserve accumulation as well as their effects has been largely similar in middle-income and low-income countries. African countries have accumulated these reserves in the context of a macroeconomic policy orientation that focuses on stabilisation, especially inflation targeting. The trends in Africa are consistent with those in other developing regions that also experienced substantial build-up of reserves, thus financing the current account and budget deficits in industrialised countries, especially the US.

The study has investigated the motivations, sources, and impact of the reserves accumulation, with a focus on the impact on key macroeconomic variables, namely public and private investment, the exchange rate, and inflation. The empirical analysis shows that reserves hoarding cannot be justified by returns to assets considerations, given the low world interest rates and the high rates of returns to domestic assets in African countries (high domestic real interest rates). Therefore, reserves accumulation can carry a high opportunity cost for African countries and imply cheap financing of the deficits for reserve asset countries.

A key result of the empirical analysis is that reserves accumulation has been accompanied by appreciation of national currencies. Exchange rate appreciation undermines export competitiveness and hampers efforts aimed at diversification of exports. It can adversely affect domestic investment and employment creation and limit progress towards meeting national development goals.

The analysis shows that the increase in foreign exchange reserves has no significant impact on current inflation, but a positive effect on the price level in the long run. However, the evidence suggests that monetary authorities have been successful in containing the expansionary effects of foreign exchange inflows, notably by minimising their impact on money supply. This strategy comes at a cost. It prevents African countries from taking advantage of exports expansion and external resource inflows to stimulate domestic

investment. Indeed, the results show that in the short run, increases in reserves have not been accompanied by increases in public investment.

The empirical results in this study suggest that African countries may want to reconsider their reserve management strategies within a broader economic development policy framework. While macroeconomic stabilisation, especially inflation control, must remain an important objective of macroeconomic policy, there is a need to design strategies that maximise the gains from export revenues and external resource inflows by utilising more of these resources to boost domestic investment. In particular, African countries need to use commodity revenues to boost productivity-enhancing public investment. At the forefront of policy interventions must be strategies for encouraging allocation of these resources to stimulate diversification of exports away from primary commodities. Moreover, to minimise losses from reserve currency appreciation, African countries need to diversify their reserves holdings while also taking into account the needs of their international payments (imports and debt servicing).

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Annexes

Figure 1. Reserves buildup in developing countries, 1997-2005 (US\$ billion)

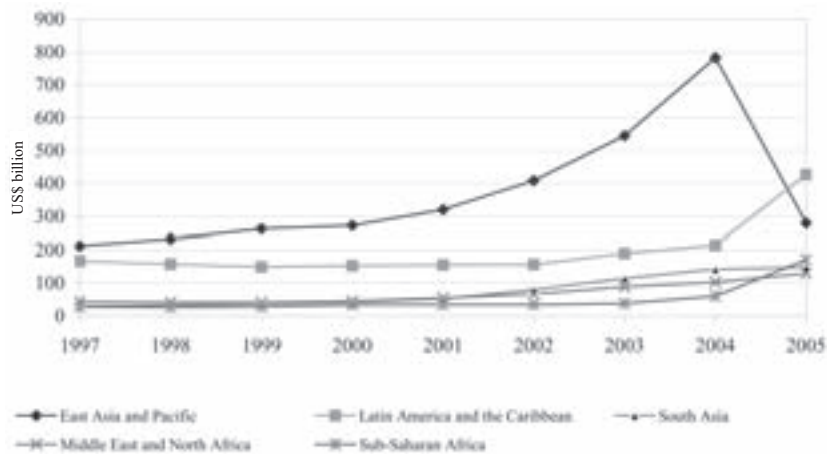


Figure 2. Reserves as a ratio of imports of goods and services (months)

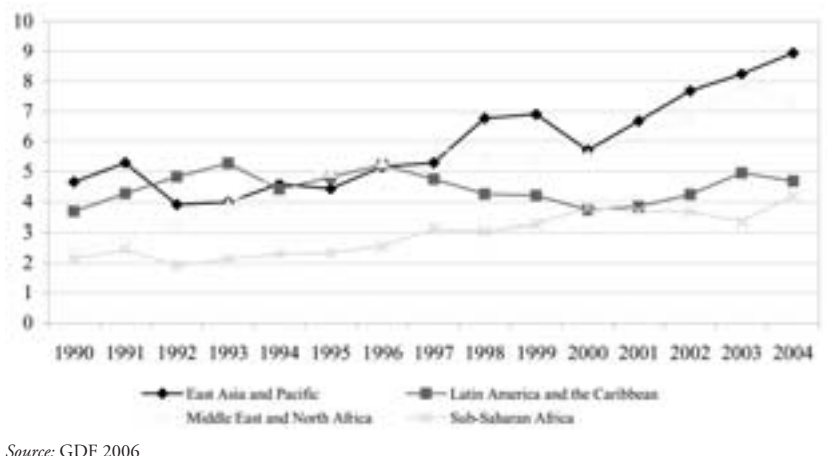
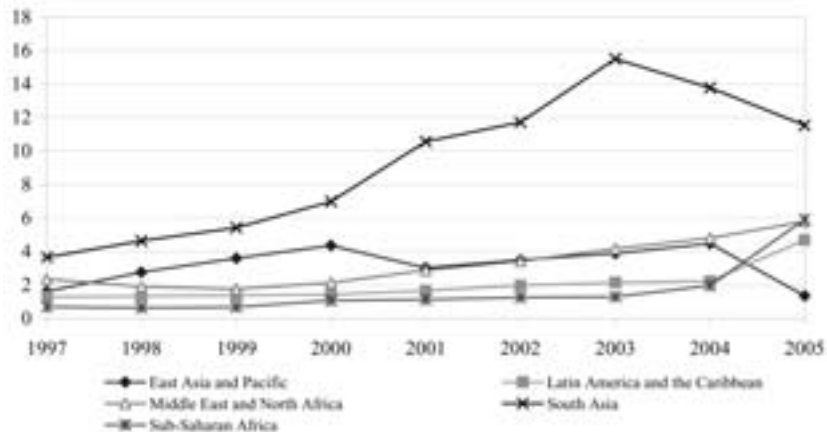
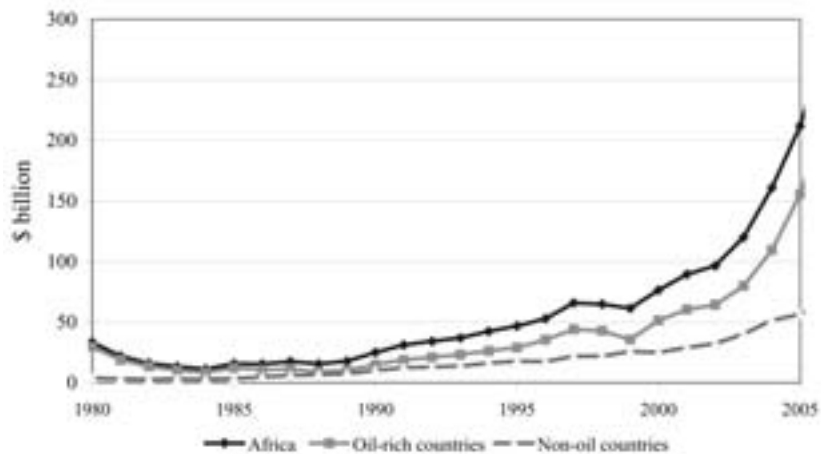


Figure 3. Reserves as a ratio of short-term debt, 1997-2005



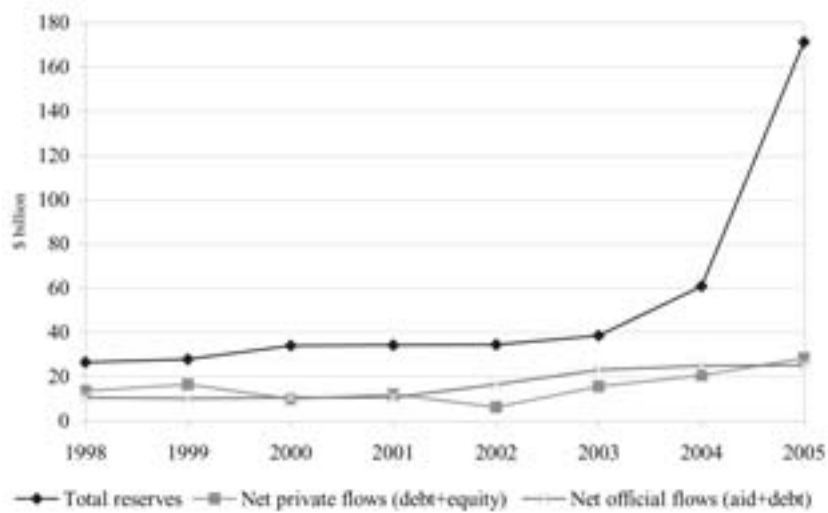
Source: GDF 2006

Figure 4. Oil and reserve accumulation in 39 African countries (USD Billion)



Source: International Financial Statistics (IFS) 2007 (Covers 39 countries with available data)

Figure 5. Capital flows and reserves build-up in sub-Saharan Africa, 1998-2005



Source: IFS 2006

Table 1. Sources of reserves accumulation in Africa (US\$ million)

	Current account balance			Capital and financial account balance		Change in reserves	ODA
	Balance on goods and services (BGAS)	Balance on income (BOI)	Balance on transfers (Btransfer)*	Capital account balance (CAA3)	Financial account balance (FA)		
1990	4251.6	-12386.3	10479.9	6052.6	-13756.0	-5358.3	14617.3
1995	-8776.7	-19599.5	9903.4	2114.6	3113.5	-4468.1	9221.8
2000	3998.2	-6665.6	11303.6	1767.3	-8246.2	-1840.8	6084.9
2001	-203.3	-10759.8	12722.0	-755.2	-5265.9	-4058.9	6641.3
2002	491.4	-10807.2	12965.0	10114.9	-13350.6	-1077.9	8036.6
2003	5869.3	-7820.9	14101.9	5003.9	-18365.7	-7080.9	8170.0
2004	8661.0	-5436.6	17866.0	-27147.0	-9165.3	-23883.0	11858.4
2005	10100.9	-7651.4	20774.8	-35568.8	-2215.3	-24682.1	NA
Average 1980-89	-4063.4	-12150.7	6351.6	4218.0	1512.2	-74.1	6931.1
Average 1990-99	-4201.0	-15059.8	11131.6	1054.8	-1050.3	-3498.5	10290.7
Average 2000-04	4819.6	-8190.3	14955.6	-7764.2	-9434.8	-10437.2	6798.5

Source: IFS 2006; GDF 2006

Notes: Data are for 21 countries only; * includes remittances and other current transfers (net).

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Table 2. Composition of African reserves – US\$ million (full sample)

	Gold	SDRs	Reserve position in the IMF	Foreign exchange*		Total reserves excl. gold
				Amount	% of total	
1990	2200.9	88.6	66.2	15746.4	99.0	15901.2
1995	2527.7	252.4	245.7	34790.3	98.6	35288.5
2000	2238.9	530.0	369.9	46468.7	98.1	47368.7
2001	2176.5	531.0	212.0	50684.6	98.6	51427.6
2002	2611.5	620.2	231.8	51653.5	98.4	52505.5
2003	2466.2	807.8	274.6	58504.1	98.2	59586.5
2004	2676.7	800.5	272.1	82396.7	98.7	83469.4
2005	3276.7	613.6	226.0	107311.8	99.2	108151.5
Average 1980-89	3376.5	174.9	217.2	7202.4	94.8	7594.5
Average 1990-99	2341.6	283.5	225.5	32733.6	98.5	33242.5
Average 2000-05	2574.4	650.5	264.4	66169.9	98.6	67084.9

Source: IFS (2006) and GDF 2006.

Notes: * Include currency plus deposits with monetary authorities and banks plus securities (US/foreign government securities, equity, bonds and notes, money markets, derivatives).

Table 3. Determinants of the demand for reserves

Explanatory Variables	Fixed effects +Cross-section weights		Two-step ECM		
	In levels (1)	In 1 st differences (2)	(3a)	(3b)	(3C)
GDP	0.482 (18.41)	0.230 (1.43)	0.381 (3.00)	0.283 (1.90)	0.366 (1.60)
Exports	0.525 (11.30)	0.645 (5.35)	0.676 (6.97)	0.623 (5.73)	1.10 (6.15)
S.T debt	-0.012 (-0.29)	-0.014 (-0.463)	0.007 (0.261)	-0.020 (-0.71)	-0.040 (-0.60)
Opportunity cost ^a		-0.0021 (-0.819)		-0.003 (-1.15)	-0.003 (-1.15)
Export variability ^b		3.60E-06 (0.519)			
DUMMIY					0.002 (0.005)
DUM0305					0.021 (1.24)
Residual (lagged)			-0.246 (-8.14)	-0.266 (-7.86)	-0.361(-8.96)
Adjusted R ²	0.94	0.08	0.20	0.21	0.24
DW	0.60	2.03	1.84	1.80	2.06
Observations	491	386	468	386	405

Notes: The dependent variable is log of real reserves in level (column 1) and in 1st difference (columns 2 and 3); a: opportunity cost is the real US treasury bill rate minus the real domestic deposit rate (this variable was lagged by one year lag in the case of equations 2 and 3); b: Export variability is measured by a moving standard deviation of exports; The figures in parentheses are t- statistics; All variables are in real national currency; Coefficient on the constant not reported for reason of space.

Table 4. Impact of reserves on public investment

Explanatory variables	Fixed effects plus cross section weights					Two-step ECM		
	In levels (1a)	In levels (1b)	In levels (1b)	1 st differences (2a)	1 st differences (2b)	(3a)	(3b)	(3C)
Reserves	0.409 (13.08)			0.027 (1.37)		0.026 (1.44)		
GDP	-0.677 (22.15)	-0.71 (-27.55)	-0.775 (-30.5)	-0.038 (-0.42)	-0.072 (-4.33)	-0.108 (-1.37)	-0.121 (-1.54)	-0.103 (1.10)
Public credit	0.460 (14.71)	0.425 (15.69)	0.08 (2.02)	0.086 (2.22)	0.087 (2.29)	0.08 (2.28)	0.083 (2.41)	0.072 (1.82)
ODA		0.329 (15.65)	0.03 (0.702)		0.087 (2.72)		0.086 (2.84)	0.10 (2.54)
Public debt			0.46 (6.03)					0.036 (0.39)
Oil rich dummy	1.437 (11.71)	1.53 (14.48)						
Residual (lagged)						-0.22 (-8.30)	-0.200 (-7.49)	1.98
Adjusted R ²	0.72	0.80	0.94	0.01	0.02	0.16	0.15	0.02
DW	0.25	1.83	0.54	1.86	1.83	1.71	1.88	
Observations	420	420	420	394	394	394	394	368

Notes: The dependent variable is the log of real public investment. Results for DUMMIY and DUM0305 are insignificant and therefore have been dropped for space consideration. Figures in parentheses are t-statistics.

Table 5. Impact of reserves on private investment

Explanatory variables	Fixed effects + cross-section weights		Two-step ECM	
	In levels	In 1 st differences	(a)	(b)
Reserves	0.081 (7.08)	0.014 (1.079)	0.015 (1.23)	0.005 (0.25)
GDP (lagged)	-0.409 (-15.65)	-0.154 (2.40)	-0.195 (-3.12)	-1.82 (-1.86)
Private credit	0.231 (7.09)	0.210 (2.90)	0.161 (2.27)	0.08 (0.85)
Public investment	0.247 (8.83)	-0.039 (1.244)	-0.011 (-0.36)	-0.092 (-2.20)
DUMMIY				0.02 (0.94)
DUM0305				0.05 (0.55)
Residual (lagged)			-0.313 (-0.85)	-0.05 (-3.86)
Adjusted R ²		0.96	0.024	0.192
Durbin Watson		0.93	2.27	2.09
Observations		394	374	374

Notes: The dependent variable is the log of real private investment. Figures in parentheses are t-statistics.

Table 6. Impact of reserves on the nominal exchange rate

Explanatory variables	Fixed effects			Two-step ECM		
	In levels (1)	In 1 st differences* (2a)	In 1 st differences* (2b)	(3a)	(3b)	(3C)
Log Reserves (lagged)	-0.023 (-3.83)	-0.034 (-3.87)	-0.027 (-3.08)	-0.041 (-4.97)	-0.038 (-4.61)	0.002 (0.50)
Log exchange rate (lagged)	0.749 (25.01)	0.062 (1.33)	0.023 (0.46)	0.735 (7.66)	0.711 (8.05)	0.60 (6.91)
Log CPI	0.209 (7.21)	0.726 (6.09)		0.607 (5.32)		0.51 (4.80)
Log deposit rate	0.035 (1.66)	0.012 (0.37)		-0.009 (-0.28)		
Inflation differential (lagged) ^a			0.006 (5.56)		0.005 (5.16)	
Interest rate differential ^b			-0.009 (-4.48)		-0.007 (-4.03)	
DUMMIY						-0.01 (-0.70)
DUM0305						-0.04 (-1.2)
Residua (lagged)				-0.830 (-7.84)	-0.830 (-8.02)	-0.74 (-8.0)
Adjusted R ²	0.99	0.16	0.19	0.27	0.29	0.31
Durbin Watson	1.1.62	1.92	1.82	1.88	1.85	1.98
Observations	458	430	415	430	407	430

Notes: a: The difference between domestic and foreign (US) consumer inflation rates; b: The difference between domestic and foreign (US treasury bill) real interest rates; the dependent variable is the nominal exchange rate defined as the price of the dollar in national currency; Figures in parentheses are t-statistics; * 1st difference does not apply to inflation and interest rate differentials.

Table 7. Impact of reserves on domestic prices (level and inflation)

Explanatory variables	With reserves				With money supply and exchange rate			
	In level	1 st differences	2-Step ECM		In level	1 st differences	2-Step ECM	
Log reserves	-0.078 (-1.46)	0.012 (10.89)	0.013 (4.18)	0.01 (1.87)				
Log real GDP	0.025 (3.04)	0.064 (4.05)	0.07 (4.81)	0.15 (5.40)	0.11 (8.38)	0.12 (6.03)	0.11 (5.62)	0.20 (8.0)
Log CPI (lagged)	0.938 (82.69)	0.396 (9.49)	0.951 (10.77)	0.45 (10.6)	0.87 (60.6)	0.35 (8.23)	0.83 (7.79)	0.80 (9.10)
Log M2					-0.015 (-3.51)	-0.003 (-0.127)	-0.008 (-0.376)	0.0001 (-0.011)
Expected exchange rate*					-0.03 (-2.24)	0.077 (2.57)	0.082 (2.85)	0.10 (3.10)
DUMMIY				-0.014 (-2.71)				-0.003 (-0.40)
DUM0305				-0.003 (-0.24)				0.03 (2.1)
Residual (lagged)			-0.677 (-7.01)	-0.033 (-1.63)			-0.547 (-4.77)	-0.55 (5.86)
Adjusted R-Squared	0.99	0.51	0.56	0.38	0.99	0.55	0.58	0.67
Durbin Watson	1.33	2.06	2.02	2.22	1.06	2.02	2.00	2.06
Observations	494	471	471	406	459	436	436	436

Notes: Dependent variable is the domestic consumer price inflation rate; * computed as a 3-year moving average; Figures in parentheses are t-statistics.

Appendix tables

Table A1. Reserves and selected economic indicators for sample countries, 1980-2005 (average)

COUNTRY	Reserves US\$ million	GDP Growth (% p.a.)	Inflation (%)	Private Investment/ GDP (%)	Public Investment/ GDP (%)	Private Credit/Total Credit (%)	Public Credit/Total Credit (%)	ODA \$ million	Ratio M2/GDP (%)
Botswana	3693.2	7.8	10.2	20.4	8.4	91.8	8.2	114.0	23.8
Congor	196.6	4.3	4.9	16.1	8.0	29.1	70.9	149.1	16.4
Côte d'ivoire	430.5	0.8	5.7	8.0	5.7	85.3	14.7	557.2	26.0
Egypt	8958.8	5.0	12.1	12.2	11.4	50.1	49.9	2330.5	77.9
Ethiopia	423.2	3.2	5.7	8.6	7.1	91.1	8.9	906.5	37.0
Gabon	192.2	2.2	4.3	22.9	6.3	0.0	100.0	89.1	17.3
Ghana	524.6	3.4	34.8	8.1	9.4	0.0	100.0	594.8	17.3
Kenya	625.3	3.1	13.3	8.2	7.3	75.2	24.8	691.5	31.3
Lesotho	265.6	4.0	12.5	34.2	17.3	56.6	43.4	114.5	34.1
Madagascar	194.7	1.3	16.3	5.8	6.9	86.7	13.3	421.6	18.0
Mauritius	648.6	5.4	8.5	18.9	5.1	71.5	28.5	46.3	64.2
Morocco	4161.0	3.5	5.1	18.8	8.2	66.6	33.4	741.9	58.4
Niger	149.5	1.4	3.5	3.5	8.3	45.5	54.5	343.5	14.0
Nigeria	5610.6	2.6	23.3	9.6	9.0	72.7	27.3	198.8	22.3
Rwanda	145.4	3.2	6.3	8.5	9.0	79.7	20.3	349.3	14.7
Senegal	266.4	3.1	4.8	9.4	5.2	91.0	9.0	599.0	25.0
Seychelles	27.8	2.6	3.2	17.2	9.9	28.3	71.7	21.6	56.7
South Africa	3190.4	2.1	10.9	10.2	5.9	63.1	36.9	402.7	51.2
Sudan	188.0	4.4	48.2	11.4	3.2	88.1	11.9	700.8	17.2
Swaziland	229.1	4.7	11.8	14.9	8.5	92.9	7.1	46.5	26.4
Tunisia	1468.7	4.4	5.1	15.4	13.1	50.5	49.5	279.1	46.4

Table A2. Sources of reserves accumulation in Africa US\$ million (oil-producing countries)

	Current account balance			Capital and financial account balance		Change in reserves (CRES3)	ODA
	Balance on goods and services (BGAS)	Balance on income (BOI)	Balance on transfers (Btransfer)*	Capital account balance (CAA3)	Financial account balance (FA)		
1990	3357.4	-5428.0	6324.8	7664.7	-15248.6	-3329.7	7251.9
1995	-4517.7	-9880.5	5663.7	2142.7	-894.6	-2968.7	2815.11
2000	5309.6	-51.1	6779.9	-1499.4	-8176.9	-2947.5	2006.4
2001	-353.7	-5370.6	6490.3	1317.5	-2547.9	-110.7	2088.68
2002	-870.3	-6739.3	6994.7	11197.3	-9236.8	2215.9	2297.67
2003	6840.5	274.6	6460.0	7102.0	-14975.6	-1139.1	2279.43
2004	18823.1	11721.9	9217.4	-17652.6	-15928.9	-12642.2	3394.87
2005	23063.0	12153.6	11738.3	-28410.9	-14784.8	-19528.8	NA
Average 1980-89	-4338.0	-7358.4	4110.6	3280.2	215.7	248.2	2869.578
Average 1990-99	-2923.1	-8226.6	6879.5	2897.4	-3699.8	-1813.8	4050.417
Average 2000-04	8802.0	1998.2	7946.8	-4657.7	-10941.8	-5692.1	2011.175

Source: IFS 2006; GDF 2006

Notes: Data are for 21 countries only; * includes remittances and other current transfers (net).

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**Table A3. Composition of African reserves –
 US\$ million (oil-producing countries)**

	Gold	SDRs	Reserve position in the IMF	Foreign exchange*		Total reserves excl. gold
				Amount	% of total	
1990	656.9	6.2	0.9	7626.7	99.9	7633.8
1995	718.9	111.0	80.9	19408.7	99.0	19600.7
2000	520.9	52.4	183.8	25153.2	99.1	25389.4
2001	497.8	37.4	26.4	25436.3	99.7	25500.2
2002	582.7	97.6	28.6	23158.0	99.5	23284.3
2003	644.8	192.4	31.3	24199.7	99.1	24423.3
2004	731.3	188.4	32.8	36844.4	99.4	37065.6
2005	794.7	106.3	30.2	56457.9	99.8	56594.4
Average 1980-89	670.5	78.5	123.0	3984.3	95.2	4185.8
Average 1990-99	638.4	89.1	73.4	18312.3	99.1	18474.8
Average 2000-05	628.7	112.4	55.5	31874.9	99.5	32042.9

Source: IFS (2006); GDF 2006.

Notes: * Includes currency plus deposits with monetary authorities and banks plus securities (US/foreign government securities, equity, bonds and notes, money markets, derivatives).

Table A4. Sources of reserves accumulation in Africa – US\$ million (non-oil economies)

	Current account balance			Capital and financial account balance		Change in reserves (CRES3)	ODA
	Balance on goods and services (BGAS)	Balance on income (BOI)	Balance on transfers (Btransfer)*	Capital account balance (CAA3)	Financial account balance (FA)		
1990	894.2	-6958.3	4155.1	-1612.2	1492.5	-2028.6	7365.4
1995	-4258.9	-9719.0	4239.7	-28.1	4008.0	-1499.4	6406.7
2000	-1311.4	-6614.5	4523.7	3266.7	-69.2	1106.7	4078.5
2001	150.4	-5389.3	6231.7	-2072.7	-2718.0	-3948.3	4552.6
2002	1361.7	-4067.9	5970.3	-1082.4	-4113.8	-3293.8	5739.0
2003	-971.2	-8095.6	7642.0	-2098.1	-3390.1	-5941.8	5890.6
2004	-10162.1	-17158.5	8648.7	-9494.4	6763.6	-11240.7	8463.5
2005	-12962.2	-19805.0	9036.4	-7157.9	12569.4	-5153.3	NA
Average 1980-89	274.6	-4792.3	2241.0	937.8	1296.5	-322.3	4061.5
Average 1990-99	-1277.9	-6833.1	4252.2	-1842.6	2649.4	-1684.7	6240.3
Average 2000-04	-3982.5	-10188.5	7008.8	-3106.5	1507.0	-4745.2	4787.4

Source: IFS 2006; GDF 2006

Notes: Data are for 21 countries only; * includes remittances and other current transfers (net).

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**Table A5. Composition of African reserves –
 US\$ million (non-oil economies)**

	Gold	SDRs	Reserve position in the IMF	Foreign exchange*		Total reserves excl. gold
				Amount	% of total	
1990	1544.0	82.4	65.3	8119.7	98.2	8267.4
1995	1808.8	141.4	164.8	15381.6	98.0	15687.8
2000	1718.0	477.6	186.1	21315.5	97.0	21979.2
2001	1678.7	493.7	185.5	25248.3	97.4	25927.5
2002	2028.9	522.5	203.2	28495.5	97.5	29221.2
2003	1821.4	615.4	243.3	34304.4	97.6	35163.1
2004	1945.4	612.1	239.4	45552.3	98.2	46403.8
2005	2482.1	507.4	195.8	50853.9	98.6	51557.1
Average 1980-89	2706.0	96.4	94.2	3218.1	94.4	3408.7
Average 1990-99	1703.2	194.3	152.1	14421.2	97.7	14767.7
Average 2000-05	1945.7	538.1	208.9	34295.0	97.9	35042.0

Source: IFS (2006); GDF 2006.

Notes: * Include currency plus deposits with monetary authorities and banks plus securities (US/foreign government securities, equity, bonds and notes, money markets, derivatives).

**Table A6. Unit root tests for regression variables
 (in log form in million of real values
 of domestic currency except for differentials)**

Variable	Im, Pesaran and Shin W-Stat ^(a)	Probability	Order of integration
Reserves	0.74	0.771	I(1)
GDP	0.04	0.514	I(1)
Export	-0.50	0.31	I(1)
ST debt	0.85	0.80	I(1)
Public Investment	0.05	0.52	I(1)
Private investment	-1.57	0.06 ^(b)	I(1)
Public credit	1.44	0.92	I(1)
Private credit	0.167	0.57	I(1)
Public debt (total)	-1.82	0.03	I(0)
ODA	-0.56	0.29	I(1)
Nominal exchange rate	-1.21	0.11	I(1)
Money supply (M2)	2.37	0.99	I(1)
Nominal domestic deposit rate	-0.99	0.16	I(1)
Domestic CPI	11.26	1.00	I(1)
Foreign interest rate (US treasury bill rate) ^(c)	-3.07	0.001	I(1/0)
Foreign (US) CPI	10.20	1.00	I(1)
Domestic inflation (CPI)	-7.03	0.00	I(0)
Foreign (US) inflation (CPI)	-17.79	0.00	I(0)
Export variability ^(d)	-3.42	0.00	I(0)
Inflation differential	-6.33	0.00	I(0)
Interest rate differential ^(e)	-4.66	0.00	I(0)

Notes: ^(a) Assumes individual unit root process; ^(b) probability for ADF test is 0.11 with an asymptotic chi-square of 54; ^(c) according to the Phillips-Perron (PP), this variables is strongly I(1); ^(d) measured as a 3-year moving standard deviation of export value; ^(e) real domestic deposit rate minus the real US treasury bill rate.

**Table A7. Panel cointegration tests 1979-2005
 (test statistic and probability)**

Equation	Group of variables	Assuming common AR coefficients	Assuming individual AR coefficients
Reserve demand ^(a)	Reserves, GDP, Exports, ST debt, domestic deposit rate, and foreign interest rate.	5.81 (0.00) Integrated	8.32 (0.00) Integrated
	Reserves, GDP, Exports, ST debt	0.40 (0.36) Not integrated	3.40 (0.00) Integrated
Public investment ^(a)	Reserves, public investment, GDP, public debt and public credit	3.55 (0.00) Integrated	5.47 (0.00) Integrated
	Public investment, GDP, public credit, public debt and ODA	4.81 (0.00) Integrated	7.17 (0.00) Integrated
Private investment ^(a)	Reserves, private investment, GDP, Private credit, and Public Investment	2.94 (0.01) Integrated	4.88 (0.00) Integrated
Nominal exchange rate ^(b)	Reserves, exchange rate, inflation differential, and interest rate differential	4.22 (0.00) Integrated	6.64 (0.00) Integrated
Inflation ^(c)	Inflation, GDP growth, reserves, expected exchange rate and money supply	2.87(0.01) Integrated	3.97 (0.00) Integrated

Notes: ^(a) variables are in log-form; ^(b) reserves and nominal exchange rate are in first difference of the log-form; ^(c) reserves and money supply are in first difference of the log-form.