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Overshooting and Dollarization in the Democratic Republic of the Congo

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Abstract

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The paper develops an interpretation of volatile exchange rate movements in a dollarized economy with very high rates of inflation. Differences between the rate of inflation and currency depreciation (over- or undershooting of the exchange rate) are seen as a proxy for changes in the relative demand for domestic and foreign currency. A simple model is calibrated for the Democratic Republic of the Congo in the 1990s and is used to derive estimates of the rate of dollarization.

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I. INTRODUCTION

The Democratic Republic of the Congo (hereinafter referred to as "the Congo")[2] experienced very high rates of inflation in the 1990s, which reached hyperinflation levels on several occasions.[3] From about 50 percent in the late 1980s, the annual increase in consumer prices jumped to 265 percent during 1990 and peaked at 90,000 percent in the 12-month period through September 1994. Inflation subsequently came down markedly, but rose again to 700 percent in 1996 and remained at some 500 percent in 1999–2000 before dropping to 130 percent in 2001.

During 1990–2001, the Congo's monthly inflation rate was highly variable (Figure 1).[4] Often, inflation jumped brutally in one month, from 10–20 percent to 40–60 percent or even more, before returning to its previous range. The change in the rate of inflation naturally stemmed from sharp fluctuations in the growth of currency issue, which itself resulted from various political developments and the government's inability to live within its means.[5] Under the circumstances, people developed mechanisms to protect themselves from the erosion in the value of the currency, mostly through currency substitution.

Even though the central bank recurrently failed to adjust the exchange rate in a timely manner, there was a thriving parallel market in which foreign currency banknotes—primarily U.S. dollars, but also CFA francs in the provinces bordering on the Republic of Congo (Brazzaville) and the Central African Republic, as well as Zambian kwacha and South African rand in the southern province of Katanga (formerly Shaba)—could be exchanged against domestic currency notes. Even though such transactions were illegal (and, at times, reprimanded by the authorities), the parallel market always remained active and its rates were duly monitored by the central bank.[6] The parallel market operated not only for exchanges of

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[2] The Democratic Republic of the Congo became independent from Belgium in 1960. It was renamed "Zaïre" in 1971 but reverted to its former name in May 1997.

[3] Following Cagan (1956), hyperinflation is commonly defined as beginning in the month when the monthly increase in prices exceeds 50 percent, and ending in the month before the increase in prices drops and stays below that level for at least a year. Based on this criterion, the Congo was in hyperinflation during October 1991–September 1992 and November 1993–September 1994, with brief bouts in August 1998 and December 1999.

[4] Throughout this paper, monthly inflation rates refer to changes in monthly average price indices. Quarterly or annual inflation rates are measured on an end-of-period basis (December over December, for annual inflation rates).

[5] Developments during the 1990–96 period are discussed in Beaugrand, 1997.

[6] Despite inherent measurement difficulties, the central bank data have generally been deemed reliable. Although the Congo's domestic currency was very much marginalized in the 1990s, it remained in use for transactions through the payment of civil servants' salaries.

national currency notes against foreign currency notes but also between various
denominations of the national currency, as well as between banknotes and bank deposits.[7]

Figure 1. Monthly Inflation Rate
(*In percent*)

Source: See Table 1.
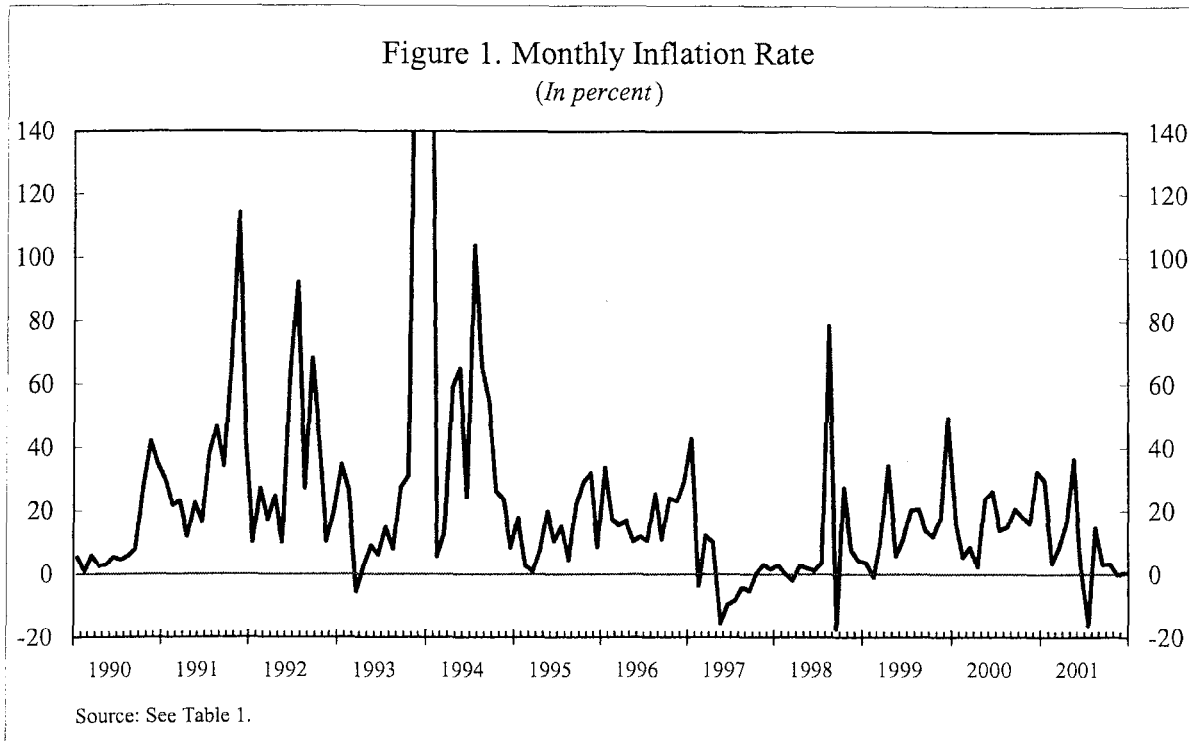
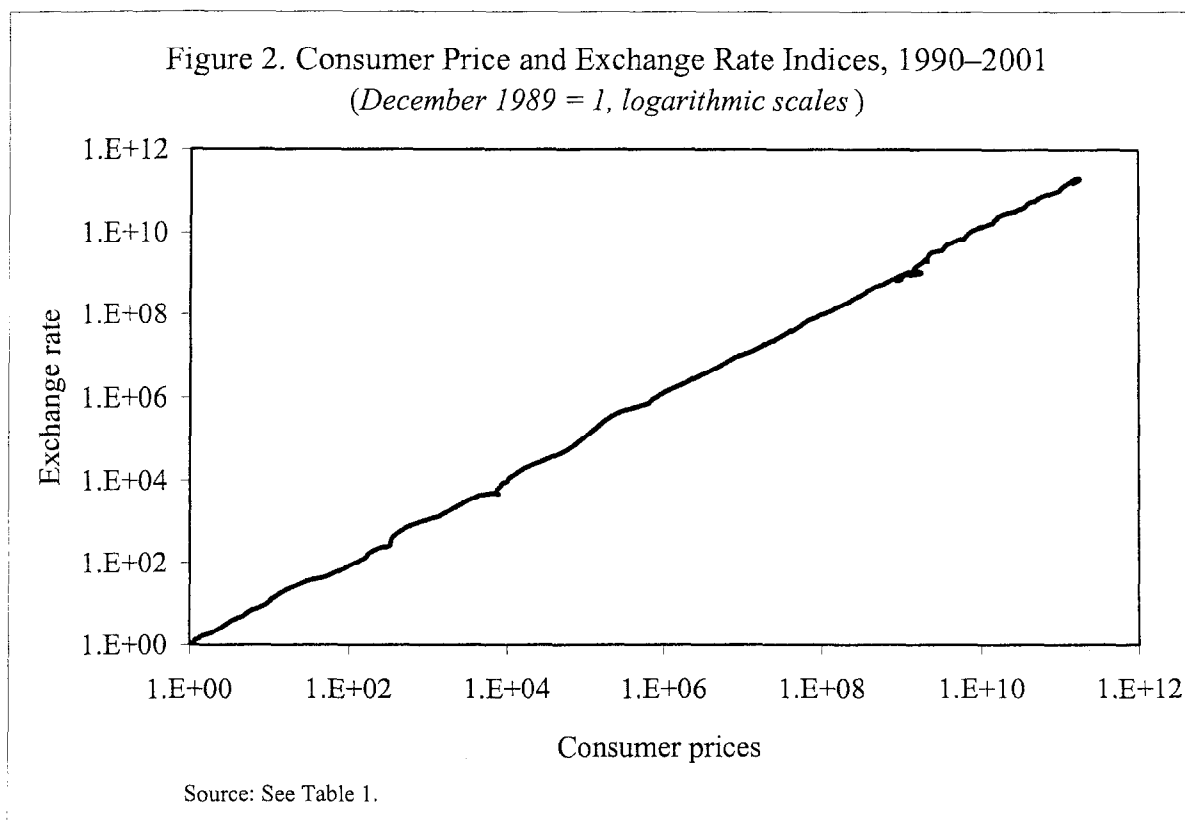There was a very close relationship between the parallel market exchange rate and consumer
prices (over 1990–2001, the simple correlation coefficient between the consumer price index
and the exchange rate index was 0.998—see Figure 2). On many occasions, however,
changes in the two indices differed significantly during a given period. Thus, for instance,
during the three months ending in December 1993 (in the aftermath of the currency exchange
of October), inflation was 1,450 percent, while the depreciation of the new zaïre against the
U.S. dollar reached 2,150 percent; currency depreciation slowed relatively in subsequent
months, and by July 1994 the cumulative inflation and depreciation since September 1993

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[7] From October 1993 until the fall of 1998, there were parallel market rates between the (old) zaïre
and the new zaïre, as the introduction of the latter had been boycotted in the Kasaï province. During
1992–97, bank deposits were difficult to mobilize because the central bank was unable to supply
commercial banks with enough cash, and deposits consequently traded at a discount (of up to
50 percent) over currency notes. In addition, from 1996 until 1998, orange NZ 100,000 currency
notes of (which had been introduced in Katanga but were boycotted in Kinshasa) traded at a discount
against the green NZ 100,000 notes that circulated in the Kinshasa region.

were of a similar magnitude (58,000 percent). In addition, the amplitude of monthly changes in the exchange rate was significantly larger than for consumer prices.[8]

Figure 2. Consumer Price and Exchange Rate Indices, 1990–2001
(*December 1989 = 1, logarithmic scales*)

Source: See Table 1.

The overshooting of the exchange rate—that is, its tendency to depreciate faster than inflation—has been frequently analyzed in the literature. The most commonly accepted model of the overshooting exchange rate is that of Dornbusch (1976), which explains why this phenomenon is necessary to ensure temporarily equilibrium on the foreign exchange market in response to monetary shocks. Dornbusch's model requires as a crucial assumption that asset prices adjust much faster than commodity prices. The model has been widely hailed as the fundamental explanation of why exchange rate overshooting occurs, and its workings have been incorporated as a generalization of the Mundell-Fleming model to a world with forward-looking agents equipped with rational expectations (Rogoff, 2002).[9]

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[8] During the 1990s, average monthly inflation and currency depreciation (in domestic currency terms) were 25–26 percent, with standard deviations of 40 and 50 percentage points, respectively.

[9] The Dornbush model was further extended by Obstfeld and Rogoff (1995) with the "*Redux* model," which has given rise to a large literature on open-economy dynamic general-equilibrium models that incorporate imperfect competition and nominal rigidities. For a survey, see Lane (1999). As construed here, over- or undershooting of the exchange rate does not refer to a deviation from any "equilibrium" rate.

The Dornbusch model of overshooting exchange rates, however, seems hardly applicable to a case such as the Congo. For one thing, interest rates were not a relevant variable in the Congo during the 1990s: there were no interest-bearing assets that any sensible Congolese would have invested in, as the banking system had passed the point of collapse and was not even able to convert bank deposits into cash. As a rule, economic operators had no direct access to alternative investment opportunities abroad. Moreover, all indications suggest that both the parallel exchange rate and commodity prices did adjust very quickly as information spread almost instantly to all markets, thanks in part to an efficient cellular phone system.[10]

In a basic setting such as the Congo's, a simpler explanation than the Dornbusch model is needed. The approach developed here relies on a global money demand function, which takes into account the holdings of both domestic currency ("zaïres") and foreign exchange (referred to hereinafter as "dollars"). In this context, the overshooting of the exchange rate is viewed as a consequence of the shift in money demand toward foreign currency, which is an expression of an increase in dollarization (i.e., the ratio of foreign currency holdings to total currency holdings). Seen in this light, the overshooting of the exchange rate is also an indicator of an upward shift in inflation expectations.

II. MEASURING DOLLARIZATION

Empirical analyses of dollarization face a serious challenge because of overwhelming measurement difficulties. Actual dollar holdings are not directly observable,[11] and anecdotal evidence of currency substitution is of limited use.[12] The basic framework below is designed

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[10] The sudden unloading of large quantities of banknotes was generally known in advance, as all operators were on the watch for the trucks, from the "Corando" security company, that left the central bank for the Kinshasa markets (rational expectations in the Congo have since been dubbed the "Corando effect").

[11] Some studies have relied on the size of foreign currency deposits relative to total bank deposits (or broad money) as a proxy for dollarization, but this approach is likely to miss a substantial share of "dollars" in the form of foreign currency holdings—especially in countries where trust in the banking system has been impaired.

[12] Very few data sources can be used directly as a basis for estimating the stock of foreign currency holdings in the Congo. One such source is the set of Currency and Monetary Instrument Reports (CMIR) collected by the U.S. Customs Service, which include all bulk shipments of dollar currency by financial institutions and individuals (see Feige, 1997). The CMIR data, however, are of limited usefulness in the case of the Congo. The scale of cumulative flows, at about US$100 million during the 1990s, would seem rather low considering the size of the domestic money stock at the beginning of period (US$500 million). The CMIR data are presumably biased because of significant changes in the Congo's regulatory environment during the 1990s. In the early part of the decade, the official importation of foreign currency notes was severely restricted, administered on a case by case basis, and limited mostly to the purchase of diamonds. From 1994 onward, the importation and use of foreign currency was broadly liberalized. In addition, it is likely that earlier importations of U.S. dollar banknotes originated mostly from Belgium, with which the Congo always maintained close

as a roundabout way to gauge the extent of dollarization in the Congo during the 1990s, based on several general assumptions and using available data. While the resulting estimates of dollar holdings and dollarization rates are undoubtedly subject to a large degree of error, they arguably provide a credible picture and illustrate the interrelation between overshooting and dollarization.

A. Basic Framework

In a dollarized economy, overall money in circulation consists of local (L) and foreign (F) currency (zaïres and dollars). Reacting to changes in domestic inflation, operators switch out of (and back into) local currency, but overall money demand is assumed to be stable relative to income. Aggregates are measured either in local currency terms or in dollar terms ($):

$$M = ML + MF \quad \text{or} \quad M\$ = ML\$ + MF\$ \tag{1}$$

$$M^D = kY \quad \text{or} \quad M\$^D = kY\$ \tag{2}$$

$$\text{with} \quad M\$ = \frac{M}{XR}; \quad ML\$ = \frac{ML}{XR}; \quad MF\$ = \frac{MF}{XR}; \quad Y\$ = \frac{Y}{XR}; \tag{3}$$

$$\text{and} \quad Y = P\,y \tag{4}$$

where:

M	=	overall money in circulation (the superscript ^{D} indicates money demand);
ML	=	local (or domestic) currency in circulation;
MF	=	foreign currency in circulation;
Y	=	nominal national income;
y	=	real national income;
P	=	price level index;
XR	=	exchange rate index, in domestic currency terms; and
k		is a constant coefficient ($0 < k < 1$).[13]

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links and where most world diamonds are traded (in Antwerp), rather than directly from the United States. Moreover, it is generally believed that at least two-thirds of the diamond trade, in value terms, from Central and West African countries have been handled through informal channels, mostly for tax evasion reasons, which suggests that U.S. dollar banknotes were also smuggled in from countries other than Belgium.

[13] No distinction is made here between currency notes and bank deposits; the database, however, takes into account the discount of bank deposits over currency (see below). The basic time period is assumed to be sufficiently short to dispense with the distinction between end-of-period and period average exchange rates. Measuring the exchange rate in domestic currency terms—rather than in foreign currency terms as is customary—makes the index directly comparable with the price index.

Local currency in circulation (ML) is exogenously determined, and results from government and central bank policies. Consistent with the well-known Cagan (1956) approach, local money demand depends on nominal income and expected inflation:

$$ML^D = \Phi\left(Y, \pi^e\right) \tag{5}$$

where Φ is a function positively related to nominal income and inversely related to the expected rate of inflation (π^e).

The standard Cagan formulation provides a convenient expression of Φ:

$$ML^D = h\,\frac{P\,y}{1+\pi^e} \tag{6}$$

where h is a constant coefficient ($0 < h \le k$).

At any point of time, the local currency issued must be held, and thus is necessarily equal to local currency money demand ($ML \equiv ML^D$). Therefore, the price level adjusts instantaneously to the amount of local currency in circulation, depending primarily on the state of expected inflation:

$$P = \frac{1+\pi^e}{h\,y}\,ML \tag{7}$$

On the highly simplified assumption that overall currency holdings always equal money demand ($M = M^D$), it is readily seen that the dollarization rate would depend solely on expected inflation (taking the parameters h and k as constant). Thus, as expected inflation increases toward infinity, the dollarization rate reaches unity:

$$\frac{MF}{M} = \frac{M - ML}{M} = 1 - \frac{h}{k\left(1+\pi^e\right)} \tag{8}$$

In the simple case where $h = k$, people prefer to hold money balances in domestic currency: there is no dollarization when expected inflation is nil, and dollarization reaches 50 percent when expected inflation is at 100 percent.

It is unrealistic, however, to assume that overall currency holdings adjust at all times to money demand. Foreign currency in circulation cannot rise or fall instantly to any desired level, as it is not readily available. While zaïres can be printed locally, dollars must be acquired by generating an export surplus or drawing down on foreign assets. In the very short run, the stock of foreign currency should rather be assumed constant $\left(MF\$ = \overline{MF\$}\right)$. In order for total money demand to adjust fully to its desired level, domestic prices and the exchange rate move to equilibrate the two components of overall money in circulation:

$$M = kY = ML + MF = ML + \overline{MF}\$ \ XR \tag{9}$$

$$k \ P \ y = P \ y \ \frac{h}{1 + \pi^e} + \overline{MF}\$ \ XR \quad \text{or} \quad P \ y \left(k - \frac{h}{1 + \pi^e} \right) = \overline{MF}\$ \ XR$$

$$\frac{XR}{P} = \frac{y}{\overline{MF}\$} \left(k - \frac{h}{1 + \pi^e} \right) \tag{10}$$

The ratio of the exchange rate to the price level $\left(\dfrac{XR}{P} \right)$ is the *overshooting index*, i.e., the extent to which exchange rate depreciation (measured in domestic currency terms) exceeds inflation, relative to an arbitrary base period. While some studies of dollarization assume that this ratio remains equal to unity (because of the "Law of One Price"), overshooting necessarily occurs in the presence of co-circulating currencies and accelerating inflation. As long as expected inflation is constant, changes in prices translate pari passu into changes in the exchange rate level. When expected inflation increases, however, the exchange rate depreciates faster than prices increase; this raises real foreign currency balances to compensate for the drop in real domestic currency balances. It should be noted that this result does not depend on an assumption of sticky prices. Exchange rate overshooting takes place because, at first, the existing stock of foreign currency does not suffice to meet the desired level of cash balances.

The overshooting index is closely related to the real effective exchange rate index.[14] As a rule, the depreciation of the exchange rate should rather undershoot inflation. Increases in domestic prices normally outstrip increases in the nominal exchange rate because of the Balassa-Samuelson effect—i.e., as a result of stronger productivity growth in the tradable sector than in the nontradable sector. However, such a pattern is highly unlikely in a severely disrupted environment, marked by high and volatile inflation, crumbling public services and infrastructure, as well as large forced savings and the substantial immobilization of assets required for dollarization.[15]

A simpler and more intuitive way to look at the adjustment of domestic and foreign currency money balances is to decompose the stock of real money balances as follows:

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[14] For developing countries, the real effective exchange rate index is generally computed as the relative consumer price index measured in a common currency (i.e., $\dfrac{P_{domestic}}{P_{foreign} \ XR}$), which is equal to the inverse of the overshooting index as long as foreign prices remain constant.

[15] Actually, a country such as the Congo in the 1990s may rather have experienced a reverse Balassa-Samuelson effect, as the economic order collapsed and many productive activities ground to a halt.

$$\frac{M}{P} = \frac{ML + MF}{P} = ML\frac{1}{P} + MF\$ \frac{XR}{P} \tag{11}$$

As long as overall money balances are kept constant in real terms, an overshooting exchange rate is required to compensate for a drop in real domestic currency holdings. Suppose, for example, that the initial dollarization ratio is 50 percent ($ML = MF$ at $t = 0$); if ML increases by 20 percent and P by 25 percent (because of higher expected inflation), the nominal exchange rate depreciation (in domestic currency terms) will need to reach 30 percent to raise the real money balances in foreign currency, thus overshooting inflation by 5 percentage points. Starting from a higher (lower) dollarization ratio, overshooting would be lower (higher) than the excess of inflation over domestic money growth.[16]

In reality, foreign currency holdings cannot adjust instantly to desired levels, nor do they remain constant over time. Overall money velocity increases when inflation accelerates, even though it tends to return to its normal level with a lag as additional foreign currency is acquired. The overshooting exchange rate ensures that part of foreign exchange earnings and other foreign exchange proceeds (such as the sale of foreign assets) are sold on the local money market, and retained to supplement domestic currency holdings. The speed of this process depends not only on the scale of available foreign exchange earnings (relative to national income), but also on the scope for savings. Thus, the adjustment of foreign currency holdings will be gradual, depending on the share of income that can be allotted for rebuilding money balances. Seen in this light, the study of dollarization, overshooting, and changes in the dollarization rate is essentially an empirical exercise.

This simple framework does not provide a complete analysis of dollarization. Obviously, equation (10) above is not a reduced form, insofar as $MF\$$ is endogenous, while π^e depends on changes in local money supply and inflation. However, it highlights a *process* whereby inflation—and, in particular, expectations of higher inflation—breeds dollarization. Inferences on dollarization *levels* require specific assumptions regarding initial conditions (the starting rate of dollarization) and the adjustment mechanism for foreign currency holdings (the amount of savings that can be used to acquire foreign exchange, and thus supplement domestic currency holding).

B. Empirical Estimates

Money and Velocity in the Congo

The level of broad money in the Congo fell dramatically in the early 1990s (Figure 3—source data are summarized in Table 1). From an equivalent of about US$500 million, broad money declined to US$200 million in 1991–92 and US$100 million in 1994–96. With

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[16] Looking at the exchange rate in foreign currency terms ($e = 1 / XR$) would not be as convenient in this respect, as the rate of depreciation equivalent to a given rate of inflation is always lower (e.g., an increase in domestic prices by 100 percent is equivalent to a 50 percent depreciation).

inflation falling sharply in 1997, the stock of broad money rose somewhat and hovered in the vicinity of US$200 million, but did not recover to its previous level.

Figure 3. Broad Money
(*Local currency, in millions of U.S. dollars*) 1/

Source: See Table 1.
1/ Measured at the parallel market exchange rates for both currency notes and bank deposits (i.e., the estimates take into account the discount of bank deposits over currency).

Observed velocity in the Congo—based on the stock of domestic broad money only—rose to extraordinary high levels during the 1990s (Figure 4). From an already very high level of 17–18 in 1990, velocity surged to nearly 40 at end-1991 and 60–80 during 1994–96![17] The Congo's gross domestic product was estimated at about US$8.5 billion in 1990–91, and it fell gradually to less than US$6 billion at the end of the decade.[18] Even though the GDP estimates are subject to a large degree of errors, substantial revisions would not materially affect the picture of observed velocity.

Extraordinarily high levels of velocity are not credible or, rather, should be seen as a biased indicator of money demand. With broad money equivalent to US$500 million in 1990, per capita holdings of cash were on the order of US$14 (given the Congo's total population of 35 million), which would seem very low by international standards. By the mid-1990s, with the drop in the value of broad money (and the increase of population to 43 million), per

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[17] The spike observed in early 1994 presumably reflected in part data problems, as there are ground to suspect that a significant share of currency issue was not recorded by the central bank.

[18] GDP dollar estimates were computed on the basis of exchange rates at purchasing power parity (PPP), using relative GDP deflators with a 1985 base year. Monthly velocity was derived from geometric interpolations of annual GDP.

capita cash holdings had declined to US$2.50 only! Such small levels of cash holdings are obviously insufficient to fulfill the minimum requirements for transaction purposes, store of value, and reserves for contingencies. Thus, a very high velocity should be seen as an indication of extensive dollarization.
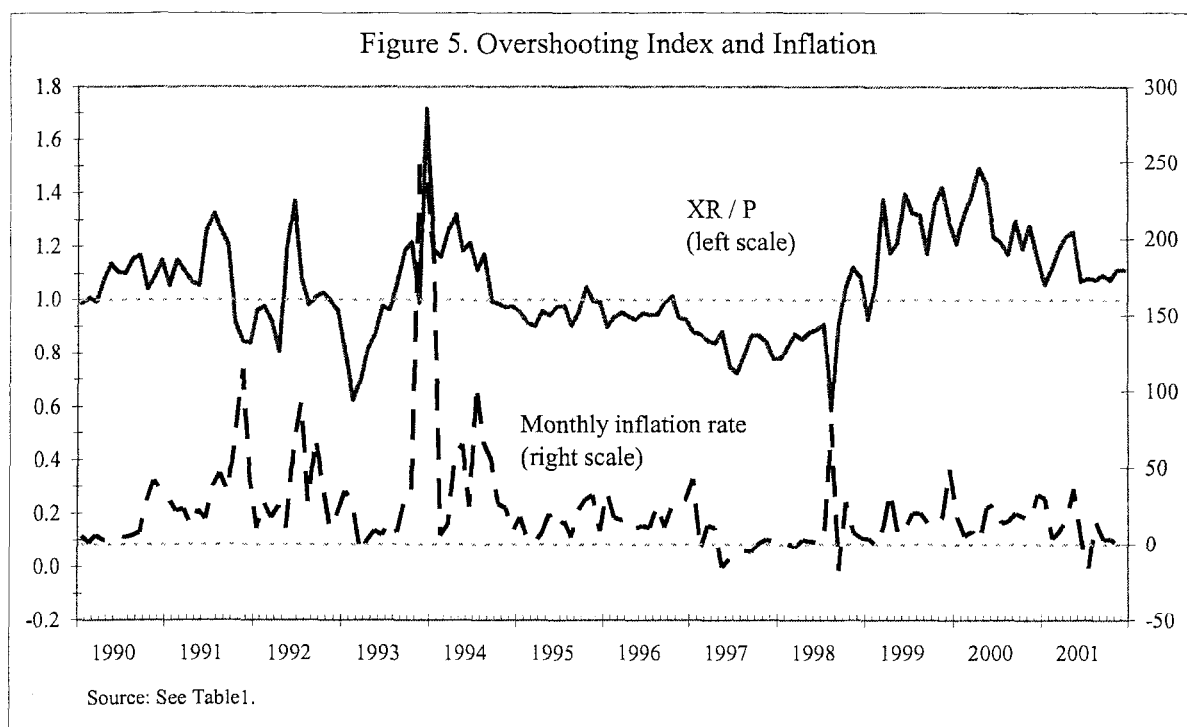

Figure 4. Velocity of Broad Money
(*Local currency only*)

Sources: Data from Table 1; IMF, *International Financial Statistics*; and staff estimates.

As indicated earlier, throughout the 1990s inflation and currency depreciation—measured in local currency terms—were of similar magnitudes (Figure 2 above). At the same time, however, the overshooting index often deviated significantly and durably from unity. While far from perfectly correlated, changes in the inflation rate and in the overshooting index were obviously closely related (Figure 5). As a rule, the depreciation of the exchange rate tended to exceed the rate of inflation whenever inflation accelerated, or was about to accelerate. In particular, the overshooting of the exchange rate clearly preceded the bouts of high inflation in late 1991, mid-1992, and late 1993. By contrast, the resumption of high inflation in August 1998 was not anticipated.[19] Thus, the changes in the overshooting index would seem a good indicator of the change in inflation expectations.[20]

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[19] The 12 months through July 1998 was a period of stabilization, which culminated with the successful currency reform in which zaïres and new zaïres were replaced by the Congo franc. Civil war resumed unexpectedly in early August 1998, when the authorities dismissed foreign military advisers from the army.

[20] Developments during the 1999–2001 period are somewhat puzzling, however. Inflation returned to relatively low levels, except for brief periods in December 1999, December 2000–January 2001, and May 2001, but the depreciation of the exchange rate continued to overshoot inflation by a wide margin (25–30 percent) for a long time. While this could reflect structural changes in the economy,

Figure 5. Overshooting Index and Inflation

Figure 5. Overshooting Index and Inflation

Source: See Table1.

Velocity in Sub-Saharan African Countries

Very high levels of money velocity are invariably associated with dollarization. Looking at a set of about 40 sub-Saharan African countries, and averaging data over 1990–2000, it is readily seen that velocity normally ranges from 2 to 6, with an average of about 4–5 (Figure 5; data are shown in Table 2). Velocity is plotted here against per capita income, on the general observation that velocity tends to decline as the standard of living increases (because a higher income level allows holding larger cash reserves; thus the velocity of M2 in the more advanced economies is commonly in the 2–3 range). Although the relationship between per capita income and velocity is not very close, it holds quite well overall.

High-velocity countries nearly always exhibit one or two special characteristics that explain why they do not conform to the standard pattern. These characteristics are (a) high inflation, and (b) a large mineral sector. High inflation naturally encourages currency substitution and results in a higher observed velocity—i.e., measured exclusively on the basis of domestic currency in circulation.[21] Large mineral sectors (e.g., petroleum, copper, or bauxite) explain why a substantial share of national income is not traded locally, or is traded in foreign

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the long-lasting overshooting of the exchange rate probably rather stemmed from persistently high inflation expectations, as the Congo's civil war turned into a stalemate.

[21] Insofar as broad money includes foreign currency deposits with local commercial banks, observed velocity may seem relatively low even in the presence of significant dollarization.

Figure 6. Velocity of Broad Money and Per Capita GDP in Sub-Saharan Africa 1/
(1990 – 2000 averages)

Sources: See Table 2.

1/ Excludes the Democratic Republic of the Congo, for which velocity exceeded the printable range, as well as Angola and Somalia, for which no consistent data were available.

currencies (notably gold and diamond). In such cases, estimates of "true" velocity would need to take into account the special factors that tend to reduce the use of domestic currency. Thus the high velocity in Guinea (10) reflected the large share of mining activities (some 25 percent of GDP and 90 percent of export earnings).[22] The level of velocity in the Central Africa CFA zone (CEMAC), which was significantly higher than in the Western Africa CFA zone (WAEMU), did not reflect high inflation—which remained generally low and about the same in the two zones—but rather the large weight of petroleum revenue, most of which has been managed through offshore accounts.[23]

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[22] Operators in Guinea have often suggested that overall currency circulation consisted of one-third only of Guinean francs, with the other two thirds comprising U.S. dollars and CFA francs.

[23] The trend line shown on Figure 6 gives only a rough indication of the relation between money velocity and per capita income. Rigorous estimates would require indications on the extent of dollarization due to a history of high inflation, as well as the computation of velocity on the basis of net national income (rather than gross domestic product), but the required data are not available.

Dollarization in the Congo

Given the low income level in the Congo (on the order of US$150 per capita), one could expect velocity of broad money to be about 6. With its significant mining sector (accounting for some 10 percent of GDP in 1990), velocity in the Congo was presumably somewhat higher. At any rate, a velocity of 7–8 would seem in the upper range of possible estimates. A baseline of 7.5 is chosen for 1990 (or $k = 0.133$); given national income estimated at US$8.6 billion, total money in circulation was on the order of US$1.15 billion in 1990, of which slightly less than half consisted of domestic currency. Thus, the dollarization ratio in 1990 was about 55 percent. (With an overall velocity assumed at 6, dollarization would have been as high as 66 percent in 1990.)

The rather high degree of dollarization in the Congo in 1990—that is, before the onset of hyperinflation—is not altogether surprising. Inflation had remained high throughout the 1980s, at an annual average of 55 percent. Even the 1970s had been a period of repressed inflation, marked by a growing real exchange rate appreciation, which ended with a large devaluation in September 1983 (78 percent in nominal effective terms). Moreover, as in other countries such as Angola, Sierra Leone, and Guinea, the purchase of "artisanal" diamond output against U.S. dollars resulted in a steady inflow of foreign currency notes and promoted currency substitution.

It should be noted that the stock of "dollars," totaling more than US$600 million in 1990, did not consist exclusively of currency notes in use in the Congo. Part of this stock was probably held in the form of bank deposits abroad and exchanged between domestic operators (even though such transactions were generally banned by the central bank). Indeed, some 10 commercial banks remained in operation in the Congo during the 1990s almost exclusively by brokering such transactions off their balance sheets (by contrast, traditional banking in domestic currency nearly disappeared). Nevertheless, the stock of foreign deposits holdings would be a poor proxy for dollarization in the Congo, as part of such deposits were rather kept as reserves for contingencies and did not serve transaction purposes.[24]

Changes in Dollarization

From late 1989 to early 1994, the amount of domestic money in circulation in the Congo fell from US$500 million to about US$100 million. Ceteris paribus, the amount of foreign currency had to increase by US$400 million, to reach about US$1 billion, in order to compensate for this drop—in which case the rate of dollarization would have surged from 55 percent to more than 90 percent. In the meantime, however, GDP had fallen by more than 20 percent in U.S. dollar terms and overall velocity presumably increased to some extent.

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[24] Data from the Bank for International Settlements show total deposits of Congo residents of US$1.7 billion at end-1990, declining almost steadily thereafter to about US$0.8 billion in the late 1990s. This drop probably contributed to fueling dollarization in the form of currency notes circulating in the Congo.

Dollarization is not directly observable, but the overshooting index provides a proxy for measuring the extent of changes in foreign currency holdings. The desired amount of foreign currency can be derived from the overall money demand:

$$MF\$^D = k\,Y\$ - ML\$ \tag{12}$$

We also know that the demand for foreign currency is related to the overshooting index (or its inverse, the undershooting index) and inflation expectations (see equations (9) and (10) above):

$$MF\$^D = \frac{P}{XR}\left(k\,y - \frac{h\,y}{1+\pi^e} \right) \tag{13}$$

If there were no over- or undershooting ($XR\,/\,P = 1$), $MF\$^D$ would depend solely on the elements within the parenthesis in equation (13). It follows that the undershooting index ($P\,/\,XR$) can be seen as an indicator of the proportion by which $MF\$$ falls short of $MF\$^D$. For example, if the exchange rate overshoots inflation by 10 percent, foreign currency holdings are likely to be some 10 percent below the desired level.[25]

Any attempt to use this approach to estimate changes in dollarization faces two problems, however. First, the choice of a base period for the overshooting index is critical, and could result in biased estimates of foreign currency holdings. To avoid measuring the overshooting index relative to an arbitrary base period, a six-monthly moving base is adopted.[26] Second, the implied changes in the amount of foreign currency holdings at times of rapid inflation and currency depreciation appear excessively large (up to US$200–300 million per month, which would represent about one-half of monthly income), considering the potential savings in a country like the Congo. In order to smooth the estimates of foreign currency holdings, the monthly change is bound by an amount equivalent to 2.5 percent of monthly income (about US$15 million per month).[27]

To sum up, dollarization in the Congo is estimated using the following procedure (with time $t = 0$ for December 1989):

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[25] More accurately, foreign currency holdings would fall short of the desired level by 9.1 percent. However, this statement is not fully correct because $MF\$^D$ depends on π^e, which itself is related to changes in the rate of inflation.

[26] Various alternatives yield broadly similar results—although the variance in the foreign currency holdings estimates tends to decrease as the time horizon increases. In a high-inflation context, the relevant time horizon is likely to be in the range of 3–6 months.

[27] The assumptions used are the result of an arbitrary choice among various experiments, and are designed to provide a credible picture ("stylized facts"), rather than a description of a reality that cannot be directly observed.

$V_0 = 7.5$, equivalent to $k = 0.133$;

$$MF\$_t = MF\$_t^D \ \frac{P_t / P_{t-6}}{XR_t / XR_{t-6}} \ , \text{ subject to } abs\left(MF\$_t - MF\$_{t-1}\right) \ \leq \ 0.025 \ Y\$_t.$$

The resulting estimates of foreign currency holdings, together with domestic currency holdings, are shown in Figure 7. (The light dotted line shows the direct estimate of $MF\$$, without setting a limit on its monthly change.) From about US$600 million, foreign currency holdings rose to US$800 million in early 1992, before falling to some US$650 million in 1992; they resumed an upward trend during 1994–96, peaking at more than US$800 million in early 1997, and subsequently declined to hover at US$500–600 million during 1999–2001.

Figure 7. Currencies in Circulation
(*In millions of U.S. dollars*)

Source: Staff calculations, based on data in Table 1.
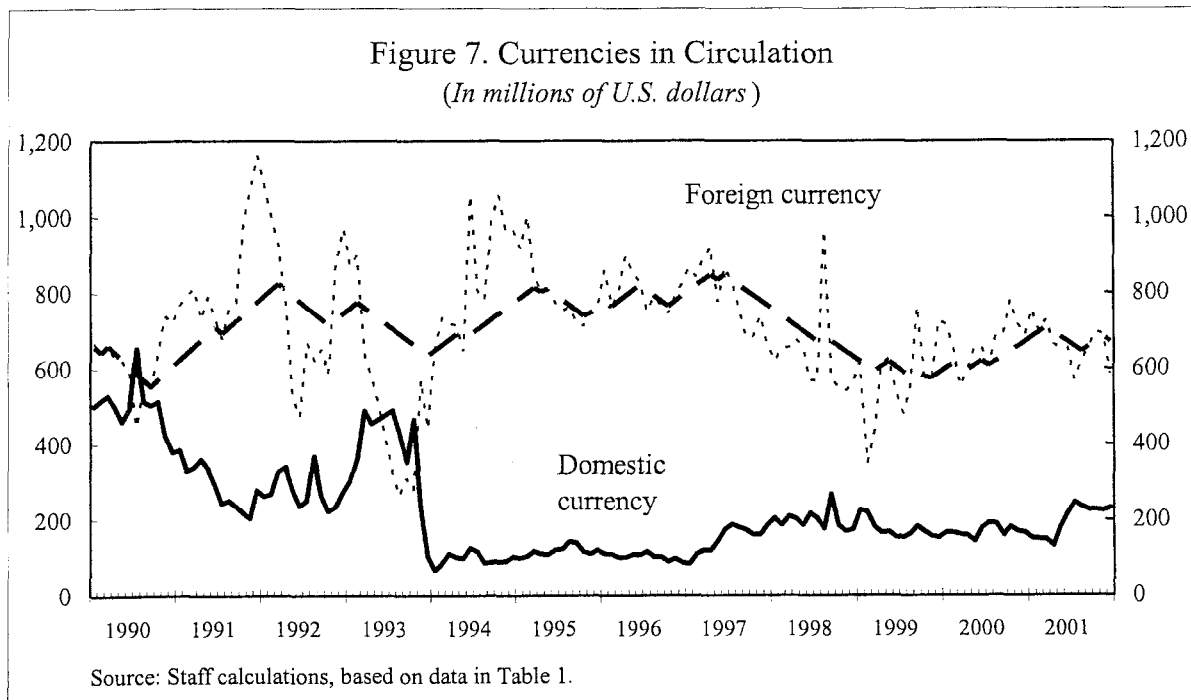
The dollarization ratio corresponding to these estimates is shown in Figure 8, and overall velocity in Figure 9. From about 55 percent, dollarization rose sharply to reach 80 percent in late 1991, and fell slightly in the following two years. With the failed currency exchange of October 1993, inflation surged to record levels and dollarization rocketed to 90 percent, a level that remained broadly constant until early 1997. Although inflation decelerated sharply in 1997 and stayed subsequently much lower than in the early part of the 1990s, dollarization did not return to its earlier level but hovered at 75–80 percent during 1998–2000. The sharp disinflation recorded in 2001 appears to have translated into a further decline of dollarization to about 75 percent. Overall velocity fluctuated sharply during this period, even though it returned to its long-term assumed value of 7.5 with a long lag.

Figure 8. Dollarization Ratio
(*In percent*)
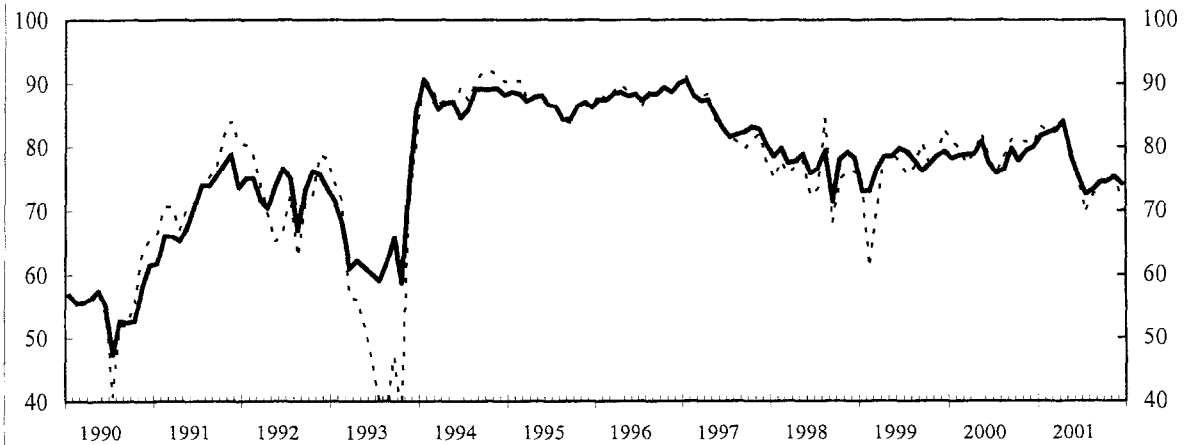
Source: Staff calculations, based on data in Table 1.

Figure 9. Aggregate Velocity
(*Local currency and dollars*)
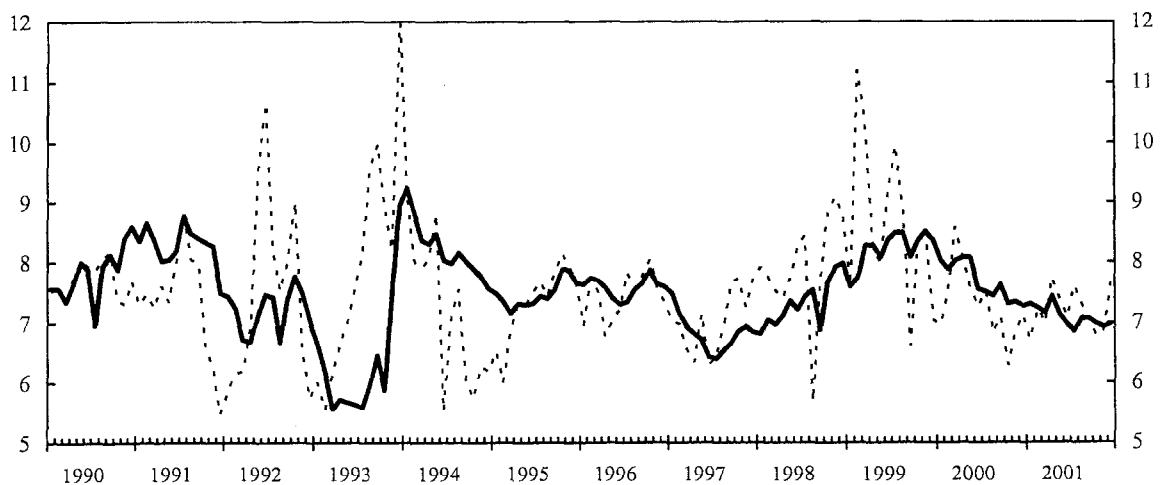
Source: Staff calculations, based on data in Table 1.

The estimates of dollarization in the Congo during the 1990s should be seen as illustrative. Since the amount of dollars in circulation cannot be observed directly, its level and change over time must be gauged through empirical methods that involve various shortcuts and heroic assumptions. Nevertheless, these estimates seem to confirm the relevance of the overshooting index as proxy for measuring changes in foreign currency holdings, and thus a basis to assess changes in dollarization.

An interesting feature of the quantitative results for the Congo is the rapid increase in dollarization after the onset of hyperinflation, and its persistently high level even after several years of disinflation. In the aftermath of the calamitous currency exchange of October 1993 and the period of disorderly currency issue in 1994, the Congo found a measure of stability during 1995–96. In particular, inflation slowed sharply during the first half of 1995, which showed that there was little inertia in the hyperinflation experienced during 1993–94. Yet, the level of foreign currency holdings did not fall back, which is consistent with the notion of "hysteresis" often associated with dollarization.

III. Concluding Remarks

Exchange rate overshooting and dollarization were closely related phenomena in the Congo during the 1990s. As a rule, whenever inflation accelerated or was about to accelerate, the Congolese endeavored to switch out of domestic currency and into dollar currency holdings in order to protect their cash balances. The increased demand for dollars invariably translated into a higher relative price, or greater depreciation, of the domestic currency, which is the essence of exchange rate overshooting. At such time, the premium attached to foreign currency holdings enticed economic operators to retain or save export earnings in order to supplement money circulation. In demand terms, they were thus switching away from goods toward foreign currency—hence the higher price of dollars compared with goods.

Insofar as exchange rate overshooting is associated with dollarization, its explanation does not depend on any assumption of price rigidity, as in the famous Dornbusch model. On the contrary, experience in the Congo suggests that both prices and the exchange rate (on the parallel market) did adjust speedily to changes in the money supply. On average, inflation and exchange rate depreciation were of the same magnitude, but the amplitude of movements in the exchange rate was significantly larger. The wider fluctuations in the depreciation of the exchange rate were a signal of the desire to increase (or, at times, to decrease) foreign currency holdings.

The model developed in this paper remains crude in many respects. It uses a simple formulation for domestic money demand (based on the 1956 Cagan model) and assumes that overall money demand (for both domestic and foreign currency) exhibits a constant velocity. Nevertheless, the resulting estimate of dollarization based on the overshooting ratio provides a credible picture for the Congo in the 1990s. Refinements in the model could undoubtedly provide more reliable estimates, as well as lay the basis for an indirect measure of inflation expectations.[28]

While increased dollarization in the face of expectations of higher inflation may explain exchange rate overshooting in the Congo during the 1990s, such a pattern may not be directly

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[28] Conversely, a formal specification for inflation expectations could also form the basis for alternative estimates of dollarization.

relevant for countries with different circumstances. The vast literature on exchange rate overshooting contains many alternative explanations, which are not necessarily exclusive or mutually incompatible.[29] Nevertheless, while few countries use foreign currencies to any significant extent, similar phenomena may well be at play under diverse conditions. In a broad sense, the notion of "overshooting" refers to the fact that the prices of various assets, goods, and services do not move pari passu with the general price index, as one might assume casually. When inflation accelerates, or is expected to accelerate, the relative demand for various assets, goods, and services will change—people may switch away from "zaïres" into "dollars," but they may also spend less on goods and more on real estate, precious metals, or securities. Under such circumstances, the change in relative prices (such as the overshooting or undershooting of the exchange rate) provides a signal that some readjustment is under way and ensures that resources are reallocated accordingly.

For the Congo, estimating the amount of foreign currency in circulation is more than an academic exercise. With a dollarization ratio of up to 90 percent in the mid-1990s, and a persistently high ratio of 75 percent in 2001, the scope for using domestic monetary policy instruments has clearly been very limited. In order to regain control over monetary policy, the authorities would need to pursue vigorously anti-inflation policies in order to restore their credibility.[30] This would translate into expectations of lower inflation, which can be assessed to some extent by analyzing changes in the overshooting ratio. However, the Congo's experience in the 1990s suggests that regaining credibility and reducing dollarization substantially is likely to be challenging and may require many years of rigorous financial policies.

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[29] The explanations listed in Cavallo et al. (2002) include uncertainty about future monetary policy, liquidity run and crunch in the immediate aftermath of a shock, large external imbalances, a sudden stop or reversal of capital inflows, terms of trade shocks, boom/bust cycles in bank credit, and—more generally—banking crises. The authors note that "these alternative explanations of overshooting and output contraction are not necessarily inconsistent with the balance sheet effects that we stress in this paper."

[30] Various aspects of dollarization are reviewed in Berg (2002), which contains extensive references to research work by IMF staff on the topic.

Table 1. Democratic Republic of the Congo: Database

	Exchange rate[1]	Exchange rate index	Consumer price index	Currency outside banks	Broad money	Broad money (In millions of
		(December 1989 = 1)		(In domestic currency)[2]		U.S. dollars)[3]
Dec 89	493.0	1.000	1.000	153.1	273.6	555.0
Jan 90	512.8	1.040	1.055	141.4	256.4	500.1
Feb 90	529.1	1.073	1.064	154.2	272.7	515.5
Mar 90	551.8	1.119	1.126	163.3	291.5	528.3
Apr 90	614.3	1.246	1.156	165.8	305.7	497.7
May 90	667.5	1.354	1.191	174.6	307.5	460.7
Jun 90	684.8	1.389	1.256	195.9	338.2	493.9
Jul 90	713.5	1.447	1.314	308.7	466.0	653.2
Aug 90	791.5	1.605	1.389	232.9	405.9	512.8
Sep 90	863.1	1.751	1.500	247.9	433.9	502.8
Oct 90	983.5	1.995	1.910	268.7	503.7	512.2
Nov 90	1,456.9	2.955	2.711	343.8	616.9	423.4
Dec 90	2,066.3	4.191	3.650	427.1	784.6	379.7
Jan 91	2,468.8	5.008	4.735	470.6	952.8	385.9
Feb 91	3,262.5	6.618	5.757	532.5	1,075.1	329.5
Mar 91	3,875.0	7.860	7.077	736.4	1,318.2	340.2
Apr 91	4,175.0	8.469	7.926	927.7	1,506.0	360.7
May 91	5,050.0	10.243	9.690	1,052.5	1,698.4	336.3
Jun 91	7,000.0	14.199	11.290	1,549.5	2,074.8	296.4
Jul 91	10,200.0	20.690	15.614	1,756.5	2,493.9	244.5
Aug 91	14,250.0	28.905	22.911	2,567.2	3,589.3	251.9
Sep 91	18,250.0	37.018	30.741	2,919.8	4,332.2	237.4
Oct 91	23,250.0	47.160	51.533	4,843.6	5,149.7	221.5
Nov 91	46,000.0	93.306	110.365	8,149.9	9,413.7	204.6
Dec 91	65,250.0	132.353	157.959	10,845.4	18,282.2	280.2
Jan 92	82,500	167.34	174.07	11,627.9	21,814.0	264.4
Feb 92	106,250	215.52	221.28	13,955.2	28,661.0	269.8
Mar 92	117,500	238.34	259.21	18,263.3	38,583.9	328.4
Apr 92	128,500	260.65	323.18	23,887.5	53,762.0	340.9
May 92	209,750	425.46	356.14	32,275.0	74,699.0	280.3
Jun 92	392,500	796.15	581.58	54,656.9	119,548.4	238.5
Jul 92	595,000	1,206.90	1,117.80	95,476.5	190,017.0	253.2
Aug 92	687,500	1,394.52	1,422.74	134,665.0	346,278.0	369.0
Sep 92	1,192,500	2,418.86	2,394.47	191,124.4	422,451.0	267.0
Oct 92	1,712,500	3,473.63	3,373.81	248,931.0	495,838.0	224.0
Nov 92	1,825,000	3,701.83	3,728.06	280,818.7	557,637.0	236.0
Dec 92	2,112,500	4,284.99	4,469.95	364,297.3	770,719.6	273.2
Jan 93	2,350,000	4,766.7	6,012.1	440,548.2	965,644.0	304.0
Feb 93	2,337,500	4,741.4	7,599.3	479,845.4	1,187,421.0	361.5

Table 1. Democratic Republic of the Congo: Database

	Exchange rate[1]	Exchange rate index	Consumer price index	Currency outside banks	Broad money	Broad money (*In millions of U.S. dollars*)[3]
		(*December 1989 = 1*)		(*In domestic currency*)[2]		
Mar 93	2,462,500	4,994.9	7,181.3	520,946.3	1,846,043.0	488.3
Apr 93	2,975,000	6,034.5	7,375.2	697,942.1	1,983,853.0	454.4
May 93	3,450,000	6,998.0	8,031.6	782,485.7	2,418,640.0	465.9
Jun 93	4,100,000	8,316.4	8,529.6	846,304.0	3,060,948.0	477.3
Jul 93	4,650,000	9,432.0	9,791.9	989,621.4	3,539,573.0	488.7
Aug 93	5,625,000	11,409.7	10,575.3	1,041,343.2	3,736,825.0	427.1
Sep 93	7,875,000	15,973.6	13,483.5	1,174,454.8	4,329,523.0	352.9
Oct 93	10,600,000	21,501.0	17,676.8	2,404,304.4	5,436,299.0	465.2
Nov 93	30,000,000	60,851.9	61,586.1	4,748,997.7	7,660,506.0	235.9
Dec 93	177,000,000	359,026.4	209,331.3	14,078,999.5	19,903,785.0	104.2
Jan 94	118.5	721,095	606,851	5.509	9.069	66.5
Feb 94	122.5	745,436	641,442	6.768	13.972	86.2
Mar 94	150.0	912,779	724,188	10.500	22.201	111.1
Apr 94	250.0	1,521,298	1,151,459	17.416	32.235	102.0
May 94	370.0	2,251,521	1,899,907	25.132	47.874	99.6
Jun 94	470.0	2,860,041	2,359,685	40.280	73.217	125.7
Jul 94	880.0	5,354,970	4,804,318	80.489	116.660	116.1
Aug 94	1,525.0	9,279,919	7,927,125	107.390	140.731	86.8
Sep 94	2,000.0	12,170,385	12,239,480	152.446	186.892	89.1
Oct 94	2,500.0	15,212,982	15,446,224	194.002	237.169	91.0
Nov 94	3,050.0	18,559,838	19,091,533	233.143	285.707	91.2
Dec 94	3,325.0	20,233,266	20,717,309	277.090	374.603	103.2
Jan 95	3,812.5	23,199,797	24,351,928	301.65	440.03	100.3
Feb 95	3,750.0	22,819,473	25,016,973	324.53	444.64	105.3
Mar 95	3,740.0	22,758,621	25,230,910	354.91	459.90	119.0
Apr 95	4,262.5	25,938,134	27,122,846	400.65	482.78	110.5
May 95	5,025.0	30,578,093	32,473,982	474.76	554.65	109.1
Jun 95	5,750.0	34,989,858	35,903,247	614.49	714.67	122.3
Jul 95	6,650.0	40,466,531	41,317,601	718.62	827.69	123.3
Aug 95	6,412.5	39,021,298	43,214,980	790.53	928.16	143.0
Sep 95	8,230.0	50,081,136	52,635,845	1,028.64	1,166.74	139.5
Oct 95	11,750.0	71,501,014	67,952,876	1,201.53	1,367.09	116.1
Nov 95	14,655.0	89,178,499	89,629,844	1,405.32	1,618.69	110.5
Dec 95	15,872.5	96,587,221	97,427,640	1,683.93	1,927.87	121.5
Jan 96	19,226	116,995,132	130,153,585	1,888.18	2,125.56	110.6
Feb 96	23,462	142,770,213	152,526,986	2,290.70	2,568.09	109.5
Mar 96	27,543	167,607,383	176,214,427	2,504.63	2,778.46	100.9
Apr 96	31,714	192,987,540	205,659,858	2,898.30	3,230.76	101.4
May 96	34,586	210,464,687	227,254,143	3,628.16	3,789.79	109.4
Jun 96	39,748	241,876,802	254,433,738	3,934.49	4,370.69	107.9

Table 1. Democratic Republic of the Congo: Database

	Exchange rate[1]	Exchange rate index	Consumer price index	Currency outside banks	Broad money	Broad money (*In millions of U.S. dollars*)[3]
		(December 1989 = 1)		*(In domestic currency)*[2]		
Jul 96	43,726	266,081,665	281,810,809	4,630.40	5,239.44	117.3
Aug 96	54,833	333,671,400	353,080,762	5,142.93	5,819.47	103.4
Sep 96	63,805	388,264,271	392,202,111	5,932.35	6,734.91	102.6
Oct 96	81,091	493,453,808	486,056,076	6,887.50	7,484.21	90.5
Nov 96	91,667	557,809,331	598,237,818	7,752.61	9,700.29	99.2
Dec 96	117,658	715,970,962	772,564,318	9,132.70	11,001.07	87.8
Jan 97	159,182	968,652,038	1,103,299,103	10,514.8	14,808.0	84.2
Feb 97	152,053	925,269,563	1,062,808,026	13,494.3	19,009.5	110.0
Mar 97	166,048	1,010,431,759	1,193,852,255	15,217.0	24,229.0	121.6
Apr 97	181,136	1,102,249,677	1,316,938,423	15,967.4	27,249.9	120.6
May 97	161,188	980,856,998	1,113,866,518	16,612.1	29,420.0	145.1
Jun 97	123,750	753,042,596	1,006,712,559	15,221.0	26,599.1	174.7
Jul 97	110,000	669,371,197	924,061,458	14,532.7	25,520.7	189.0
Aug 97	115,238	701,246,016	885,712,907	14,932.1	25,689.2	180.6
Sep 97	119,545	727,457,127	838,150,124	15,152.7	24,186.2	174.0
Oct 97	120,000	730,223,124	840,664,575	14,776.0	21,653.3	160.8
Nov 97	120,250	731,744,422	866,220,778	14,568.4	21,427.8	161.9
Dec 97	112,227	682,924,580	879,127,467	16,547.8	22,839.0	187.5
Jan 98	115,619	7.0356E+08	9.0480E+08	16,315.6	23,809.9	205.9
Feb 98	123,200	7.4970E+08	9.0661E+08	15,282.0	23,061.2	187.2
Mar 98	127,364	7.7503E+08	8.8938E+08	18,055.1	26,811.4	210.5
Apr 98	128,091	7.7946E+08	9.1428E+08	18,049.3	26,162.5	204.2
May 98	134,571	8.1889E+08	9.3166E+08	17,915.0	25,191.1	187.2
Jun 98	137,682	8.3782E+08	9.4284E+08	21,941.7	30,092.4	218.6
Jul 98	146,000	8.8844E+08	9.7772E+08	21,341.0	29,949.0	205.1
Aug 98	169,048	1.0287E+09	1.7452E+09	21,341.0	29,949.0	177.2
Sep 98	212,955	1.2959E+09	1.4416E+09	47,448.4	57,376.2	269.4
Oct 98	317,273	1.9307E+09	1.8351E+09	49,170.8	58,813.5	185.4
Nov 98	364,286	2.2167E+09	1.9746E+09	50,577.1	61,948.4	170.1
Dec 98	367,826	2.2383E+09	2.0595E+09	51,607.2	64,433.0	175.2
Jan 99	3.250	1.9777E+09	2.1336E+09	590.44	739.78	227.6
Feb 99	3.700	2.2515E+09	2.1123E+09	669.18	822.38	222.3
Mar 99	5.300	3.2252E+09	2.3446E+09	794.71	961.33	181.4
Apr 99	6.100	3.7120E+09	3.1489E+09	819.67	1,011.61	165.8
May 99	6.650	4.0467E+09	3.3346E+09	933.55	1,122.51	168.8
Jun 99	8.500	5.1724E+09	3.7014E+09	1,101.01	1,306.12	153.7
Jul 99	9.700	5.9026E+09	4.4491E+09	1,276.20	1,502.97	154.9
Aug 99	11.600	7.0588E+09	5.3568E+09	1,656.44	1,908.07	164.5
Sep 99	11.750	7.1501E+09	6.0960E+09	1,869.95	2,166.70	184.4
Oct 99	15.250	9.2799E+09	6.8275E+09	2,189.96	2,583.85	169.4

Table 1. Democratic Republic of the Congo: Database

	Exchange rate[1]	Exchange rate index	Consumer price index	Currency outside banks	Broad money	Broad money (*In millions of*
		(December 1989 = 1)		*(In domestic currency)[2]*		*U.S. dollars)[3]*
Nov 99	18.750	1.1410E+10	8.0360E+09	2,459.11	2,940.45	156.8
Dec 99	25.500	1.5517E+10	1.2014E+10	2,944.50	3,915.27	153.5
Jan 00	28.119	1.7111E+10	1.4116E+10	3,204.0	4,713.2	167.6
Feb 00	32.369	1.9697E+10	1.4893E+10	3,804.6	5,380.2	166.2
Mar 00	36.924	2.2469E+10	1.6173E+10	4,326.3	5,958.1	161.4
Apr 00	40.600	2.4706E+10	1.6562E+10	4,690.3	6,452.4	158.9
May 00	48.250	2.9361E+10	2.0470E+10	5,069.9	6,913.0	143.3
Jun 00	52.477	3.1933E+10	2.5813E+10	5,929.2	9,407.2	179.3
Jul 00	58.738	3.5743E+10	2.9426E+10	7,528.6	11,361.2	193.4
Aug 00	65.217	3.9686E+10	3.3870E+10	8,187.9	12,407.0	190.2
Sep 00	86.833	5.2840E+10	4.0779E+10	9,720.9	13,925.0	160.4
Oct 00	94.182	5.7311E+10	4.8079E+10	10,050.2	17,256.3	183.2
Nov 00	117.500	7.1501E+10	5.5868E+10	12,617.9	19,987.7	170.1
Dec 00	141.000	8.5801E+10	7.3969E+10	15,962.8	23,558.1	167.1
Jan 01	167.500	1.0193E+11	9.5937E+10	17,756.4	25,520.1	152.4
Feb 01	182.500	1.1105E+11	9.9199E+10	19,639.8	27,402.5	150.2
Mar 01	210.000	1.2779E+11	1.0753E+11	21,853.3	31,332.8	149.2
Apr 01	252.900	1.5389E+11	1.2441E+11	24,815.0	33,428.9	132.2
May 01	349.300	2.1256E+11	1.6958E+11	26,482.6	63,747.1	182.5
Jun 01	305.900	1.8615E+11	1.7331E+11	29,764.6	66,757.0	218.2
Jul 01	259.210	1.5773E+11	1.4558E+11	30,527.1	64,179.7	247.6
Aug 01	295.700	1.7994E+11	1.6698E+11	30,672.4	69,811.3	236.1
Sep 01	310.000	1.8864E+11	1.7215E+11	29,950.7	70,251.1	226.6
Oct 01	315.000	1.9168E+11	1.7784E+11	29,796.0	71,770.3	227.8
Nov 01	325.000	1.9777E+11	1.7748E+11	28,708.5	72,906.1	224.3
Dec 01	326.625	1.9876E+11	1.7837E+11	30,476.7	76,202.0	233.3

Sources: Data provided by the Congolese authorities; and IMF staff estimates.

[1] Monthly average parallel market rate, in terms of U.S. dollars—zaïres through 1993, new zaïres from 1994 through December 1998, and Congo francs from January 1999 onward. The new zaïre was introduced in October 1993, at a parity of NZ 1 = Z 3,000,000; the Congo franc was introduced in July 1998, at a parity of NZ 100,000 = CGF 1.

[2] In billions of zaïres through 1993, billions of new zaïres for 1994–98, millions of Congo francs from 1999 onward. Broad money excludes foreign currency deposits.

[3] Converted at the parallel market exchange rates for currency notes and bank deposits.

Table 2. Average Per Capita Income and Velocity in Sub-Saharan Africa, 1990–2000 [1]

(*Per capita income in SDRs*)

Country	Income	Velocity	Country	Income	Velocity
Benin	534	3.3	Malawi	271	4.8
Botswana	4,057	3.2	Mali	349	3.6
Burkina Faso	348	3.6	Mauritania	493	4.6
Burundi	228	4.5	Mauritius	4,658	1.2
Cameroon	1,060	5.1	Mozambique	213	3.8
Cape Verde	1,596	1.3	Niger	308	6.6
Central African Rep.	490	4.5	Nigeria	957	4.8
Chad	321	6.3	Rwanda	398	5.9
Comoros	531	4.0	Senegal	816	3.5
Republic of Congo	1,332	5.1	Seychelles	9,401	1.6
Côte d'Ivoire	1,037	3.1	Sierra Leone	260	7.2
Djibouti	1,224	1.2	South Africa	4,645	1.8
Equatorial Guinea	1,221	11.5	Sudan	437	7.1
Ethiopia	142	2.1	Swaziland	1,824	3.0
Gabon	6,691	5.2	Tanzania	290	5.0
Gambia	467	3.3	Togo	483	2.8
Ghana	394	7.4	Uganda	222	14.6
Guinea	648	9.9	Zambia	409	9.1
Kenya	440	2.2	Zimbabwe	830	4.0
Lesotho	624	2.6			
Liberia	795	5.7	CEMAC [2]	1,048	5.1
Madagascar	344	4.5	WAEMU [2]	614	3.5

Sources: Data compiled from International Monetary Fund, *International Financial Statistics* (IFS) and *World Economic Outlook* (WEO) databases.

[1] Velocity derived on the basis of five-quarter average broad money and nominal GDP.
[2] The CEMAC (Central Africa Economic and Monetary Community) is comprised of Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea, and Gabon. The WAEMU (West African Economic and Monetary Union) is comprised of Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal, and Togo. Estimates for individual countries in the CEMAC and WAEMU currency zones are inherently unreliable because of severe measurement problems.

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