

IMF Working Paper

© 1997 International Monetary Fund

This is a *Working Paper* and the author would welcome any comments on the present text. Citations should refer to a *Working Paper of the International Monetary Fund*. The views expressed are those of the author and do not necessarily represent those of the Fund.

WP/97/50

INTERNATIONAL MONETARY FUND

African Department

Zaire's Hyperinflation, 1990-96

Prepared by Philippe Beaugrand *

Authorized for distribution by Paul A. Acquah

April 1997

Abstract

This paper reviews Zaire's experience with hyperinflation during 1990-96 and develops an illustrative model based on a money demand function that includes government revenue as a determinant. Government revenue is itself subject to the "Tanzi effect," in which inflation tends to lower revenue collections. The model is estimated over the 1990-96 period, and simulations are also presented. The paper concludes with a number of observations and policy recommendations for stopping hyperinflation in Zaire.

JEL Classification Numbers: E31, E37, E41

Author's E-Mail Address: PBeaugrand@IMF.org

*The author would like to thank Paul A. Acquah, David T. Coe, Pierre Dhonte, Michel Galy, Enrique Gelbard, Michael T. Hadjimichael, Jean-Claude Nachege, Frederick Ribe, and Norbert Toé for comments on earlier versions of this paper. The usual disclaimer applies.

Contents

	Page
I. Introduction	1
II. From High Inflation to Hyperinflation	1
A. The Genesis of Hyperinflation	2
B. Economic Tailspin, 1992-93	4
C. Steady Hyperinflation, 1994-96	6
III. Money Supply and Demand, and the Tanzi Effect	10
A. Money Supply and Demand	11
B. The Tanzi Effect	12
C. Modeling the Hyperinflation Process	13
IV. Econometric Estimates	16
A. Government Nonmining Revenue	17
B. The Price Equation	19
V. Simulations	21
VI. Stopping Hyperinflation	23
 Figures	
Figure 1. Zaïre—Exchange Rate and Price Developments	26
Figure 2. Zaïre—Selected Economic and Financial Indicators	27
Figure 3. Model Estimates	28
Figure 4. Recursive Estimates of Coefficients	29
Figure 5. Model Simulations	30
 Tables	
Table 1. Zaïre—Basic Data	31
Table 2. Simulations of Model	33
Appendix: Database	37
References	39

SUMMARY

Since 1990, Zaïre has experienced an extraordinary period of very high inflation—among the longest on record. From 56 percent in 1989, the annual increase in consumer prices surged to 256 percent in 1990, 2,500-4,500 percent during 1991-93, and 10,000 percent in 1994, before returning to 370 percent in 1995 and 657 percent in 1996.

The roots of hyperinflation in Zaïre were essentially political, as the collapse of the traditional form of government was accompanied by an explosion in government spending and dwindling revenue collections. During 1991-92, opposition forces derailed the gradual liberalization process laid out by the President, and by 1993 Zaïre's political system had all but disintegrated. A measure of control over monetary and fiscal policies was restored in 1995, but in late 1996, political conditions further deteriorated and inflationary pressures reemerged.

To analyze the dynamics of hyperinflation in Zaïre, this paper develops a formal illustrative model, which consists of three building blocks: money supply is exclusively the counterpart of government deficit financing; money demand is based on the traditional Cagan formulation, but also includes nonmining government revenue as a determinant; and, in turn, nonmining government revenue is subject to the "Tanzi effect," whereby inflation erodes real revenue collections. The model is estimated for 1990-96, and the dynamics of hyperinflation are analyzed through a series of simulations.

The paper highlights the difficulty of halting hyperinflation in Zaïre, as this requires addressing its fundamental causes. There are three key steps: find a solution to the prolonged political stalemate; halt currency issue completely and abruptly; and raise sufficient revenue to fund core government outlays. These requirements would involve changing the way fiscal and monetary policy are conducted, which in turn argues in favor of adopting a restrictive arrangement that precludes the government's access to monetary financing.

I. INTRODUCTION

For many years, high inflation was the norm in Zaïre. Beginning in 1990, as the country entered a protracted period of political transition, the authorities lost control over economic and financial developments, and inflation reached extraordinarily high levels. From about 56 percent in 1989, the annual increase in consumer prices rose to 256 percent in 1990, and reached nearly 10,000 percent in 1994 (Table 1).¹ Since then, inflation has come down markedly, to 370 percent in 1995, but it rose to 657 percent in 1996. During this period, the zaïre exchange rate and consumer prices moved in close relationship (Figure 1).

Zaïre's hyperinflation experience in the 1990s is typical in many respects. The country's predicament was brought about by a prolonged political crisis, which led to an explosion of government spending financed almost entirely by printing currency, an extended period of very high inflation, and a dramatic contraction of external trade and output (Figure 2). The case is also relatively simple to analyze, insofar as Zaïre's financial system has remained largely underdeveloped—without any market for government bonds, in particular. At the same time, financial developments in Zaïre have been well documented, principally through the regular publication of statistics by the Bank of Zaïre in its *Annual Report*, *Monthly Bulletin of Statistics*, and *Weekly Statistical Summary*. Zaïre thus offers an opportunity for policy analysts and researchers to study the causes and consequences of prolonged hyperinflation in an environment characterized by rudimentary financial institutions, over an unusually long period.

This paper is organized as follows. Section II reviews developments in Zaïre during 1990-96; Section III presents an illustrative model of hyperinflation based on three building blocks, namely money supply and demand, and a government revenue equation; the model is estimated in Section IV, and simulations are discussed in Section V; finally, Section VI presents some conclusions and policy recommendations for stopping hyperinflation.

II. FROM HIGH INFLATION TO HYPERINFLATION

In the 1970s, Zaïre's currency—the zaïre—was pegged to the SDR. Under the fixed peg, supported by trade restrictions, expansionary financial policies yielded high inflation and a steady appreciation of the currency in real effective terms. The SDR peg was abandoned in September 1983, with a sharp devaluation of the currency (78 percent in nominal effective terms) and the introduction of a market-determined exchange rate system. However, the authorities interfered recurrently with the operation of the new system, and there was a thriving parallel market for foreign exchange. Annual inflation averaged 62 percent in the second half of the 1970s, 44 percent in the first half of the 1980s, and 69 percent in the second half of the 1980s. Throughout the 1980s, the velocity of circulation of money in Zaïre remained very high

¹Throughout this paper, inflation is measured on an end-of-period basis (December over December, in the case of annual inflation rates).

(albeit lower than in the 1970s), which testified to the widespread use of foreign currency for domestic transactions.²

In 1990, Zaïre entered a protracted period of political transition, and inflation accelerated to 265 percent. During 1991-94, the political and economic situations worsened in parallel: as the one-party state crumbled, inflation surged to 3,000-4,500 percent in 1991-93, and 9,800 percent in 1994 (or nearly 50 percent a month on average). By end-1993, the traditional forms of government had ceased operating, and monthly inflation peaked at 225 percent during November 1993-January 1994. Over the 12 months ending in September 1994, broad money growth was 12,850 percent; currency depreciation, 99.9 percent; and annual inflation reached a record 90,000 percent.³ Inflation slowed markedly in 1995, to 370 percent, but rose to 657 percent in 1996, thus remaining in the vicinity of hyperinflation levels.⁴

A. The Genesis of Hyperinflation

A series of events in 1990 set the stage for the gradual disintegration of the political system and the loss of control over economic and financial management. First, on April 24, 1990, President Mobutu announced an upcoming process of democratization and the establishment of a multi-party system within a 12-month period. Second, political opposition gathered forces and organized widespread demonstrations to demand an acceleration of the democratization process. Third, with a view to appeasing demonstrators, the authorities awarded unsustainably large increases in government wages. And, fourth, the government's financial difficulties were compounded by a drop in mining sector revenue.

²Developments in the 1980s and the early 1990s are reviewed in IMF [1996a].

³In other words, prices increased by a factor of 900 in the 12-month period through September 1994, thus exceeding the record set in recent times by Nicaragua (640, in March 1991). Historically, the most severe episode of hyperinflation was recorded in Hungary during 1945-46, with prices increasing by a factor of 3.8×10^{27} over a 12-month period (see Cagan [1956], p. 26).

⁴Following Cagan's classic study [1956], hyperinflation is commonly defined as beginning the month when the 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, Zaïre's hyperinflation began in October 1991 and ended in September 1994. Throughout this paper, however, "hyperinflation" is used less rigorously, to apply broadly to the full 1990-96 period. An alternative definition fitted to Zaïre's case would rely on a threshold monthly inflation rate of 20 percent on average over three months (equivalent to a 73 percent quarterly inflation rate, and nearly 8,000 percent on an annual basis); based on this criterion, Zaïre's hyperinflation began in November 1990 and is not over yet, as the three-month inflation rate was 88 percent at end-1996.

In late 1989, Zaïre was swept by the winds of democratization that arose in the wake of the collapse of the former Soviet bloc. As a means to quell domestic dissent and foreign criticism, President Mobutu announced a forthcoming revision of the constitution, and the organization of multiparty elections. A new government was named to conduct the transition and address worsening economic conditions, but political parties were not liberalized, pending an unspecified selection process that would limit the number of political parties to three, to avoid stirring up ethnic tensions. Even though the opposition leader, Mr. Tshisekedi, was released from house arrest, demonstrations by his supporters were violently suppressed. On May 11, 1990, security forces cracked down on protesting students in the southern city of Lubumbashi (capital of the Shaba province, formerly known as Katanga), with a death toll of perhaps 100. Zaïre's refusal to allow an independent inquiry into the massacre of Lubumbashi ultimately led to the suspension of most external aid.⁵

Faced with growing discontent, the authorities granted government employees large wage increases that nearly trebled the wage bill by October 1990 relative to the 1989 average. At the same time, government revenue began falling, reflecting a drop in mining taxes and dividends. Total government revenue fell from the equivalent of US\$900 million in 1989 to less than US\$800 million in 1990, wholly as a result of lower tax and royalty payments from the main copper mining concern, Gécamines (Générale des Carrières et des Mines). In turn, Gécamines' difficulties stemmed partly from declining world market prices, but above all from a 12 percent fall in copper output resulting from a cave-in at a major mining site (Kamoto).

Overall, the government deficit on a commitment basis increased sharply in 1990, to the equivalent of US\$1.1 billion (13.1 percent of GDP), compared with US\$0.8 billion in 1989 (9.3 percent of GDP). Apart from the buildup of external payments arrears, and excluding the disbursement of project assistance, the deficit was entirely financed by the domestic banking system. Domestic bank financing covered half of nondebt government expenditure in 1990, and accounted for the bulk of the 187 percent increase in broad money. By late 1990, inflation and currency depreciation reached monthly rates in excess of 40 percent.

In December 1990, the government allowed the establishment of political parties and lifted controls over the press. Demonstrations by the opposition and fierce repression by security forces continued in the spring of 1991. Under the circumstances, the authorities were not in a position to organize national elections; instead, the President convened a national conference, to draft a new constitution and prepare the ground for legislative elections. When it opened, on August 7, 1991, the national conference had about 2,800 participants, representing 225 political groups. Soon, however, the opposition called for a boycott, and President Mobutu suspended the national conference on August 15, 1991. In the midst of a worsening economic and financial situation, a mutiny erupted in September 1991 in the army, with demands for higher wages and the payment of back pay. As the mutiny generalized into widespread looting

⁵For detailed information on political developments through end-1993, see Meditz and Merrill [1994].

throughout the country, Belgium and France organized the evacuation of some 10,000 expatriates, who in most cases had to abandon their businesses and properties. The outbreak of violence and large-scale looting resulted in extensive destruction of basic infrastructures, which accelerated the fall in economic activity.

The opening of the national conference marked the beginning of an institutional stalemate. Yielding to calls from the opposition, President Mobutu appointed Mr. Tshisekedi as Prime Minister in late September 1991, but dismissed him within a few weeks. Reflecting a dramatic fall in economic activity and recurrent strikes in the civil service, revenue collection was halved, to less than US\$400 million in 1991, but current spending continued to increase. Broad money growth in 1991—at 2,230 percent—again reflected entirely the government's recourse to domestic bank financing. Monthly inflation averaged 37 percent over the year as a whole, with a peak of 114 percent in November 1991. By then, it was clear that the economy had plunged into a spiral of hyperinflation, currency depreciation, and falling output.

B. Economic Tailspin, 1992-93

Throughout 1992 and 1993, Zaïre's political and economic situation continued to worsen at an alarming pace. The President suspended the national conference on several occasions, which led to widespread unrest and rioting. When it was reconvened in April 1992, the conference declared itself "sovereign," with enforceable decisions. On August 15, 1992, the national conference elected Mr. Tshisekedi as Prime Minister, and the President promulgated his nomination on August 19, but the government remained largely powerless. As inflation eroded the value of the currency, the Bank of Zaïre issued new banknotes with a face value of Z 5 million in December 1992 (worth about US\$2), which were declared illegal by Prime Minister Tshisekedi. Also in December 1992, the national conference concluded its work by establishing itself as the High Council of the Republic (Haut Conseil de la République, or HCR) to act as a transition parliament pending the organization of national elections. In the next week, President Mobutu ordered the permanent secretaries to run their respective ministries in lieu of the cabinet named by Prime Minister Tshisekedi.

The Treasury endeavored to settle its commitments, including wages and salaries, with the newly issued banknotes, but most recipients refused to accept the new notes. In December 1992, and again on several occasions during January 1993, riots and looting broke out throughout the country, and soldiers demonstrated, demanding the payment of salary arrears. An estimated 1,000 people were killed in clashes on January 22, 1993.

During 1993, the relations between President Mobutu and Prime Minister Tshisekedi continued to deteriorate. On January 29, the President issued an ordinance removing Prime Minister Tshisekedi from office, but he refused to step down. The President charged the Prime Minister with high treason, while the national conference stated its intention to impeach President Mobutu. In February, the Bank of Zaïre announced the issuance of Z 10 million banknotes (about US\$4); at the same time, a 15-ton shipment of Z 5 million notes was seized in Belgium at Mr. Tshisekedi's request.

In March 1993, the President named another prime minister, and convened a “conclave” with a view to resolving the political stalemate and drafting a new constitution. However, members of the HCR declined to participate in the conclave, which comprised mostly former parliamentarians allied to President Mobutu. During most of the year, Zaïre had two prime ministers and two parliaments, and no working government. Over January-September 1993, inflation slowed to about 13 percent on average per month, mainly reflecting the Treasury’s inability to effect payments with the new currency notes.

On October 22, 1993, the Bank of Zaïre implemented a currency exchange, in which the zaïre was replaced by the new zaïre at a rate of NZ 1 = Z 3 million, with an initial parity of NZ 3 per U.S. dollar. The new notes were again boycotted by the opposition, and soldiers refused to accept them in salary payments, which gave rise to renewed rioting. The central bank tried to slow down the depreciation of the new currency in the interbank market, but by year-end the exchange rate of the new zaïre had depreciated to NZ 102 per U.S. dollar in the parallel market, and the differential with the interbank market reached 191 percent. Monthly inflation surged to about 250 percent in November and December 1993, and 190 percent in January 1994—yielding cumulative price increases that exceeded 3,300 percent during the three-month period ending in January 1994.

Beginning in 1992, and until early 1995, domestic bank deposits traded at a discount against currency notes, a phenomenon referred to as the domestic money exchange rate. In parallel with the acceleration of inflation and the extraordinary increase in velocity, shortages of currency notes at the central bank at times made the conversion of bank deposits into cash next to impossible. Given the high costs of printing currency, the central bank often earmarked its stocks of banknotes for the government’s use (and its own as well), and refused to convert commercial banks’ reserves into cash; in turn, depositors were unable to mobilize their bank balances, except through transfers or checks at a steep discount. The money exchange rate, which reports the value of currency notes relative to bank deposits, surged from about 2 in the spring of 1992 to 12 in early 1993, and peaked at 170 in June 1993 (see IMF [1996a], p. 87).

The velocity of circulation of broad money rose from about 17 in 1989-90 to nearly 30 in 1991-92, and dropped to 15 in 1993 before surging to 60 in 1994 (Table 1). However, the 1993 drop was only apparent insofar as bank deposits, which accounted for up to 73 percent of broad money, were nearly worthless (given the steep discount of bank deposits over currency). Currency substitution presumably continued to develop at a rapid pace during this period: by end-1993, the stock of new zaïres in circulation was worth only US\$46 million at the parallel market exchange rate, down from US\$158 million at end-1992 and more than US\$300 million at end-1989. Rough estimates suggest that the circulation of foreign banknotes—primarily U.S. dollars, but also CFA francs in the provinces next to BEAC member countries and Zambian kwachas in southern Zaïre—probably rose to the equivalent of US\$300-400 million in Zaïre. Nor was the co-circulation of currencies limited exclusively to foreign banknotes: in the aftermath of the currency exchange, and in response to the boycott, old zaïres continued to circulate in the Western Kasai province at a rate that gradually appreciated against the U.S. dollar, from about Z 20 million per U.S. dollar at end-1993 to Z 15-16 million more recently.

At the time of the currency reform, some Z 460 trillion in old zaïre notes (slightly more than one-third of total currency issue) was not exchanged for new notes, or the equivalent of US\$30 million at the present exchange rate for the old zaïres (see Bank of Zaïre, *Rapport Annuel 1994*, p. 174).

As the country's infrastructure crumbled and became unreliable, Zaïrian entrepreneurs developed in partnership with U.S. companies an efficient cellular telephone network. Among others, currency traders became regular users of the cellular network. Instant and reliable communication was an important tool to ensure the timely transmittal of information in the parallel exchange market. In particular, currency traders in Zaïre were on the watch for the sudden unloading of large quantities of banknotes, which invariably exerted an immediate impact on the parallel exchange rate ("Corando effect").⁶

Anecdotal evidence suggests that, from 1990 onward, prices in Zaïre were increasingly set in foreign currency (U.S. dollars or Belgian francs), although small-scale transactions generally continued to be carried out in domestic currency. As wages and salaries in the formal economy were settled in domestic currency, wage earners adopted substitution practices to avoid relying on the new zaïre as a store of value. Hence, foreign exchange bureaus and street money changers were particularly active, handling transactions on a continuous basis—from a few dollars to several thousand dollars. While some barter mechanisms developed as well (for example, companies provided their employees with transportation and housing services, or individuals paid teachers with basic food items), overall, barter remained limited in scale.

Reflecting a combination of several factors, the rates of inflation and currency depreciation were highly unstable. As a rule, Zaïre's currency depreciated in sudden and rapid steps, when new notes were made available to the Treasury on a large scale, or when impending deliveries were expected. However, there was often a pause in the depreciation, or even a slight appreciation of the currency, toward the end of each month, as companies built up stocks of banknotes to meet their wage payments and tax liabilities.

C. Steady Hyperinflation, 1994-96

On January 14, 1994, President Mobutu dismissed the two rival governments and launched consultations to resolve the political stalemate. Although the radical opposition refused to negotiate, a number of moderate members of the opposition accepted the merging of the national conference and the presidential conclave into a transition parliament (Haut Conseil de la République - Parlement de Transition, or HCR-PT) that comprised some 800 members. In March 1994, the Parliament approved a formal arrangement providing for a 15-month transition, through July 1995, during which the prime minister would be chosen in consultations with political parties from outside the President's party. Mr. Kengo wa Dondo, a leader

⁶"Corando" is a private security company operating in Kinshasa, whose name is printed on trucks and four-wheel drive vehicles that were often seen delivering boxes of new banknotes.

from the moderate opposition, was elected Zaïre's Prime Minister by the Parliament on June 14, and his nomination was ratified by President Mobutu soon thereafter.

The task of Prime Minister Kengo as set out by the HCR-PT was to lead the country to national elections by end-June 1995, but in the event this proved unrealistic (on July 7, 1995, the transition period was extended by another two years, through July 1997). In the meantime, the government endeavored to regain control over economic and financial management, and to reestablish normal relations with Zaïre's foreign partners. The strengthening of financial management had two main components: first, the restoration of effective control over the issuance of currency, and, second, the balancing of budgetary operations.

The extraordinary inflation episode of late 1993 had given rise to widespread rumors of disorderly currency issues, including possibly the printing of counterfeit notes. It is doubtful that the Zaïrian currency was counterfeited on a large scale at the time, considering that seigniorage gains were rather low (because the Bank of Zaïre often delayed the introduction of high denomination notes). However, "legal" banknotes were often issued during 1993-94 without proper accounting in the balance sheet of the central bank, which was facilitated by a shift to a less reputable foreign supplier of currency notes—ostensibly as a means of lowering printing costs.⁷

Soon after coming into office, Prime Minister Kengo suspended the governor of the Bank of Zaïre in July 1994, and named his deputy as acting governor. However, the governor refused to step down until the revocation decree was signed by the President, in November. A new governor was named at the Bank of Zaïre in January 1995, or six months after the prime minister's decision to suspend the former governor. During the first half of 1995, the Bank of Zaïre reverted to its traditional supplier of banknotes and security paper, and endeavored to recover stocks of banknotes and printing plates from the less reputable company.

Money growth slowed down gradually in 1994, from about 230 percent in the first and second quarters to 155 percent in the third quarter and 100 percent in the fourth quarter of the year. Inflation remained surprisingly high, however, in excess of 50 percent a month on average during January-September 1994, before declining to about 25 percent in October and November, and less than 10 percent in December.

With the progressive reestablishment of control over central bank operations in early 1995, the authorities turned their attention to fiscal management. Measures were taken to improve

⁷The Bank of Zaïre has its own printing facilities in Kinshasa, which generally account for about half of newly printed banknotes. However, all key inputs—including printing plates, ink, and security paper—are imported. In principle, illegal currency issue can be detected by checking serial numbers, but this would have been a Herculean task in Zaïre: since 1993, banknotes have been so numerous and of so little value that they were often "counted" by weight in the branches of the central bank, with only spot checks of their face values.

government revenue collection, and the Treasury was instructed to tighten expenditure control procedures and limit actual spending within available resources. As a result, government revenue rose to some US\$150 million during the first half of 1995, or 10 percent more than the total collections for 1994. Expenditure sequestration, which involved inter alia the accumulation of wage payment arrears, resulted in a buildup by the Treasury of surplus balances with the Bank of Zaïre, and inflation slowed to a monthly average of 10 percent during the first half of the year. Residual inflationary pressures stemmed from a deficit in central bank operations, mainly reflecting the large costs associated with currency printing and payments on short-term external debt obligations, as well as a strong expansion in central bank refinancing that accommodated the weakening position of several commercial banks.

By mid-1995, the disinflation gains gradually ground to a halt. Spending by the Treasury rose somewhat, and the deficit of central bank operations remained large. Inflation was subdued during July-August, but surged in the latter part of the year. Beginning in September, the authorities yielded to political pressures and started spending the balances accumulated with the central bank, to settle the allowances of parliamentarians, clear government wage arrears, and launch urgent public works such as road repair. With the monetization of government deposits, inflation surged from a monthly average of 13½ percent during the third quarter of 1995 to 23 percent during the last quarter, and to 34 percent in January 1996 alone. In turn, government revenue collection weakened to US\$55 million in the last quarter of 1995, as against some US\$90 million in the second and third quarters.

Following its January 1996 surge, monthly inflation hovered in the range of 10-20 percent, while government revenue remained on the order of US\$20 million a month. At least until late 1996, the precarious political modus vivendi found in 1994 appeared to be holding. Zaïre remained on the brink of hyperinflation, but positive real GDP growth was expected for the first time since 1988. Although it is doubtful that hyperinflation can be “stabilized” durably, as the process is inherently highly unstable, economic and financial collapse had been avoided since the extraordinary inflation episode of late 1993, owing to the imposition of stricter controls over public finances and central bank operations.

The war in Kivu, in which Tutsi rebels seized major cities in eastern Zaïre in the latter part of 1996, brought strong pressures on the government of Prime Minister Kengo and renewed calls by the radical opposition for the nomination of Mr. Tshisekedi as prime minister. After undergoing cancer treatment in August 1996, President Mobutu convalesced in Europe for more than three months before returning to Kinshasa with the aim of retaking control over the country. The crisis in the Great Lakes region and the speed at which rebels routed the Zaïrian army highlighted the extraordinary weakness of government authority.

As of end-1996, in addition to losing control over a sizable portion of Zaïre’s territory, the government’s hold over the financial situation appeared to have weakened as well. Reflecting a surge in government spending, monthly inflation accelerated to 24 percent during October-December, while the money exchange rate, which had nearly disappeared since early 1995,

rose to about 2. The inflation rate for the 12-month period ending December 1996 reached 657 percent, equivalent to a monthly average of 18½ percent.

As indicated above, throughout 1995 and 1996, the Bank of Zaïre remained the main impetus behind inflationary pressures: its deficit mostly reflected the cost of printing currency and the settlement of short-term external liabilities, including arrears vis-à-vis the foreign supplier of banknotes and security paper. The average cost of banknotes issued by the Bank of Zaïre was relatively low (on the order of US\$100 per thousand, including transportation charges), but volumes were considerable. Thus, the Bank of Zaïre issued some 830 million new banknotes in 1995 (in part out of the fear that the introduction of higher denomination notes would elicit adverse political reactions, as in 1992 and 1993) at an aggregate cost of about US\$80 million. During this period, the currency stock increased by some NZ 1½ trillion,⁸ or the equivalent of US\$180 million (converted monthly at the parallel exchange rate). In effect, nearly half of the currency newly issued by the Bank of Zaïre in recent years was used to acquire foreign exchange in order to pay for the issuance of currency!

From 1989 to 1994, the Zaïrian economy contracted cumulatively by some 40 percent, and consumer prices rose by a factor of 21 million; government revenue collections fell from nearly US\$900 million in the late 1980s to US\$138 million in 1994. During 1995-96, the contraction in economic activity bottomed out, and even showed some signs of reversal, while prices rose by a factor of about 35. But even with sustained progress toward stabilization of the economy, the task ahead to rebuild the country is enormous, and the challenge of restoring the authority of the state is perhaps even greater. By end-1996, Zaïre's infrastructure had fallen into disrepair: most roads, railways, and rivers had become impracticable; the government had all but stopped providing health and education services; and many public enterprises had ceased operating. The informal sector showed an amazing resilience, which partly buffeted the plummeting activity in the formal economy. But the development of "survival reflexes"—with greater autonomy of provinces and generalized self-subsistence, in particular—also translated into "noncivic" behavior, including the extension of corruption and the ransacking of the population by unpaid soldiers. Hyperinflation in Zaïre in the 1990s thus left a trail of deleterious consequences on the fabric of society, which will take many years to remedy.⁹

⁸Thus, the average banknote issued in 1995 had a face value of less than NZ 2,000—equivalent to US\$0.50 at the beginning of the year, and US\$0.13 by year-end. Early in the year, the Bank of Zaïre was issuing NZ 500 notes (US\$0.13), and introduced denominations of NZ 1,000 and NZ 5,000 in April 1995. NZ 10,000 notes were introduced in January 1996, at a time when the parallel exchange rate had reached NZ 22,000 per U.S. dollar.

⁹Zaïre's example provides a vivid illustration of Keynes' oft quoted dictum: "Lenin was certainly right. There is no subtler, no surer means of overturning the existing basis of society than to debauch the currency." *The Economic Consequences of the Peace* [1919], p. 149.

III. MONEY SUPPLY AND DEMAND, AND THE TANZI EFFECT

Developments in Zaïre during 1990-96 clearly testify to the strong relationship between the monetary financing of government deficits and inflation, even though the link seems to have weakened at times (as in 1994). To explore the dynamics of hyperinflation in Zaïre, this section develops an illustrative model consisting of three building blocks: money supply, money demand, and a government revenue equation. The framework remains deliberately simple: there are only two economic agents, the government, whose activity encompasses central bank operations, and the private sector. Any possible impact of hyperinflation on real economic activity is disregarded.¹⁰

“Money” is defined as currency outside banks, rather than broad money, which avoids the measurement problem arising from fluctuations in the money exchange rate (discount of bank deposits over currency). The counterpart to the issuance of money consists entirely of government credit. In effect, this assumes that private sector credit is financed out of bank deposits, with no contribution from central bank refinancing. In the absence of complete data on central bank operations, overall government spending is defined as the change in the currency stock *minus* government revenue. Foreign financing (which practically disappeared after 1992) is thus not considered, nor is the financing of government expenditure through the build up of domestic payments arrears. In contrast to the normal case, the interest rate is not included as a determinant of money demand because, at least until 1996, interest rates did not play an active role in Zaïre.

The domestic currency exchange rate is not considered separately either. In effect, it is assumed that the nominal effective exchange rate evolves as the inverse of the price level. While this was contradicted at times, especially when Zaïre’s currency depreciated at an extraordinarily high pace, by and large the correlation between the exchange rate and the price level has been very close to 1 (see Figure 1).¹¹

The definition of variables is summarized in the following box:

¹⁰During 1990-95, nonmining activity dropped less than overall real GDP, and a large part of the decline was presumably accounted for by the destruction of property in the wake of the recurrent rioting and looting, especially in October 1991 and December 1992. Unfortunately, no reliable monthly indicators of economic activity in Zaïre are available.

¹¹Thus, the index of the effective exchange rate (expressed in foreign currency terms) times the price level increased by less than 15 percent from 1990 to mid-1996, even though it rose threefold during the November 1993-January 1994 period. (While Zaïre’s nominal effective exchange rate is published in *IFS*, its absolute level with the 1990 base year is so low that it has been shown as zero since 1993—it stood at $6.55 \cdot 10^{-7}$ in June 1996.)

Definition of Variables

Values are expressed in billions of zaïres (i.e., old zaïres, even in the period that followed the currency reform of October 1993). The database is drawn from the publications of the Bank of Zaïre (see Appendix).

M	Currency outside banks, as reported by the Bank of Zaïre in the monetary survey
Y	Nominal aggregate income (= $P y$)
y	Real aggregate income
R	Central government revenue
RM	Central government revenue from the mining sector (Gécamines)
RO	Other central government revenue (nonmining)
G	General government spending, defined residually as the change in currency <i>minus</i> revenue
P	Consumer price index, December 1989 = 1
π	Inflation, defined as $\Delta \text{Log } P$

A. Money Supply and Demand

Money supply is a direct function of the government deficit:

$$M_t^S = M_{t-1} + G_t - R_t = M_{t-1} + G_t - RM_t - RO_t. \quad (1)$$

This is an identity, since the government sector (inclusive of the central bank) is by convention the sole source of money creation. Thus, any increase in the stock of broad money necessarily reflects a deficit in government operations insofar as there are no other financing sources, either domestic or external.

The demand for real money balances in domestic currency is:

$$\frac{M_t^D}{P_t} = A e^{-\alpha \pi_t^e} \left(\frac{RO_t}{P_t} \right)^\beta. \quad (2)$$

Equation (2) takes the usual form, as in Cagan's model, where the demand for real balances in domestic currency depends on expected inflation ($\alpha > 0$), but also on the level of real non-mining revenue ($\beta > 0$); A is a scaling constant. Nonmining revenue is included as a proxy for the demand of transaction balances in domestic currency (mining revenue is not taken into

account, because it is paid directly in foreign currency).¹² As inflation reaches very high levels, the local currency loses its usefulness, both as a store of value and as a medium of exchange, and even as a unit of account. As a result, economic operators tend to reduce their cash holdings as much as possible and substitute foreign exchange; even common transactions are increasingly conducted in foreign currency notes. Yet, the demand for domestic currency does not fall to zero as long as the government continues to collect revenue: even if inflationary expectations were to become infinite, taxpayers would still need to acquire domestic currency in order to settle their obligations to the Treasury—and thus real money demand is unlikely to drop to zero unless government revenue collections collapse entirely.

Applying a log transformation to equation (2) yields:

$$\text{Log } P_t = \frac{\alpha}{1-\beta} \pi_t^e + \frac{1}{1-\beta} \text{Log } M_t - \frac{\beta}{1-\beta} \text{Log } RO_t - \frac{\text{Log } A}{1-\beta}. \quad (3)$$

Equation (3) is expressed in terms of prices, which is the adjustment variable that clears the money market. The superscript for M_t has been dropped, since equilibrium in the money market implies that money supply equals money demand. Ceteris paribus, any increase in money supply translates into higher prices, by a factor of $1/(1-\beta)$. Equation (3), however, is not a reduced form because M_t is itself a function of RO_t .

B. The Tanzi Effect

The Tanzi effect refers to the erosion of the tax base by inflation.¹³ There is unavoidably a lag between the time tax payments are assessed and the time they are collected by the Treasury. In the case of indirect, domestically based taxes (such as turnover taxes), the collection lag is generally four to six weeks; for direct taxes, the lag is much longer, and may reach well over a year for personal income taxes. Even in the case of customs duties, where the assessed base is denominated in foreign currency, taxpayers are generally allowed several weeks to make payments to the Treasury. As regards nontax revenue such as licenses and fees, the amounts due are normally set in local currency terms, which tend to make their value insignificant under conditions of hyperinflation.

¹²A broader indicator of transactions in domestic currency would need to cover activity in the formal economy (especially public enterprises and the retail distribution of petroleum products). While such data are not readily available in Zaire, nonmining tax revenue may be seen as rather comprehensive, especially insofar as the tax system remained broadly unchanged during the 1990-96 period.

¹³See Tanzi [1977]. The impact of inflation on collection lags is also referred to as the “Tanzi-Olivera effect,” in reference to the pioneering article published by Olivera [1967].

In Zaïre, where the bulk of government revenue consists of indirect taxes, the average collection lag may be on the order of one to three months. The Tanzi effect on government revenue is thus quite large: with inflation running at 10 percent a month, real revenue collection drops by 9.1 percent if the collection lag is one month, or 17.4 percent if the lag is two months (relative to the case with no inflation). As inflation reaches 50 percent a month, the drop in real revenue collection amounts to 33.3 percent or 55.6 percent, respectively.¹⁴ Under such circumstances, taxpayers will always endeavor to delay the settlement of tax obligations; moreover, tax and customs agents will often use their prerogatives to allow delayed payments and share some of the taxpayers' gains.

In the general case, various taxes are collected with lags ranging from zero to n months; non-mining government revenue is thus specified as:

$$RO_t = \tau \prod_{i=0}^n Y_{t-i}^{\tau_i} \quad (4)$$

While an arithmetic specification is more commonly used, the geometric formulation is better suited to a hyperinflation environment; it also provides computational convenience, as it can be linearized by a log transformation. Let k be the average collection lag; as short-term fluctuations in output are not considered, equation (4) may be simplified as follows:

$$RO_t \approx \tau \prod_{i=0}^n (P_{t-i} y_{t-k})^{\tau_i}, \quad \text{with } Y_{t-i} \approx P_{t-i} y_{t-k} \quad \forall i, \quad \text{or,} \quad (5)$$

$$\text{Log } RO_t \approx \text{Log } \tau + \sum_{i=0}^n \tau_i \text{Log } P_{t-i} + \sum_{i=0}^n \tau_i \text{Log } y_{t-k}.$$

This formulation has the advantage of separating price effects, while eliminating real income from the distributed lag structure (there are no reliable monthly indicators of activity in Zaïre, and the index used for estimation purposes is simply a geometric interpolation of real GDP).

C. Modeling the Hyperinflation Process

In the standard model, the stability of the inflation process depends entirely on the behavioral coefficients for expected inflation: the inflationary process is stable "when money demand responds little to expected inflation and when expectations adjust sluggishly." Under rational expectations, "there is typically an infinity of solutions for the price path, with only one of them not implying unstable price behavior" (Dornbush and Fischer [1986], Section II).

¹⁴The formula is $(1 + \Delta P/P)^n - 1$, where P is the monthly price index and n the collection lag expressed in months.

The introduction of the Tanzi effect in the base model makes things worse, relative to the case where taxes are not considered, insofar as inflation lowers government revenue and thus enlarges the deficit in real terms. When real government spending is set at a level in excess of current revenue, inflation increases, *ceteris paribus*, which reinforces the spiraling impact of inflationary expectations. At the same time, however, the inclusion of real nonmining government revenue in the money demand function acts as a brake on this vicious spiral.

Many historical precedents testify that hyperinflation is inherently highly unstable, and quickly leads to total collapse and forced stabilization.¹⁵ The famous Weimar episode in Germany lasted only 15 months, and the record Hungarian hyperinflation of 1945-46, less than a year. Developments in Zaïre since 1990, however, show that hyperinflation can be sustained and total collapse avoided for many years. A number of Latin American countries have also experienced triple- or quadruple-digit inflation rates for several consecutive years (notably Brazil, 1987-94, and Nicaragua, 1985-90). A key aspect of these long-lasting cases of extraordinary inflation was the *high variability* of inflation, as a consequence of *large fluctuations* in real government spending (see Végh [1992]).

An important prerequisite for modeling the hyperinflation process, therefore, is to treat government spending as a variable rather than as a fixed parameter.¹⁶ Highly variable real government spending and unstable inflation are common features of all hyperinflation episodes, and should be seen as intrinsic elements of the hyperinflation process. When inflation reaches very high levels and the potential gains from seigniorage tend to disappear, or when no foreign exchange is available to print new notes and adapting the face values of banknotes no longer seems a viable option, the government is compelled to reduce spending temporarily. With government spending sharply down, inflation drops quickly, which creates the opportunity for a new outburst of government spending.¹⁷

There is no straightforward way to reduce equations (1), (3), and (5), because of the linear structure of the money supply equation. Combining these equations yields:

¹⁵“Hyperinflation, therefore, cannot be sustained for long. When a society has reached this extreme, the alternatives are stark and simple: Stabilize or else!” Heymann and Leijonhufvud [1995], p. 108.

¹⁶Throughout this section, and in the econometric estimates that follow, government spending is taken as exogenous, but an attempt is made at treating it as endogenous in the simulations.

¹⁷The necessity to cut down sporadically on government spending should be distinguished from readjusting expenditure (on a commitment basis), which suggests that the change in government arrears is also an important feature of hyperinflation processes. In Zaïre, however, there is no reliable information on the buildup of domestic government arrears.

$$\begin{aligned} \text{Log } P_t = & \frac{\alpha}{1-\beta} \pi_t^e + \frac{1}{1-\beta} \text{Log} \left(M_{t-1} + G_t - RM_t - \tau_0 \prod_{i=1}^n P_{t-i}^{\tau_i} \right) \\ & - \frac{\beta}{1-\beta} \left(\sum_{i=0}^n (\text{Log } \tau + \tau_i \text{Log } P_{t-i}) + \sum_{i=0}^n \tau_i \text{Log } y_{t-n/2} \right) - \frac{\text{Log } A}{1-\beta}. \end{aligned} \quad (6)$$

Two alternative specifications are used for inflationary expectations. Under rational expectations (RE), there is no uncertainty and π^e is equal to the actual rate of inflation (implying a perfect ‘‘Corando effect’’), while under adaptive expectations (AE), $\Delta \pi^e$ is a function of the discrepancy between actual and expected inflation in the previous month:

$$\begin{aligned} RE: \quad \pi_t^e &= \pi_t, \\ AE: \quad \Delta \pi_t^e &= \lambda (\pi_{t-1} - \pi_{t-1}^e) \quad \text{with} \quad 0 < \lambda < 1. \end{aligned} \quad (7)$$

The adaptive expectation specification is equivalent to a distributed lag of past inflation rates, which offers some parallelism with the specification of the Tanzi effect:

$$\begin{aligned} \pi_t^e &= \lambda \pi_{t-1} + (1 - \lambda) \pi_{t-1}^e = \lambda \sum_{i=1}^{\infty} (1 - \lambda)^{i-1} \pi_{t-i} \\ &= \lambda \text{Log } P_{t-1} - \lambda^2 \sum_{i=2}^{\infty} (1 - \lambda)^{i-2} \text{Log } P_{t-i}. \end{aligned} \quad (8)$$

Given the inclusion of government revenue in the money demand function and the Tanzi effect, it may be difficult in practice to distinguish the RE and AE specifications, since in both cases the price equation (3) will involve distributed lags of $\text{Log } P_t$ (or $\Delta \text{Log } P_t$).

Substituting (8) into (3) is most straightforward in the RE case:

$$\text{Log } P_t = \frac{-\alpha \text{Log } P_{t-1} + \text{Log } M_t - \beta \text{Log } RO_t - \text{Log } A}{1 - \alpha - \beta}, \quad (9)$$

or:

$$\Delta \text{Log } P_t = \frac{(\beta-1) \text{Log } P_{t-1} + \text{Log } M_t - \beta \text{Log } RO_t - \text{Log } A}{1 - \alpha - \beta}. \quad (10)$$

In the AE case, π^e is eliminated by subtracting $(1-\lambda) \text{Log } P_{t-1}$ from both sides in equation (3):

$$\begin{aligned} \text{Log } P_t &= (1-\lambda) \text{Log } P_{t-1} + \frac{\alpha \lambda}{1-\beta} \Delta \text{Log } P_{t-1} + \frac{1}{1-\beta} \text{Log } M_t \\ &- \frac{1-\lambda}{1-\beta} \text{Log } M_{t-1} - \frac{\beta}{1-\beta} \text{Log } RO_t + \frac{\beta (1-\lambda)}{1-\beta} \text{Log } RO_{t-1} \quad (11) \\ &- \text{Log } \frac{A}{1-\beta} + \frac{1-\lambda}{1-\beta} \text{Log } A, \end{aligned}$$

or:

$$\begin{aligned} \Delta \text{Log } P_t &= -\lambda \text{Log } P_{t-1} + \frac{\alpha \lambda}{1-\beta} \Delta \text{Log } P_{t-1} + \frac{1}{1-\beta} \Delta \text{Log } M_t \\ &+ \frac{\lambda}{1-\beta} \text{Log } M_{t-1} - \frac{\beta}{1-\beta} \Delta \text{Log } RO_t - \frac{\beta \lambda}{1-\beta} \text{Log } RO_{t-1} \quad (12) \\ &- \frac{\lambda}{1-\beta} \text{Log } A. \end{aligned}$$

Neither equation 10 nor equation 12 can be reduced to a difference equation in terms of prices, insofar as distributed lags of P_t enter into RO_t , and thus into M_t as well. As a rule, an important condition for the stability of the inflation process is that the first coefficient in equation 3 ($\alpha / (1-\beta)$) should be less than unity (i.e., $\alpha + \beta < 1$). If this condition is not met, inflationary expectations could exert an explosive self-fulfilling effect, in which higher prices generate ever higher inflationary expectations. Yet, this condition is neither necessary nor sufficient to ensure stability. This is because the second element in equation 3 tends to reinforce inflationary pressures (especially if β is low—that is, if money demand is little sensitive to changes to government revenue collection, and depends almost entirely on inflationary expectations), while the third element has the reverse effect. In other words, the inclusion of government revenue in the money demand function, together with the specification of the Tanzi effect, partly neutralizes the impact of expectations on inflation—expectations essentially affect the *speed* of adjustment, rather than its path.

IV. ECONOMETRIC ESTIMATES

The estimates presented below were made using monthly data covering the period June 1990 to June 1996, in terms of first differences or, in the case of government nonmining revenue, in real terms, so as to ensure that the regressors are all stationary. Standard ADF unit root tests were used to verify stationarity; all unit root tests were satisfactory at the 1 percent level (estimates were made with PCGIVE 8.0 (see Doornik and Hendry [1995]), while simulations and charts were produced in AREMOS 1.32).

A. Government Nonmining Revenue

Direct estimates of the Tanzi effect on nominal government nonmining revenue based on first differences do not yield significant results. Alternatively, equation (5) above may be transformed to express government nonmining revenue in real terms:

$$\begin{aligned}
 \text{Log } \frac{RO_t}{P_t} &= \text{Log } \tau + \sum_{i=0}^n \tau_i \text{Log } P_{t-i} + \sum_{i=0}^n \tau_i \text{Log } y_{t-k} - \text{Log } P_t \\
 &= \text{Log } \tau - (1-\tau_0) \Delta \text{Log } P_t - (1-\tau_0-\tau_1) \Delta \text{Log } P_{t-1} \\
 &\quad - (1-\tau_0-\tau_1-\tau_2) \Delta \text{Log } P_{t-2} - \dots \\
 &\quad - (1-\tau_0-\tau_1-\tau_2-\dots-\tau_n) \text{Log } P_{t-n} + \sum_{i=0}^n \tau_i \text{Log } y_{t-k}.
 \end{aligned}
 \tag{13}$$

Insofar as all τ_i are positive while their sum should be close to 1, the distributed lags for $\Delta \text{Log } P$ can be expected to decline monotonously (in absolute terms) to zero. For estimation purposes, a dummy variable is included (*Loot*) that takes the value of 1 during the looting episodes of 1991 and 1992-93 (October-December 1991, and December 1992-February 1993). This dummy provides a limited correction to the aggregate index of economic activity (which, as indicated above, is a geometric interpolation of real GDP). In addition, the regression includes seasonal dummies, as government revenue is normally subject to marked seasonal fluctuations. The regression results are shown below (** and * indicate significance at the 1 percent and 5 percent levels, respectively):

Regression 1. Estimates of Real Government Revenue (Monthly data, June 1990-June 1996—seasonal coefficients not reported)				
Regression on $\text{Log } RO_t / P_t$	Coefficient	Standard error	t-value	Partial R^2
$\Delta \text{Log } P_t$	-0.4435	0.1909	-2.32 *	0.0879
$\Delta \text{Log } P_{t-1}$	-0.5517	0.2289	-2.41 *	0.0940
$\Delta \text{Log } P_{t-2}$	-0.7764	0.1892	-4.10 **	0.2311
$\text{Log } y_{t-1}$	1.5264	0.2075	7.36 **	0.4914
<i>Loot</i>	-0.6905	0.1340	-5.15 **	0.3216
<i>Constant</i>	-4.0496	0.9037	-4.48 **	0.2639
	$R^2 = 0.8098$	SEE = 0.2902	$DW(1) = 1.85$	
	Adj. $R^2 = 0.7556$	$F(16,56) = 14.91 **$	$DW(12) = 1.84$	

The goodness of fit is excellent, but the coefficients for the first two lags of $\Delta \text{Log } P$ are not significant at the 1 percent level (the inclusion of $\text{Log } P$ or $\Delta \text{Log } P$ with a three-month lag

yields a coefficient and a *t*-value close to zero). While all coefficients have the expected signs, the slope of the distributed lags for $\Delta \text{Log } P$ is inverted relative to what could be expected—increasing, rather than decreasing, in absolute value. This could be due to the fact that $\Delta \text{Log } P$ is somewhat autocorrelated, a characteristic that may also prevent the detection of longer time lags. For the sake of parsimony, it is preferable to drop $\Delta \text{Log } P_{t-1}$ to ensure that all coefficients are significant at the 1 percent level.

Regression 2. Estimates of Real Government Revenue (Monthly data, June 1990-June 1996—seasonal coefficients not reported)				
Regression on $\text{Log } RO_t/P_t$	Coefficient	Standard error	<i>t</i> -value	Partial R^2
$\Delta \text{Log } P_t$	-0.7105	0.1619	-4.39 **	0.2525
$\Delta \text{Log } P_{t-2}$	-1.0372	0.1617	-6.42 **	0.4193
$\text{Log } y_{t-1}$	1.5211	0.2161	7.04 **	0.4650
<i>Loot</i>	-0.6639	0.1391	-4.77 **	0.2856
<i>Constant</i>	-4.0113	0.9409	-4.26 **	0.2418
	$R^2 = 0.7902$	SEE = 0.3022	$DW(1) = 1.91$	
	Adj. $R^2 = 0.7350$	$F(15,57) = 14.31 **$	$DW(12) = 1.76$	

The goodness of fit has marginally diminished, but remains quite good (see Figure 2); standard mis-specification tests on the residuals are all satisfactory.¹⁸ The sum of the distributed lags remains about the same, at -1.75, compared with -1.77 in Regression 1. This indicates that the *Tanzi effect* has been quite powerful in Zaire: with monthly inflation at 1 percent, 10 percent, or 20 percent a month, real government nonmining revenue drops by 1.8 percent, 16 percent, or 28 percent, respectively (in the arithmetic formulation, this would stem from an average collection lag of about 1½ months).

The large coefficient for real activity, in excess of 1.5, is at first surprising. However, it must be recalled that *Log y* does not reflect short-term fluctuations in output, some of which are captured in the dummy *Loot*. Overall, the sum of the coefficients for *Log y* and *Loot* (0.86) suggests that the Zairian tax system has had a rather low elasticity with respect to real economic activity.

¹⁸The mis-specification tests on the regression residuals aim at detecting autocorrelation, autoregressive conditional heteroscedasticity (ARCH), a non-normal distribution, heteroscedasticity, and certain functional form mis-specification.

B. The Price Equation

As a preliminary step, the structural equations (10) and (12) are estimated directly by imposing nonlinear restrictions on the coefficients. The results are summarized below:

Regressions 3 and 4. Estimates of $\Delta \text{Log } P$ (Monthly data, June 1990-June 1996)							
	Regression 3 (Equation 10 — RE)			Regression 4 (Equation 12 — AE)			
	α	β	Const.	α	β	λ	Const.
Coefficient	-2.674	0.611	2.153	2.660	0.016	0.112	4.779
t-value	4.304	4.040	5.026	2.279	0.348	2.552	14.397
	$R^2 = 0.2704$			$R^2 = 0.5636$			
	$F(2,70) = 12.97$			$F(3,69) = 29.71$			

Clearly, neither regression is acceptable. In both cases, a large part of the variance is captured by the constant term, and the correlation coefficients are rather small. In the RE equation, all the coefficients are significant at the 1 percent level, but α has the wrong sign, while β seems too large. All the coefficients for the AE equation have the expected positive sign, but α is excessively large, and β is not significantly different from zero. An examination of alternative estimates of these coefficients provides indications on the reasons for the instability of the regression. Figure 4 shows the recursive estimates of α , β , and λ in Regression 4 over successive 25-month periods (dates are centered; thus, for example, the estimates shown for January 1992 were made over the period July 1991-July 1992). It is noteworthy that the estimates from early 1993 to mid-1994—covering mid-1992 to late 1994—are relatively stable, especially considering that this period included the record hyperinflation episode of late 1993. By contrast, major deviations occur over the second half of 1992 and in late 1994/early 1995. These correspond to two periods of temporary disinflation, which suggest that actual inflationary expectations in Zaïre have been much more complex than assumed earlier (equation 7 above). In particular, this may indicate that expectations are asymmetric, or that they take into consideration significantly longer lags than specified above.

To arrive at a better estimate of the price equation, an additional variable is included to reflect the six-monthly inflation rate, the restrictions on the coefficients in equation 12 are lifted, and seasonal dummies added. To improve the significance of the estimates, $\text{Log } M_{t-1}$ and $\Delta \text{Log } M_t$ are collapsed into $\text{Log } M_t$, while nonmining government revenue is dropped, considering that it duplicates the distributed lags of $\text{Log } P$ and/or $\Delta \text{Log } P$. The results are shown below:

Regression 5. Estimates of Monthly Inflation (Monthly data, June 1990-June 1996—seasonal coefficients not reported)				
Regression on $\Delta \text{Log } P_t$	Coefficient	Standard error	t -value	Partial R^2
$\text{Log } P_{t-1}$	-0.6705	0.0654	-10.26 **	0.6485
$\Delta \text{Log } P_{t-1}$	0.3406	0.0799	4.26 **	0.2415
$\text{Log } P_{t-1}/P_{t-7}$	0.0908	0.0213	4.27 **	0.2423
$\text{Log } M_t$	0.7112	0.0695	10.24 **	0.6477
Constant	-3.4472	0.3583	-9.62 **	0.6189
$R^2 = 0.8169$		SEE = 0.1220	$DW(1) = 2.11$	
Adj. $R^2 = 0.7687$		$F(15,57) = 16.95$ **	$DW(12) = 2.20$	

All coefficients are significant at the 1 percent level, with particularly high t -values for $\text{Log } P_{t-1}$ and $\text{Log } M_t$, and the signs are those that would be expected. The coefficient for $\text{Log } P_{t-1}$, in particular, may be seen as a proxy for $-\lambda$ in equation 12 above, although the changes made on the functional form prevent proper identification. While all standard mis-specification tests are satisfactory, a careful examination of the residuals shows systematic errors during 1994-95. A possible explanation is that the actual stock of currency was higher than reported, reflecting the parallel issuance of currency at the time when banknote printing was temporarily shifted to a less reputable company. To test this hypothesis, a dummy variable ($D9495$) is added, which takes the value of 1 from June 1994 through August 1995, and zero otherwise. The revised estimates are shown below:

Regression 6. Estimates of Monthly Inflation (Monthly data, June 1990-June 1996—seasonal coefficients not reported)				
Regression on $\Delta \text{Log } P_t$	Coefficient	Standard error	t -value	Partial R^2
$\text{Log } P_{t-1}$	-0.7535	0.0652	-11.56 **	0.7045
$\Delta \text{Log } P_{t-1}$	0.3469	0.0737	4.71 **	0.2834
$\text{Log } P_{t-1}/P_{t-7}$	0.0968	0.0197	4.92 **	0.3016
$\text{Log } M_t$	0.7942	0.0687	11.56 **	0.7046
$D9495$	0.1464	0.0440	3.33 **	0.1653
Constant	-3.8452	0.3512	-10.95 **	0.6816
$R^2 = 0.8472$		SEE = 0.1125	$DW(1) = 2.36$	
Adj. $R^2 = 0.8035$		$F(16,56) = 19.40$ **	$DW(12) = 2.10$	

While not very large in absolute terms, the dummy coefficient is significant at the 1 percent level, and the goodness of fit has improved noticeably. Moreover, all t -statistics are somewhat

larger than in Regression 5. The estimates above would thus seem to confirm that there were substantial amounts of currency issued without proper accounting during this period, even though it is probable that the dummy also captured other special factors that were at play during the 1994-95 period.

Given these estimates, the long-term stationary solution to the price equation is:

$$\text{Log } P = 1.054 \text{ Log } M - \text{constant} .$$

However, the short-run elasticity of prices relative to the money stock is much higher than 1 because of the Tanzi effect, since the increase in prices depresses government revenue, which generates a deficit in government operations and thus a further increase in the money stock. The simulations below indicate that the short-term elasticity of prices relative to the money stock is about 1.25, while the long-run elasticity is on the order of 1.07.

V. SIMULATIONS

Simulations are used to study the impact of changes in government spending on prices, government revenue, and the government balance. The pre-simulation period is defined such that government operations are balanced and prices are stable, with mining sector revenue constant in real terms. Real output is assumed to remain constant at 100. Thus, with prices initially set at 3, and mining sector revenue at Z 10 billion, total government revenue equals Z 87.4 billion, and the money stock totals Z 429 billion (these conditions are broadly similar to those that prevailed in Zaïre in late 1990). The model relies on the coefficients estimated in Regressions 2 and 6 above, excluding seasonals and other dummies (equations were rearranged in level forms, and constants adjusted to incorporate average seasonal coefficients):

$$\begin{aligned} M_t &= M_{t-1} + G_t - R_t \\ R_t &= RM_t + RO_t \\ RM_t &= 3.33 P_t \\ RO_t &= 0.0234 P_t^{0.2895} P_{t-1}^{0.7105} P_{t-2}^{-1.0372} P_{t-3}^{1.0372} y_{t-1}^{1.5211} \\ P_t &= 0.0186 P_{t-1}^{0.6902} P_{t-2}^{-0.3469} P_{t-7}^{0.0968} M_t^{0.7942} . \end{aligned}$$

An additional equation specifies the pattern for government spending. Four variants are considered. In Variant A, spending is kept constant in real terms; in Variant B, nominal spending is maintained at 35 percent above revenue; in Variant C, spending is doubled temporarily at time $t = 2$ through $t = 4$, and a balanced budget applies thereafter; Variant D uses a reaction function, in which the authorities attempt to raise spending by 50 percent if

prices are stable, or less, depending on the latest monthly and three-monthly inflation rates.¹⁹ Specifically:

$$\begin{aligned} \text{Variant A: } & G_t = 38 P_t \\ \text{Variant B: } & G_t = 1.35 R_t \\ \text{Variant C: } & G_t = \mu R_t, \text{ with } \mu = 2 \text{ for } t = 2, \mu = 1 \text{ otherwise} \\ \text{Variant D: } & G_t = 0.75 G_{t-1} \left(4 - \frac{P_{t-1}}{P_{t-2}} - \frac{P_{t-1}}{P_{t-4}} \right). \end{aligned}$$

The main results of the simulations are shown in Figure 5, and details are in Table 2.

Variant A. At time $t = 1$, government spending increases by nearly 40 percent in nominal terms, and remains constant in real terms thereafter. The money stock surges immediately by 7 percent, and inflation reaches 6 percent. Inflation depresses real government revenue, and the deficit keeps on enlarging: within three months, inflation exceeds 12½ percent, and slows temporarily before resuming an upward trend. By the end of the second year, inflation runs at 13½ percent a month and keeps on rising, while real government revenue has fallen by nearly 20 percent in real terms. Within six years, monthly inflation reaches 30 percent and government revenue falls below two-thirds of its initial level. Clearly, a constant level of real spending much above revenue is not sustainable, as it ultimately leads to an ever higher inflation rate.²⁰

Variant B. With spending kept 35 percent above revenue in nominal terms, monthly inflation quickly rises to 10 percent, before declining and stabilizing at 7-8 percent after less than a year. The slowing down of inflation is related to the *Tanzi effect*: inflation erodes government revenue, which implies a drop in spending as well. Over the longer run, however, inflation keeps on increasing—reaching 9½ percent after six years, and 12 percent after ten years. Even after six years, real government expenditure remains some 17 percent above its initial equilibrium level, but it declines slowly, *pari passu* with revenue. Thus, while linking government expenditure to revenue makes the system less explosive than in Variant A, the persistent deficit would also result in an ever higher inflation rate.

Variant C. A discretionary shock on government spending has strong effects, which also tend to dissipate rather quickly. With spending twice as large as revenue for three months in a row, inflation surges to 30 percent, before returning to zero with an oscillating movement. Both real government revenue and expenditure decline temporarily, but then return toward their initial levels. Reflecting the monetary financing of the government deficit, money surges by 77½ per-

¹⁹The coefficients were chosen so as to yield patterns of broadly similar amplitude in Figure 5, while avoiding “out of range” errors over at least a six-year horizon.

²⁰In this variant, real government spending proper actually needs to decline, as an increasing share of total spending would be required to finance the printing of currency.

cent above its level at $t = 0$, while prices approximately double (a short-term elasticity of 1.25). Over the long run, however, the money stock remains constant while prices stabilize at about 83 percent above the base level (a long-term elasticity of 1.07).

Variante D. This variant broadly mimics actual developments in Zaïre since late 1994. Overall government spending tends to exceed available resources by a substantial margin, but also fluctuates widely in response to changes in the rate of inflation. In turn, the fluctuations in the government deficit impart an unstable inflation rate. Inflation surges to 24 percent after three months, but then declines before rising again, with movements gradually of lesser amplitude. Over the long run, inflation stabilizes at about 11½ percent; government spending remains at 8-9 percent above its initial level, while revenue has fallen by about 15 percent relative to its level at $t = 0$.

A common feature of these simulations is that the monetary financing of government deficits depresses real government revenue, which tends to enlarge the government deficit. Spiraling effects are not very strong initially, but tend to amplify over time, and if the government spending continues to exceed revenue, inflation increases gradually and brings with it the risk of total collapse. Inflation can be brought down within a few months, however, albeit with rather sharp oscillating movements. Over time, government revenue and expenditure would return to their initial levels but the real money stock would have fallen permanently.

These simulations were kept within relatively narrow bands, especially insofar as they incorporated a stabilizing factor in the form of constant mining sector revenue in real terms. Looking at Zaïre's experience, especially during 1992-94, it is clear that the forces at play were much stronger than assumed in the variants above. Thus, during this period, Gécamines' contributions to the budget disappeared altogether, government spending surged as revenue collection fell, and the recourse to domestic bank financing rose to the equivalent of five times the level of revenue in 1992, and three times in 1993. By 1994, the expansion in the domestic assets of the central bank revealed a quasi-fiscal deficit, which produced similar effects (Table 1).

VI. STOPPING HYPERINFLATION

Stopping hyperinflation is no easy task. To reverse its root cause, the government must live within its means, which is precisely what it has been utterly unable to do to start with. Even if a political consensus could emerge, and all parties agreed to join efforts to mobilize government revenue and control expenditure, the constraints might well be such that available means and needs may not be balanced without exceptional measures and/or external assistance. The latter, however, is likely to be forthcoming and on an adequate scale only when clear signs emerge that the authorities have reestablished control over economic and financial developments—that is, when hyperinflation has been halted.

Zaire's predicament during 1995-96 illustrates the difficulty. Major efforts aimed at securing a minimum level of government revenue succeeded in doubling tax revenue collections; expenditure controls were strengthened at the Treasury; and the disorderly issuance of currency was halted. While inflation fell considerably, it was not brought under control. The revenue base proved insufficient to fund core budgetary expenditure as well as the incompressible charges of the Bank of Zaire, and the Bank of Zaire itself was unable to stop issuing currency, part of which paid for the cost of printing currency notes. Inflation resumed an upward trend, which further depressed government revenue, thereby compounding the difficulty of stabilizing the economy.

In retrospect, Zaire's revenue base in 1995 or 1996 fell short of the minimum required to halt hyperinflation by at least one-third. While treasury revenue was on the order of US\$300 million in 1995, considerably more resources would have been needed to balance the consolidated government sector accounts. Even considering that the economy contracted by some 40 percent in real terms between 1989 and 1995, and taking into account the much-reduced production capacities in the mining sector, the potential probably existed to collect higher tax revenue, but this would have required restoring a strong tax system, or at least a return to the level of efficiency that prevailed in the late 1980s. This was probably not within the realm of possibility, as the administration had been wrecked by five years of hyperinflation and unsettled political conditions.²¹

Stopping Zaire's hyperinflation would require extraordinary action, designed not only to halt the monetary financing of government deficits, but also to ensure the credibility of government policies. In effect, therefore, the authorities must play on both the variables and parameters of the system, with a view to reducing government expenditure, improving revenue collections and providing an anchor for low price expectations. With this end in mind, temporary price and wage norms might play a useful, but merely complementary, role in stopping hyperinflation,²² this too, however, has been ruled out in Zaire, not only because of the rudimentary structure of the economy, but also because of the government's lack of authority to enforce such norms. There is therefore no alternative to facing the problems that have been at the root of hyperinflation itself. This requires a comprehensive approach that addresses all the elements that were listed in equation (3) above:

Inflationary expectations: Inflationary expectations in Zaire may be lowered only if a genuine stabilization program is launched in a credible manner, preferably with external support. In

²¹Thus, in 1996, a vacancy at the head of the customs department remained unfilled for many months, mainly reflecting the political parties' insistence on apportioning the distribution of key positions according to the political spectrum.

²²Wage and price controls have been typically relied upon in the context of exchange rate-based stabilization. See IMF [1996b], p. 113.

turn, this would presuppose a solution to the political stalemate that has plagued the country since 1990.

Currency: The issuance of currency should halt completely and abruptly (to help break inflationary expectations), which requires the elimination of the public sector deficit. Given the problems facing the Bank of Zaïre, a new monetary arrangement may need to be found, either through the establishment of a currency board²³ (provided that assistance is available to fund the start-up reserves), or through a halt in currency issue, at least on a temporary basis; in the latter case, the economy would have to operate with the existing stocks of monies (including foreign currency notes). This could well reinforce the trend toward the dollarization of the economy, unless, however, government revenue collection improves markedly.

Government revenue: To fund expenditure, Zaïre's government must mobilize revenue beyond the minimum threshold that covers wages and other core current outlays (about US\$400 million). This necessitates strong action to revitalize revenue collection agencies, but exceptional measures (such as a flat tax surcharge on domestically produced and imported goods, with no exemptions allowed) may be needed as well, which in turn require that the government has the political authority to enforce them.

This set of requirements clearly points to the need *to change the rules of the game* as regards the way fiscal and monetary policies are conducted (see Sargent [1982], pp. 89-90). Zaïre's experience in the 1990s has shown that the (general) government had considerable difficulty in balancing its financial operations, which calls for systemic changes to ensure that it *cannot* spend more than it earns. The surest way to achieve this aim is to bar the authorities' access to monetary financing through a temporary halt of all currency issue, followed by the adoption of a restrictive arrangement such as a currency board as soon as conditions permit.

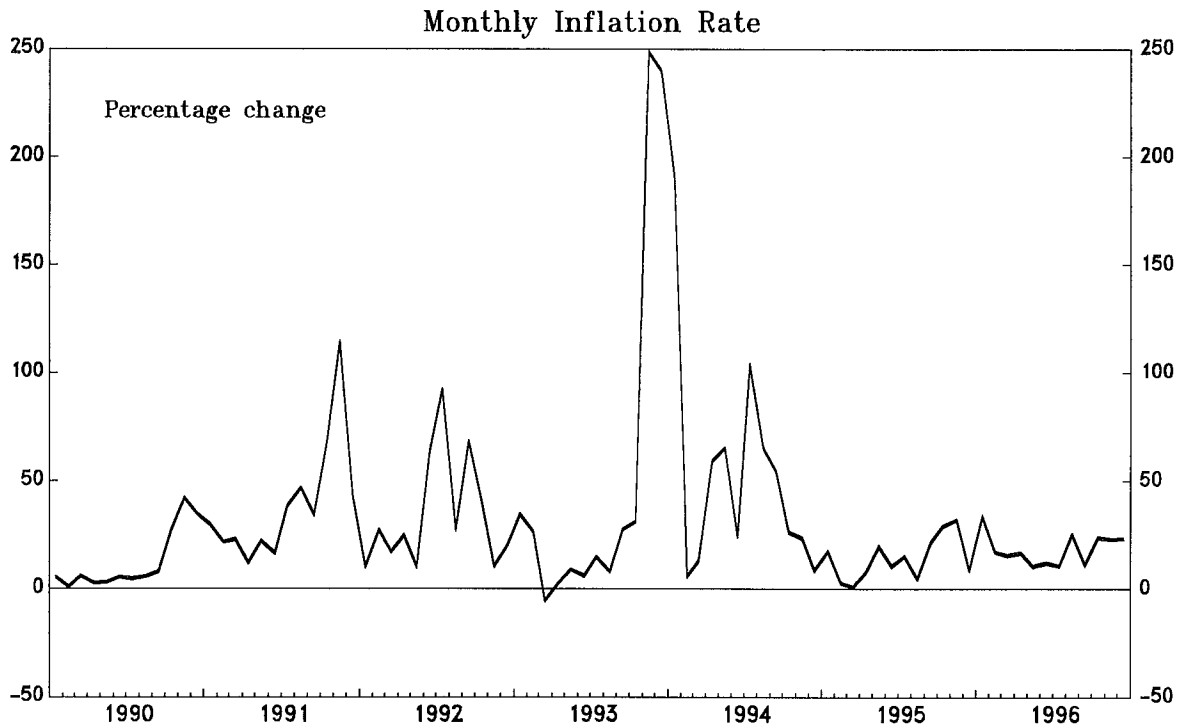
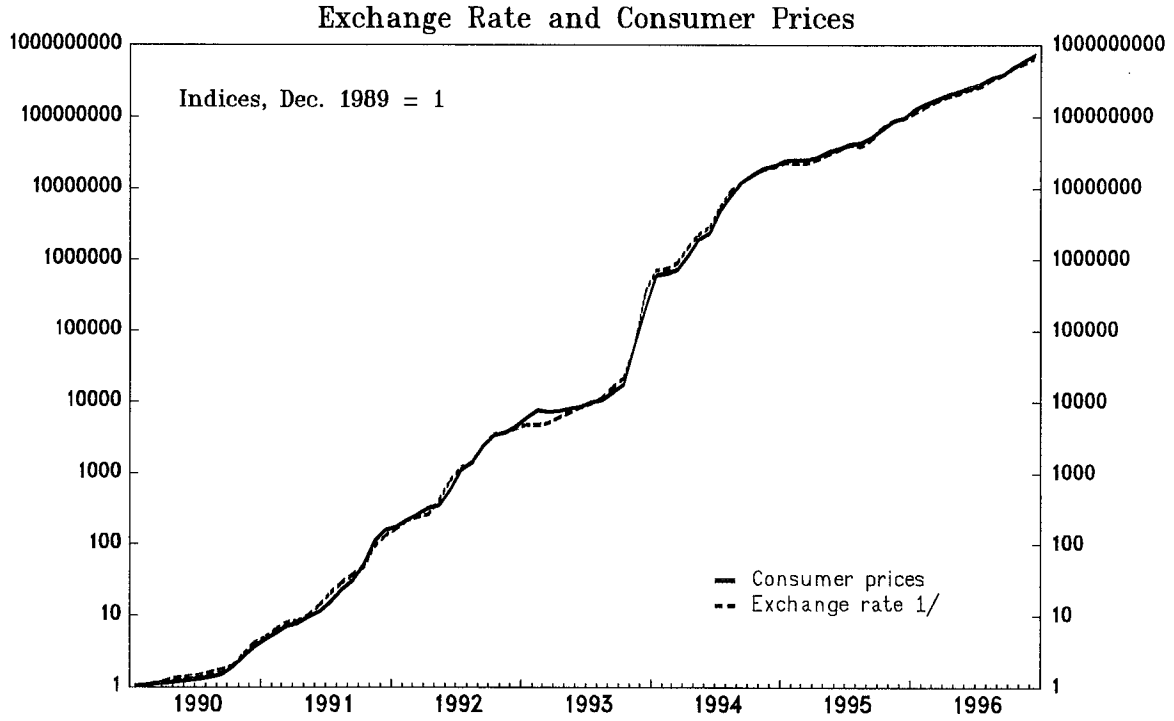
Once genuine stabilization measures are implemented in a forceful manner, inflation would drop rapidly and durably. The estimates presented in this paper are consistent with the experience of other countries, and suggest that disinflation would take no more than a few months, although fluctuations in the inflation rate would persist until expectations stabilize at a lower level. At this point, the authorities could begin to focus on the launching of a comprehensive adjustment program, with a view to rebuilding the economy and fulfilling Zaïre's vast growth potential.

²³Recent experience with currency boards is reviewed in Bennett [1994].

Figure 1

ZAIRE

Exchange Rate and Price Developments



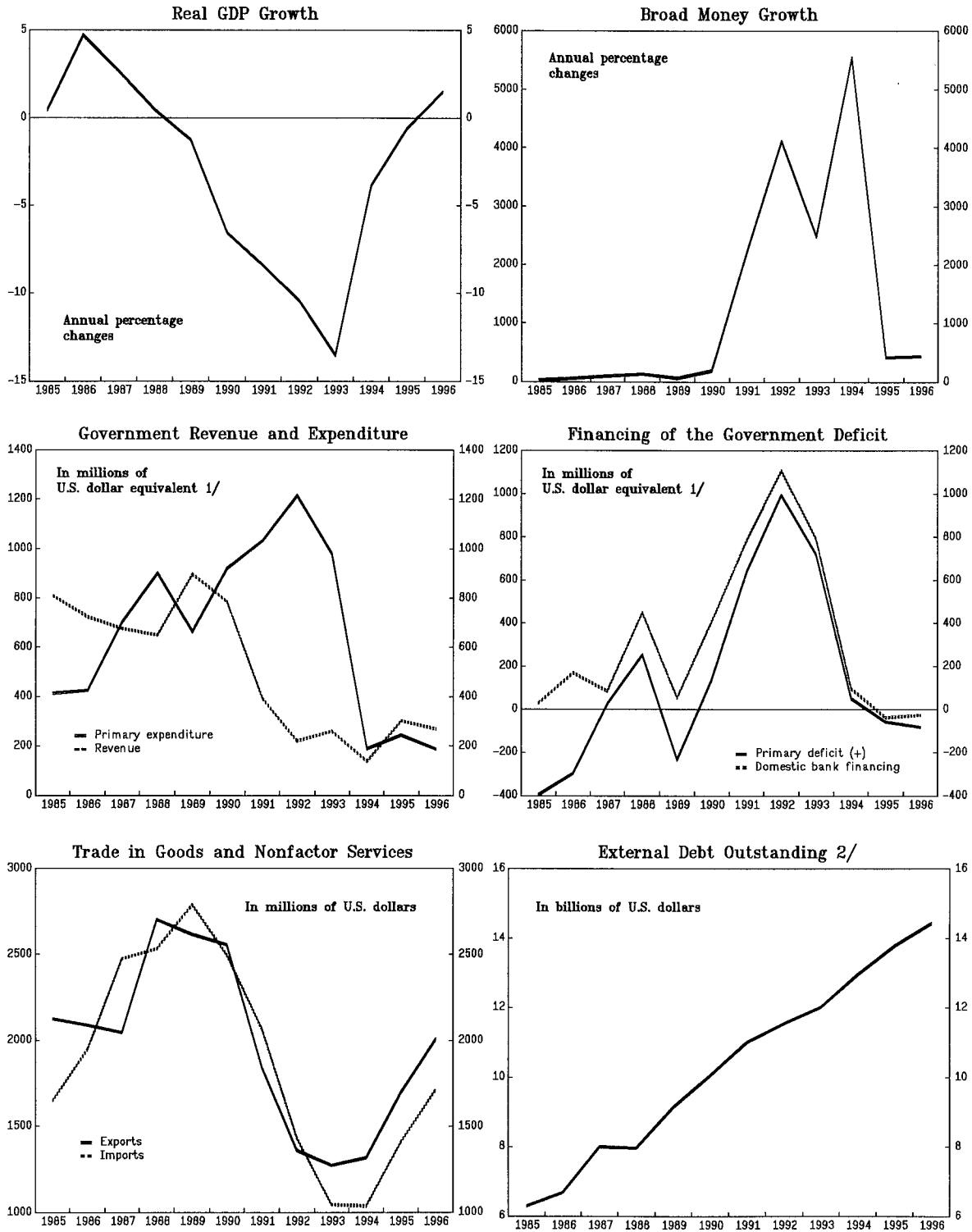
Sources: Data provided by the Zairian authorities; and staff estimates.

1/ Parallel exchange rate, in terms of old zaires. The new zaire was introduced in October 1993, at a parity of NZ 1 = Z 3,000,000; later data have been rescaled accordingly.

Figure 2

ZAIRE

Selected Economic and Financial Indicators



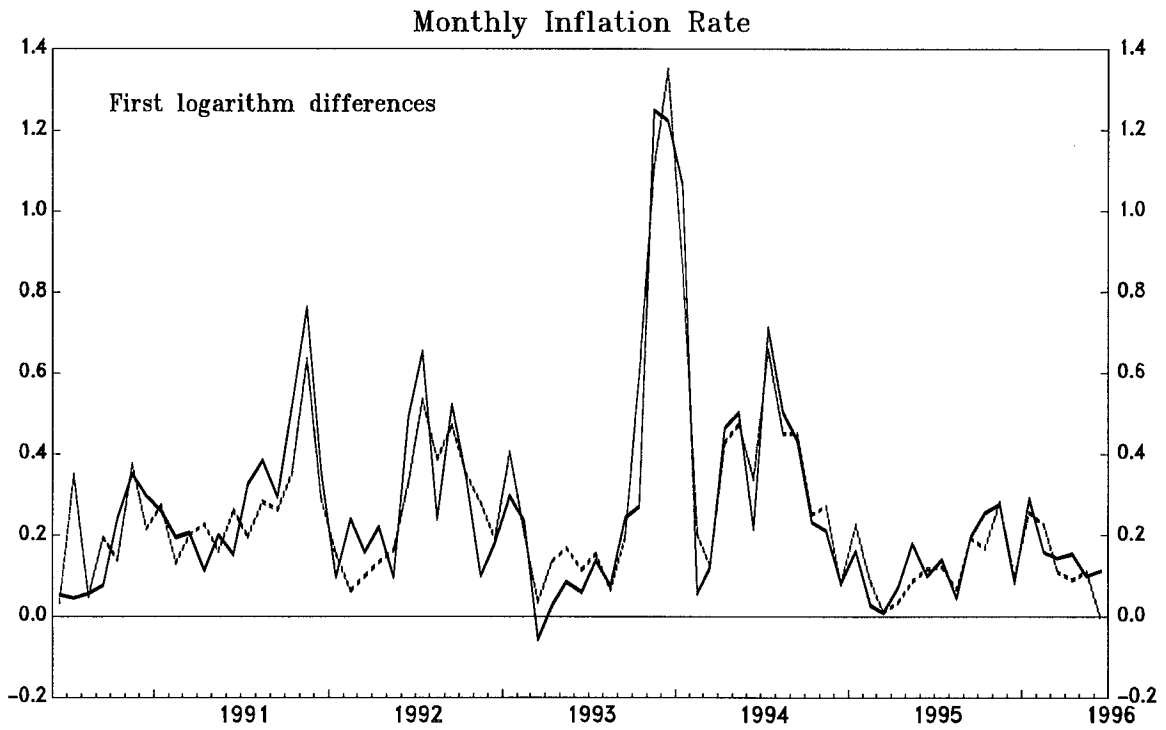
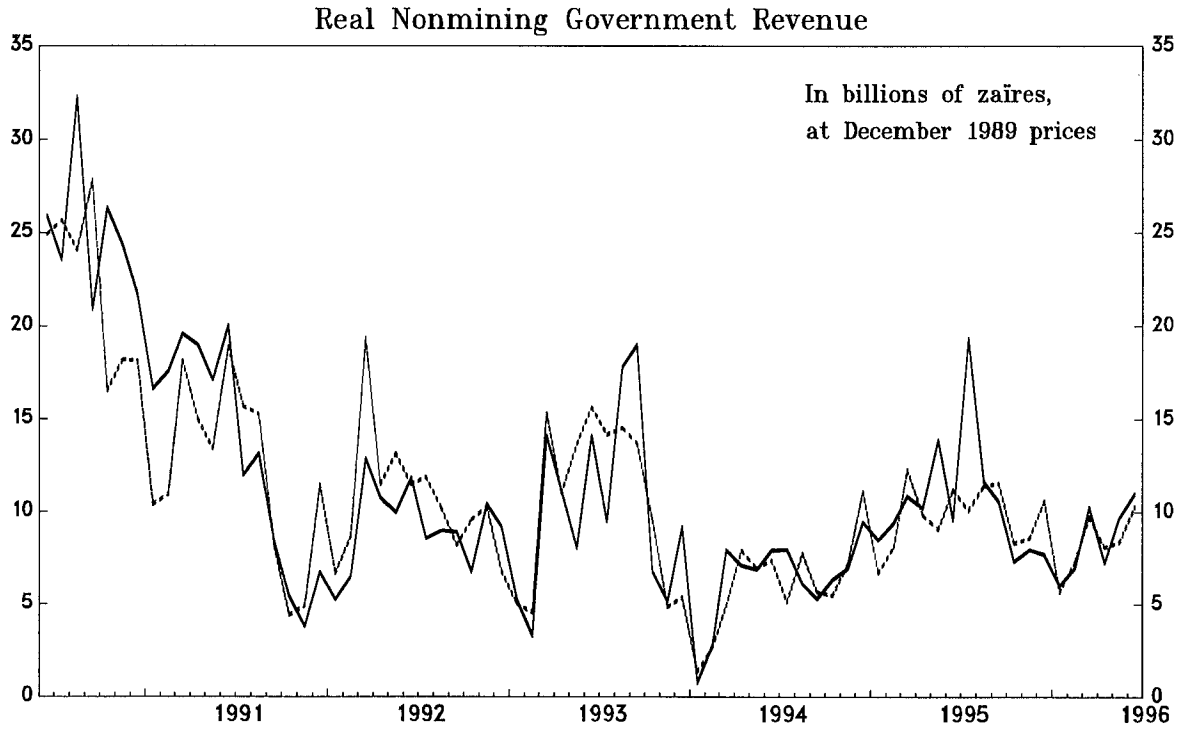
Sources: Data provided by the Zairian authorities; and staff estimates.

1/ U.S. dollar equivalent based on monthly data converted at the parallel exchange rate.

2/ Including capitalized late interest.

Figure 3

Model Estimates

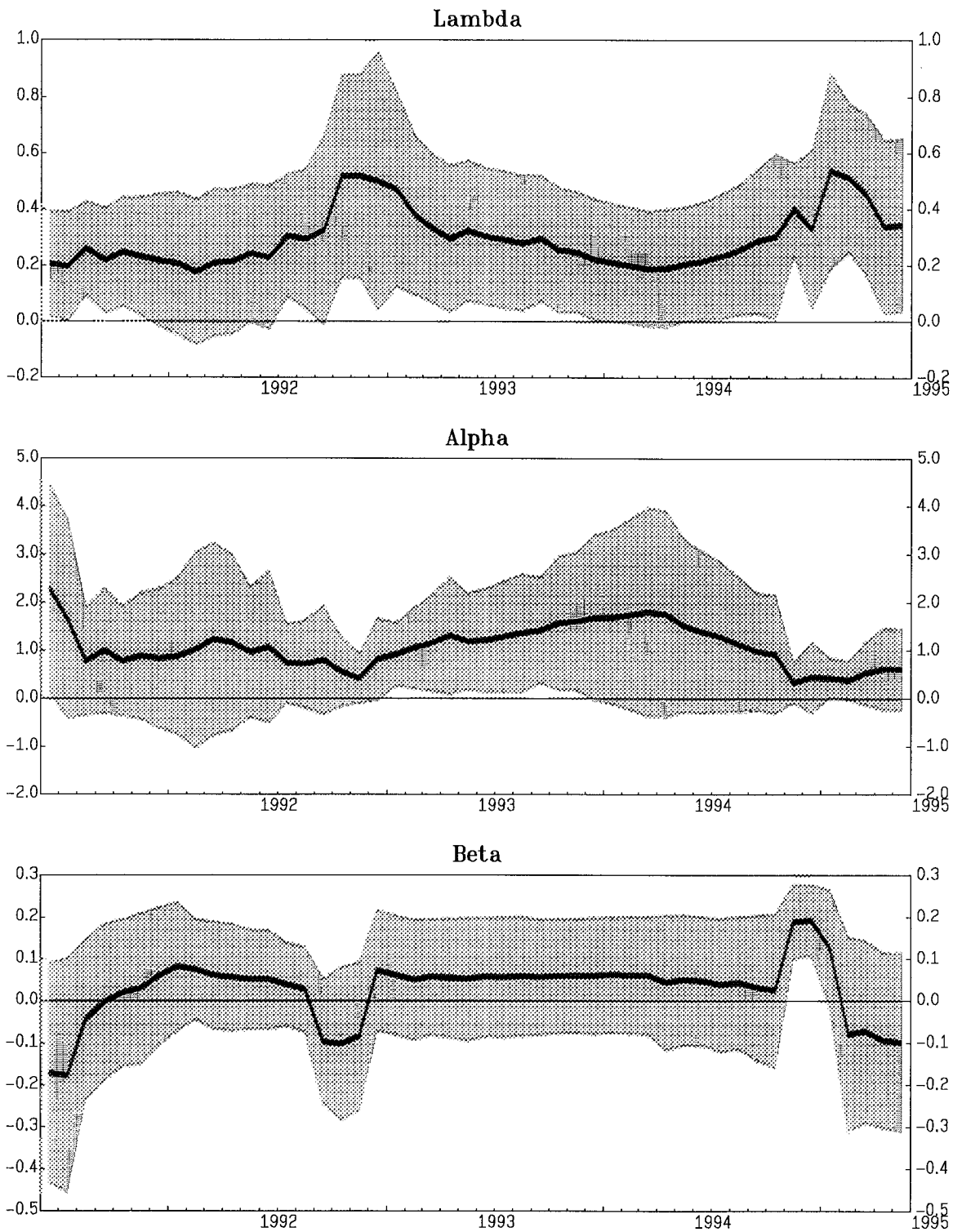


Source: Staff estimates.

Figure 4

Recursive Estimates of Coefficients

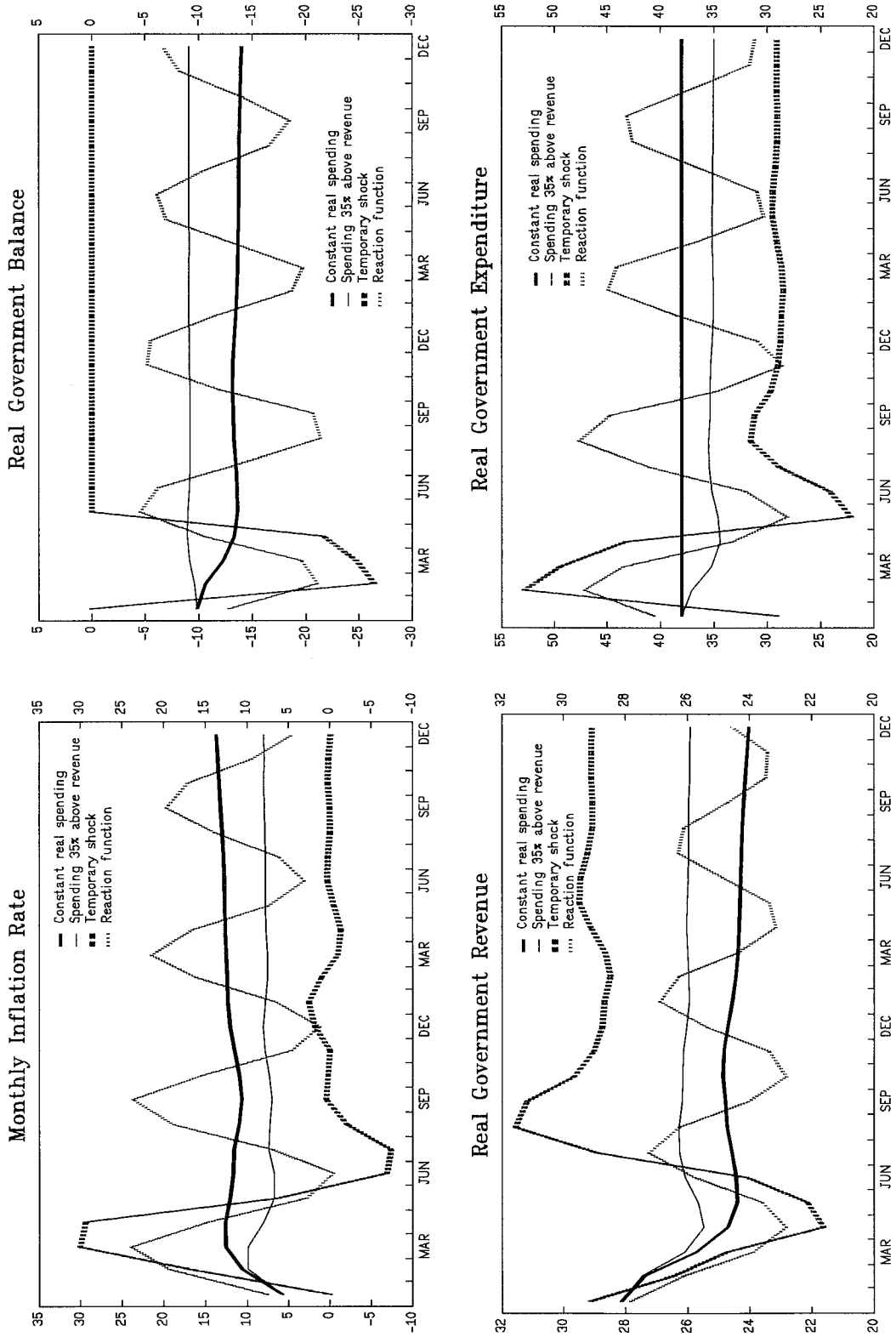
(June 1990-July 1992 to May 1994-June 1996) 1/



1/ Coefficient and 5 percent confidence intervals (coefficient \pm two standard deviations). Regression estimates over 25-month periods, with dates centered.

Figure 5

Model Simulations



Source: Staff estimates.

Table 1. Zaïre: Basic Data

Area, population, and GDP per capita

Area	2,345,000 square kilometers							
Population								
Total (1995 estimate)	40.8 million							
Annual growth rate	2.9 percent							
GDP per capita (1995 estimate)	SDR 112 (US\$170)							

	1989	1990	1991	1992	1993	1994	1995 Prov.	1996 Est.
--	------	------	------	------	------	------	---------------	--------------

	(In units indicated)							
National accounts								
Real GDP growth (in percent)	-1.3	-6.6	-8.4	-10.5	-13.5	-3.9	-0.6	1.5
GDP at current prices (in millions of U.S. dollars, at 1985 PPP)	8,599	8,641	8,267	7,525	6,764	6,646	6,944	7,319

	(In percent of GDP)							
Consumption	85.0	90.7	98.2	93.9	96.0	89.0	90.1	88.0
Gross capital formation	14.3	9.1	5.6	6.9	1.8	7.9	7.4	10.1
Net exports of goods and nonfactor services	0.7	0.3	-3.7	-0.8	2.2	3.1	2.5	1.9

	(Annual percentage change)							
Prices								
Index of consumer prices								
Year-end to year-end	56.1	265.0	4,228.0	2,729.8	4,583.1	9,796.9	370.3	657.2
Annual average	104.1	81.3	2,154.4	4,129.2	1,893.1	23,760.5	541.8	610.6
Export unit values (U.S. dollars)	3.2	0.8	-1.3	11.0	1.4	18.7	8.2	-3.0
Import unit values (U.S. dollars)	1.1	9.0	-4.3	2.5	-6.5	5.4	10.5	-1.9
Terms of trade	2.1	-7.5	3.1	8.4	8.4	12.6	-2.1	-1.1

	(In millions of U.S. dollars, based on monthly data converted at the parallel exchange rate)							
Central government finance								
Revenue	896.4	785.2	391.5	220.7	259.2	137.7	301.3	269.2
Of which: Gécamines	(317.2)	(186.9)	(100.3)	(--)	(--)	(--)	(31.8)	(32.0)
Expenditure and net lending	1,699.9	1,922.4	1,911.4	1,996.3	1,738.5	1,050.3	1,141.3	1,027.7
Interest due	482.2	609.6	636.1	725.5	733.0	720.8	744.4	779.9
Other current expenditure	612.6	860.4	922.5	1,073.4	849.6	164.6	228.1	163.9
Capital expenditure	605.1	452.4	352.7	197.5	155.9	164.8	168.8	83.8
Overall financing requirement (-)	-803.5	-1,137.2	-1,519.9	-1,775.7	-1,479.2	-912.5	-840.0	-758.5
Of which: domestic bank financing	(53.8)	(406.0)	(787.1)	(1,107.1)	(793.6)	(96.5)	(-37.1)	(-25.6)

	(In trillions of zaires, trillions of new zaires starting in 1994)							
Money and credit								
Foreign assets (net)	-0.222	-1.169	-39.65	-1,175.0	-62,510	-2.015	-10.124	-74.306
Net domestic assets	0.152	0.711	21.26	709.6	18,645	0.209	1.473	7.464
Net credit to government	0.086	0.549	23.20	706.4	12,506	0.156	0.109	-1.433
Credit to the private sector	0.074	0.154	2.39	51.5	1,041	0.083	0.564	3.768
Other net domestic assets	-0.007	0.008	-4.33	-48.3	5,098	-0.029	0.800	5.129
Money and quasi-money	0.274	0.785	18.28	770.7	19,904	0.375	1.928	10.354
Of which: currency outside banks	(0.153)	(0.427)	(10.85)	(364.3)	(14,078)	(0.277)	(1.684)	(8.664)
Velocity of circulation (level)	17.2	17.5	26.9	26.4	14.5	48.0	60.9	68.0

	(Change in percent of money stock at beginning of period)							
Net domestic assets	-7.5	204.2	2,618.8	3,765.1	2,327.1	3,056.8	337.4	310.8
Of which: net credit to government	(-19.3)	(169.2)	(2,887.3)	(3,737.2)	(1,531.0)	(2,284.4)	(-12.3)	(-80.0)
credit to private sector	(17.7)	(29.4)	(284.9)	(268.5)	(128.4)	(1,240.0)	(128.5)	(166.2)
Money and quasi-money	61.1	186.8	2,230.0	4,115.7	2,482.5	5,546.2	414.6	437.1

Table 2 (continued). Simulations of Model: Variant B -- Spending 35 Percent Above Revenue

t	Price index	Government revenue		Gov. spending	Gov. balance	Money stock	Price index	Government revenue		Gov. spending	Gov. balance	Money stock
		Total	Of which: nonmining					Total	Of which: nonmining			
0	3.0	87.4	(77.4)	87.4	0.0	428.8	(Index)	87.4	(77.4)	87.4	0.0	428.8
1	3.2	89.3	(78.7)	120.5	-31.2	460.0	(Percentage changes)	84.4	(74.4)	113.9	-29.5	435.0
2	3.5	95.7	(84.1)	129.2	-33.5	493.5		82.4	(72.4)	111.2	-28.8	424.6
3	3.8	100.0	(87.3)	135.0	-35.0	528.4		78.3	(68.3)	105.7	-27.4	413.6
4	4.1	105.5	(91.7)	142.4	-36.9	565.3		76.5	(66.5)	103.2	-26.7	409.7
5	4.4	113.4	(98.7)	153.0	-39.7	604.9		77.0	(67.0)	103.9	-26.9	410.8
6	4.7	122.9	(107.3)	166.0	-43.0	647.9		78.2	(68.2)	105.6	-27.4	412.2
7	5.1	133.0	(116.1)	179.5	-46.5	694.4		78.8	(68.8)	106.4	-27.6	411.5
8	5.4	142.7	(124.6)	192.6	-49.9	744.2		78.8	(68.9)	106.4	-27.6	411.2
9	5.8	152.1	(132.7)	205.3	-53.2	797.4		78.5	(68.5)	106.0	-27.5	411.8
10	6.2	163.1	(142.4)	220.2	-57.1	854.5		78.5	(68.5)	105.9	-27.5	411.1
11	6.7	175.7	(153.3)	237.2	-61.5	915.9		78.4	(68.4)	105.8	-27.4	408.7
12	7.3	189.1	(164.9)	255.3	-66.2	982.1		78.1	(68.1)	105.4	-27.3	405.6
13	7.8	203.3	(177.2)	274.4	-71.1	1,053.2		77.9	(67.9)	105.1	-27.2	403.3
14	8.4	218.6	(190.6)	295.1	-76.5	1,129.7		77.9	(67.9)	105.1	-27.2	402.3
15	9.1	235.6	(205.4)	318.0	-82.4	1,212.1		78.0	(68.0)	105.3	-27.3	401.3
16	9.8	254.1	(221.6)	343.0	-88.9	1,301.0		78.1	(68.1)	105.4	-27.3	399.8
17	10.5	273.8	(238.8)	369.6	-95.8	1,396.7		78.1	(68.1)	105.4	-27.3	398.2
18	11.3	294.7	(257.0)	397.9	-103.1	1,499.8		78.0	(68.0)	105.2	-27.3	396.7
19	12.2	317.5	(276.7)	428.5	-111.1	1,610.9		77.9	(67.9)	105.2	-27.3	395.3
20	13.2	342.3	(298.4)	462.1	-119.8	1,730.6		77.9	(67.9)	105.1	-27.3	393.8
21	14.2	369.3	(321.9)	498.6	-129.3	1,859.9		77.9	(67.9)	105.1	-27.2	392.1
22	15.4	398.4	(347.2)	537.9	-139.4	1,999.3		77.8	(67.8)	105.0	-27.2	390.4
23	16.6	429.8	(374.6)	580.2	-150.4	2,149.7		77.8	(67.8)	105.0	-27.2	388.9
24	17.9	463.9	(404.2)	626.2	-162.3	2,312.0		77.7	(67.7)	104.9	-27.2	387.4
36	46.0	1,186.1	(1,032.8)	1,601.1	-415.1	5,658.9		77.3	(67.3)	104.4	-27.1	369.0
48	123.6	3,168.6	(2,756.7)	4,277.4	-1,108.8	14,448.6		76.9	(66.9)	103.8	-26.9	350.6
60	348.9	8,884.0	(7,722.0)	11,992.8	-3,108.8	38,639.3		76.4	(66.4)	103.1	-26.7	332.2
72	1,039.2	26,274.1	(22,812.2)	35,469.1	-9,195.0	108,754.7		75.9	(65.9)	102.4	-26.5	314.0

Table 2 (continued). Simulations of Model: Variant C -- Temporary Shock at Time $t = 2$

t	Price index	Government revenue Total	Gov. spending	Gov. balance	Money stock	Price index	Government revenue Total	Gov. spending	Gov. balance	Money stock	
	(Index)		(In billions of zaires)			(Percentage changes)		Of which: nonmining			
0	December	87.4	87.4	0.0	428.8		87.4	(77.4)	87.4	0.0	428.8
1	January	3.0	87.4	87.4	428.8	0.0	87.4	(77.4)	87.4	0.0	428.7
2	February	3.5	92.7	185.3	521.4	16.8	79.3	(69.3)	158.6	-79.3	446.3
3	March	4.6	112.8	225.5	634.1	30.0	74.2	(64.2)	148.5	-74.2	417.5
4	April	5.9	127.5	255.0	761.5	29.4	64.9	(54.9)	129.7	-64.9	387.4
5	May	6.3	138.9	138.8	761.5	6.3	66.4	(56.5)	66.4	0.0	364.4
6	June	5.8	140.7	140.7	761.5	-6.9	72.4	(62.4)	72.4	0.0	391.6
7	July	5.4	156.2	156.1	761.4	-7.4	86.7	(76.7)	86.7	0.0	422.9
8	August	5.3	166.9	166.9	761.4	-2.1	94.7	(84.7)	94.7	0.0	431.9
9	September	5.3	165.7	165.7	761.3	0.4	93.6	(83.6)	93.6	0.0	430.0
10	October	5.3	157.9	157.9	761.3	0.2	89.0	(79.0)	89.0	0.0	429.1
11	November	5.3	154.5	154.4	761.3	-0.0	87.1	(77.1)	87.1	0.0	429.1
12	December	5.4	155.8	155.8	761.2	1.8	86.3	(76.3)	86.3	0.0	421.4
13	January	5.6	159.4	159.4	761.2	2.6	86.0	(76.1)	86.0	0.0	410.9
14	February	5.6	159.9	159.9	761.2	1.0	85.4	(75.5)	85.4	0.0	406.8
15	March	5.6	159.2	159.2	761.1	-1.0	85.9	(76.0)	85.9	0.0	410.8
16	April	5.5	159.7	159.7	761.1	-1.4	87.4	(77.4)	87.4	0.0	416.4
17	May	5.5	160.9	160.9	761.0	-0.5	88.5	(78.5)	88.5	0.0	418.5
18	June	5.5	161.2	161.1	761.0	0.3	88.4	(78.4)	88.3	0.0	417.2
19	July	5.5	160.3	160.3	761.0	0.2	87.7	(77.7)	87.7	0.0	416.2
20	August	5.5	159.4	159.3	760.9	-0.0	87.2	(77.2)	87.2	0.0	416.4
21	September	5.5	159.4	159.4	760.9	0.0	87.2	(77.2)	87.2	0.0	416.3
22	October	5.5	159.9	159.9	760.8	0.2	87.3	(77.3)	87.3	0.0	415.4
23	November	5.5	160.2	160.2	760.8	0.2	87.3	(77.3)	87.3	0.0	414.6
24	December	5.5	160.0	160.0	760.8	-0.1	87.3	(77.3)	87.3	0.0	414.9
36	December	5.5	159.9	159.9	760.3	-0.0 $\frac{1}{2}$	87.4	(77.5)	87.4	0.0	415.7
48	December	5.5	159.8	159.8	759.8	-0.0 $\frac{1}{2}$	87.4	(77.4)	87.4	0.0	415.7
60	December	5.5	159.7	159.7	759.3	-0.0 $\frac{1}{2}$	87.4	(77.4)	87.4	0.0	415.7
72	December	5.5	159.6	159.6	758.9	-0.0 $\frac{1}{2}$	87.4	(77.4)	87.4	0.0	415.7

Table 2 (concluded). Simulations of Model: Variant D -- Reaction Function on Government Spending

t	Price index	Government revenue		Gov. spending	Gov. balance	Money stock	Price index	Government revenue		Gov. spending	Gov. balance	Money stock
		Total	Of which: nonmining					Total	Of which: nonmining			
0	3.0	87.4	(77.4)	87.4	0.0	428.8	(Index)	87.4	(77.4)	87.4	0.0	428.8
1	3.2	89.9	(79.1)	131.2	-41.3	470.1	(Percentage changes)	83.5	(73.5)	121.9	-38.4	436.9
2	3.9	100.6	(87.7)	181.8	-81.2	551.2		78.3	(68.3)	141.6	-63.2	429.3
3	4.8	114.0	(98.1)	207.6	-93.6	644.7		71.7	(61.6)	130.5	-58.8	405.3
4	5.5	124.9	(106.7)	182.2	-57.3	702.0		68.5	(58.5)	99.9	-31.4	384.9
5	5.6	132.8	(114.0)	158.2	-25.5	727.5		70.8	(60.8)	84.4	-13.6	387.9
6	5.6	144.5	(125.8)	179.4	-34.9	762.4		77.4	(67.4)	96.1	-18.7	408.3
7	6.0	163.2	(143.2)	246.3	-83.1	845.4		81.7	(71.7)	123.4	-41.6	423.5
8	7.1	186.9	(163.2)	339.2	-152.3	997.7		78.8	(68.8)	143.0	-64.2	420.6
9	8.8	211.6	(182.2)	393.6	-182.0	1,179.7		72.1	(62.1)	134.2	-62.1	402.2
10	10.2	231.8	(198.0)	352.0	-120.2	1,299.8		68.5	(58.5)	104.0	-35.5	383.9
11	10.6	248.5	(213.1)	303.5	-55.0	1,354.7		70.1	(60.2)	85.7	-15.5	382.5
12	10.8	273.0	(237.2)	332.4	-59.4	1,414.1		76.1	(66.1)	92.7	-16.6	394.4
13	11.4	307.9	(269.8)	440.1	-132.2	1,546.4		80.7	(70.7)	115.3	-34.6	405.2
14	13.3	348.9	(304.7)	596.9	-247.9	1,794.3		78.8	(68.8)	134.7	-56.0	405.1
15	16.1	393.8	(340.1)	711.3	-317.5	2,111.8		73.2	(63.2)	132.2	-59.0	392.6
16	18.8	435.7	(373.1)	685.6	-249.9	2,361.8		69.5	(59.5)	109.4	-39.9	376.8
17	20.2	472.5	(405.2)	613.1	-140.7	2,502.5		70.1	(60.1)	91.0	-20.9	371.5
18	20.8	518.5	(449.1)	645.9	-127.4	2,629.9		74.6	(64.6)	93.0	-18.3	378.6
19	22.1	581.5	(507.9)	812.5	-231.0	2,861.0		78.9	(68.9)	110.2	-31.3	388.1
20	25.2	658.0	(574.2)	1,074.1	-416.1	3,277.1		78.3	(68.4)	127.9	-49.5	390.2
21	30.2	744.5	(644.1)	1,300.3	-555.8	3,833.0		74.1	(64.1)	129.4	-55.3	381.4
22	35.3	829.3	(711.7)	1,322.8	-493.6	4,326.7		70.4	(60.5)	112.4	-41.9	367.5
23	38.6	905.0	(776.4)	1,222.4	-317.4	4,644.2		70.3	(60.3)	94.9	-24.7	360.7
24	40.4	991.4	(857.1)	1,259.0	-267.6	4,911.9		73.7	(63.7)	93.6	-19.9	365.1
36	151	3,671	(3,169)	4,764	-1,093	17,144		73.1	(63.1)	94.9	-21.8	341.4
48	560	13,686	(11,819)	17,817	-4,131	59,769		73.3	(63.3)	95.4	-22.1	320.1
60	2,075	51,108	(44,195)	66,142	-15,034	207,948		73.9	(63.9)	95.6	-21.7	300.7
72	7,648	190,969	(165,488)	246,871	-55,902	722,221		74.9	(64.9)	96.8	-21.9	283.3

Source: Staff estimates.

1/ Monthly average rate over 12-month period.

Database

(In billions of old zaires, unless mentioned otherwise)

	Zaires per U.S. dollar (parallel market) 1/	Consumer price index (Dec. 1989 = 1) 2/	Government revenue			Government expenditure 4/	Currency outside banks
			Total	Of which: Mining sector 3/	Other		
1990							
January	512.8	1.055	41.8	4.0	37.8	30.2	141.4
February	529.0	1.064	27.8	8.0	19.8	40.5	154.2
March	551.8	1.126	45.1	15.0	30.1	54.2	163.3
April	614.3	1.156	40.7	8.0	32.7	43.2	165.8
May	667.5	1.191	60.4	16.0	44.4	69.2	174.6
June	684.8	1.256	49.4	16.9	32.5	70.8	195.9
July	713.5	1.314	30.9	0.0	30.9	143.7	308.7
August	791.5	1.389	51.0	6.1	44.9	24.8	232.9
September	863.0	1.500	35.4	4.1	31.3	50.4	247.9
October	983.5	1.910	63.6	13.3	50.3	84.4	268.7
November	1,456.9	2.711	97.7	31.6	66.0	172.7	343.8
December	2,066.3	3.650	125.5	46.3	79.2	208.8	427.1
1991							
January	2,468.8	4.73	94.7	16.0	78.7	138.2	470.6
February	3,262.5	5.76	121.1	20.0	101.1	183.0	532.5
March	3,875.0	7.08	153.6	15.0	138.6	357.5	736.4
April	4,175.0	7.93	193.2	42.9	150.4	384.5	927.7
May	5,050.0	9.69	165.6	0.0	165.6	290.4	1,052.5
June	7,000.0	11.29	225.9	0.0	225.9	722.9	1,549.5
July	10,200.0	15.61	186.8	0.0	186.8	393.8	1,756.5
August	14,250.0	22.91	300.3	0.0	300.3	1,111.0	2,567.2
September	18,250.0	30.74	257.5	0.0	257.5	610.2	2,919.8
October	23,250.0	51.53	1,191.8	913.8	278.0	3,115.6	4,843.6
November	46,000.0	110.37	1,483.0	1,065.1	417.9	4,789.3	8,149.9
December	65,250.0	157.96	2,510.6	1,448.7	1,061.9	5,206.1	10,845.4
1992							
January	82,500	174.1	913	0	913	1,695	11,628
February	106,250	221.3	1,433	0	1,433	3,761	13,955
March	117,500	259.2	3,331	0	3,331	7,640	18,263
April	128,500	323.2	3,470	0	3,470	9,094	23,888
May	209,750	356.1	3,543	0	3,543	11,930	32,275
June	392,500	581.6	6,869	0	6,869	29,251	54,657
July	595,000	1,117.8	9,568	0	9,568	50,388	95,476
August	687,500	1,422.7	12,755	0	12,755	51,943	134,665
September	1,192,500	2,394.5	21,290	0	21,290	77,749	191,124
October	1,712,500	3,373.8	22,722	0	22,722	80,529	248,931
November	1,825,000	3,728.1	38,748	0	38,748	70,636	280,819
December	2,112,500	4,469.9	40,942	0	40,942	124,421	364,297
1993							
January	2,350,000	6,012	31,384	0	31,384	107,635	440,548
February	2,337,500	7,599	24,982	0	24,982	64,279	479,845
March	2,462,500	7,181	101,083	0	101,083	142,184	520,946
April	2,975,000	7,375	82,142	0	82,142	259,138	697,942
May	3,450,000	8,032	64,516	0	64,516	149,060	782,486
June	4,100,000	8,530	120,287	0	120,287	184,105	846,304
July	4,650,000	9,792	92,375	0	92,375	235,692	989,621
August	5,625,000	10,575	188,131	0	188,131	239,853	1,041,343
September	7,875,000	13,483	255,854	0	255,854	388,966	1,174,455
October	10,600,000	17,677	119,533	0	119,533	1,349,382	2,404,305
November	30,000,000	61,586	317,268	0	317,268	2,661,961	4,748,998
December	177,000,000	209,331	1,915,437	0	1,915,437	11,245,440	14,079,000

Database

(In billions of old zaïres, unless mentioned otherwise)

	Zaïres per U.S. dollar (parallel market) 1/	Consumer price index (Dec. 1989 = 1) 2/	Government revenue			Government expenditure 4/	Currency outside banks
			Total	Of which: Mining sector 3/	Other		
1994							
January	3.555E+08	6.069E+05	4.650E+05	0.000E+00	4.650E+05	2.913E+06	1.653E+07
February	3.675E+08	6.414E+05	1.797E+06	0.000E+00	1.797E+06	5.574E+06	2.030E+07
March	4.500E+08	7.242E+05	5.739E+06	0.000E+00	5.739E+06	1.694E+07	3.150E+07
April	7.500E+08	1.151E+06	8.148E+06	0.000E+00	8.148E+06	2.890E+07	5.225E+07
May	1.110E+09	1.900E+06	1.302E+07	0.000E+00	1.302E+07	3.617E+07	7.540E+07
June	1.410E+09	2.360E+06	1.865E+07	0.000E+00	1.865E+07	6.410E+07	1.208E+08
July	2.640E+09	4.804E+06	3.821E+07	0.000E+00	3.821E+07	1.588E+08	2.415E+08
August	4.575E+09	7.927E+06	4.832E+07	0.000E+00	4.832E+07	1.290E+08	3.222E+08
September	6.000E+09	1.224E+07	6.480E+07	0.000E+00	6.480E+07	2.000E+08	4.573E+08
October	7.500E+09	1.545E+07	9.784E+07	0.000E+00	9.784E+07	2.225E+08	5.820E+08
November	9.150E+09	1.909E+07	1.327E+08	0.000E+00	1.327E+08	2.501E+08	6.994E+08
December	9.975E+09	2.072E+07	1.955E+08	0.000E+00	1.955E+08	3.274E+08	8.313E+08
1995							
January	1.144E+10	2.435E+07	2.067E+08	0.000E+00	2.067E+08	2.804E+08	9.049E+08
February	1.125E+10	2.502E+07	2.347E+08	0.000E+00	2.347E+08	3.033E+08	9.736E+08
March	1.122E+10	2.523E+07	2.911E+08	1.753E+07	2.736E+08	3.823E+08	1.065E+09
April	1.279E+10	2.712E+07	3.060E+08	2.944E+07	2.766E+08	4.432E+08	1.202E+09
May	1.508E+10	3.247E+07	4.970E+08	4.602E+07	4.509E+08	7.193E+08	1.424E+09
June	1.725E+10	3.590E+07	4.974E+08	1.541E+08	3.433E+08	9.167E+08	1.843E+09
July	1.995E+10	4.132E+07	7.980E+08	0.000E+00	7.980E+08	1.110E+09	2.156E+09
August	1.924E+10	4.321E+07	5.970E+08	9.404E+07	5.029E+08	8.127E+08	2.372E+09
September	2.469E+10	5.264E+07	6.293E+08	7.369E+07	5.557E+08	1.344E+09	3.086E+09
October	3.525E+10	6.795E+07	5.894E+08	9.121E+07	4.982E+08	1.108E+09	3.605E+09
November	4.397E+10	8.963E+07	8.304E+08	1.170E+08	7.134E+08	1.442E+09	4.216E+09
December	4.762E+10	9.743E+07	8.837E+08	1.334E+08	7.503E+08	1.720E+09	5.052E+09
1996							
January	5.768E+10	1.302E+08	8.573E+08	7.754E+07	7.798E+08	1.470E+09	5.665E+09
February	7.039E+10	1.525E+08	1.312E+09	2.463E+08	1.066E+09	2.520E+09	6.872E+09
March	8.263E+10	1.762E+08	1.811E+09	0.000E+00	1.811E+09	2.453E+09	7.514E+09
April	9.514E+10	2.056E+08	1.489E+09	0.000E+00	1.489E+09	2.670E+09	8.695E+09
May	1.038E+11	2.272E+08	2.202E+09	0.000E+00	2.202E+09	4.391E+09	1.088E+10
June	1.192E+11	2.544E+08	2.793E+09	0.000E+00	2.793E+09	3.712E+09	1.180E+10

Sources: Data provided by the Bank of Zaïre; and staff estimates.

1/ Monthly averages based on weekly (through 1993) or daily data (since 1994). The new zaïre was introduced in October 1993, at a parity of NZ 1 = Z 3,000,000; later data have been rescaled accordingly.

2/ Consumer prices in Kinshasa (IRES index through December 1995; Bank of Zaïre index from January 1996 onward).

3/ Gécamines' contributions to the budget.

4/ Residual item, defined such that the government deficit fully accounts for the increase in the money stock.

References

- Bank of Zaïre: *Rapport annuel*, various years through 1995.
- Bank of Zaïre: *Bulletin mensuel de statistiques*, various periods through September 1996.
- Bank of Zaïre: *Condensé d'informations statistiques* (weekly), various periods through September 1996.
- Bennett, Adam G. G. [1994]: "Currency Boards: Issues and Experiences," IMF Paper on Policy Analysis and Assessments, No. 94/18, Washington, DC (September).
- Cagan, Phillip [1956]: "The Monetary Dynamics of Hyperinflation," in *Studies in the Quantity Theory of Money*, Milton Friedman (ed.), The University of Chicago Press.
- Doornik, Jurgen A., and Hendry, David F. [1995]: "PC-Give 8.0—An Interactive Econometric Modelling System," Chapman and Hall.
- Dornbush, Rudiger, and Fischer, Stanley [1986]: "Stopping Hyperinflations Past and Present," *Weltwirtschaftliches Archiv*, No. 122, 1-46.
- Heymann, Daniel, and Leijonhufvud, Axel [1995]: *High Inflation—The Arne Ryde Memorial Lectures*, Oxford, Clarendon Press.
- IMF [1996a]: "Zaïre: Background Information and Statistical Data," IMF Country Report No. 96/28, Washington, DC (February).
- IMF [1996b]: "The Rise and Fall of Inflation—Lessons from the Post-War Experience," in *World Economic Outlook, October 1996*, 100-31.
- Keynes, John Maynard [1919]: *The Economic Consequences of the Peace*, The Collected Writings of John Maynard Keynes, Vol. II, Macmillan / St Martin's Press (1971).
- Meditz, Sandra W., and Merrill, Tim [1994]: *Zaïre—A Country Study*, edited by Sandra W. Meditz and Tim Merrill, Library of Congress, Washington, DC.
- Olivera, Julio [1967]: "Money, Prices, and Fiscal Lags: A Note on the Dynamics of Inflation," *Banca Nazionale del Lavoro Quarterly Review*, No. 20, 258-67 (September).
- Sargent, Thomas J. [1982]: "The Ends of Four Big Inflations," in *Inflation: Causes and Effects*, Robert E. Hall (ed.), The University of Chicago Press.
- Tanzi, Vito [1977]: "Inflation, Lags in Collection, and the Real Value of tax Revenue," *IMF Staff Papers*, 24:1, 154-67 (March).
- Végh, Carlos A. [1992]: "Stopping High Inflation," *IMF Staff Papers*, 39:3, 626-95 (September).