

**HOW LONG CAN INFLATION TAX COMPENSATE FOR THE LOSS
OF GOVERNMENT REVENUE IN WAR ECONOMIES? EVIDENCE
FROM BURUNDI[▲]**

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Abstract

The paper shows that civil war in Burundi in the 1990s has provoked an unprecedented decline in government revenue. Both foreign aid transfers and revenue from domestic sources dried up, inducing the government to rely more on inflation tax. Using quarterly data covering the period from 1980:1 to 2002:4 to measure the sensitivity of money demand to inflation we find that the long-run semi-elasticity of inflation to real money in circulation trebled between the pre-war to the war period. The remarkable increase of the semi-elasticity translates what is known in the literature as economic agents' 'flight from domestic currency', a strategy that limits the government's capacity to use inflation tax to compensate for the loss in more traditional revenue sources. Shedding light on the behaviour of the demand for real money amidst persistent political and economic instability, illustrates the limits of using inflation and money creation as a dependable source of government revenue.

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1. Introduction

As its name suggests, the inflation tax is defined as “the tax imposed on money holders as a result of inflation” [Blanchard and Fischer (1989: 198)]. This definition clearly identifies inflation and the stock of money held by economic agents as two determinants of inflation tax. In this study, we firstly show the extent to which the eruption of war in Burundi in October 1993 led to a remarkable decline of government revenue. Secondly, we establish that the increase in the long-run semi-elasticity (LRSE) of real money demand to inflation between the periods before and during the war induced economic agents to flee from the domestic currency. This strategy limited the government’s ability to use inflation tax as a dependable alternative source of government revenue in periods of political instability. The implication from the analysis is that in cases of prolonged political instability, inflation tax cannot be relied upon as a substitute for the more traditional government revenue sources.

Despite Burundi’s long history of political instability, there is no research on the economic consequences of past and present wars on the country. The thrust of this study is to show that the war that erupted in 1993 created an important regime change with respect to government revenue. Traditionally characterised by low inflation tax, Burundi government relied more and more on this source as its traditional domestic and external revenue sources dried up. It is surprising that empirical studies of the economic impact of regime change have remained

limited despite the centrality of the question for macroeconomic policy [Agénor and Taylor (1992)].¹ This study contributes towards bridging this knowledge gap.

An attempt is made to determine when the policy change due to the war occurred and whether it happened suddenly reflecting a ‘crash’ in the variable of interest, or gradually reflecting a ‘changing growth’ pattern.² This is a useful distinction since a crash suggests that a shock is temporary while a changing growth pattern translates a permanent shock [Perron (1989)].

Burundi is an appropriate case study because it has had periods of relative political stability followed by periods of extreme instability, providing a good sample period to analyse shock-induced policy changes. As Hendry (2001: 20) notes, there is no doubt that “changes in legislation, sudden switches in economic policy, and political turmoil” cause large shocks or “breaks” in the economy. Analysing policy choices based on time series may provide a richer framework than cross-regime tests that rely on cross-sectional evidence. While the latter aggregates a country’s time series information into one point, the former has the potential to use all the information available across a long period of time, including institutional information, to understand the process underlying a regime change.³

¹ Despite the popularity of the Lucas critique in some circles, changes in institutional environments affect policymaking and hence the economy, as we attempt to show using the case of Burundi.

² Throughout the analysis, political instability is assumed to result from an exogenous shock. Ngaruko and Nkurunziza (2003) provide a more detailed discussion of political instability in Burundi as the result of bad socio-political and economic policies.

³ Most of the studies on the subject are cross-sectional and fail to capture the dynamic nature of the incentive structure facing policymakers. They also fail to recognise the potential heterogeneity of the countries in their samples.

In the remainder of the paper, section 2 presents a brief literature review followed by a background of Burundi's economy before and during the war period. In the third section, the study discusses the methodology used to derive the level of maximum inflation tax and the long-run semi elasticity of inflation to money demand. The fourth section discusses the data and attempts to 'date' structural change in the variables of interest. Section 5 discusses empirical econometric results and section 6 concludes.

2. Political Instability, Inflation Tax and Economic Performance

2.1. Review of the Literature and General Background

In the studies of the effect of instability on economic performance, instability has often been defined in terms of the turnover of policy makers [see, for instance, Edwards and Tabellini (1991), Cukierman, *et al.* (1992), Nkurunziza and Bates (2003)]. However, in his empirical study of political instability and economic growth, Ali (2001) argues that the relevant measures of instability should be the volatility of economic policies. The author shows that, using the most common measures, political instability has no discernible effect on growth.

Other proxies of political instability such as the number of assassinations [Easterly and Levine (1997)] or the duration of wars [Collier and Gunning (1999)] do not produce statistically significant results in cross section or panel data models. The non-significance of the instability measures may be attributed to poor proxies used.⁴ Ali (2001) finds that using measures of economic 'policy volatility' explains better the variations in growth across countries.

⁴ For instance, the fact that the vast majority of countries in the sample have never experienced war may explain why the variable measuring war duration comes out insignificant in cross-section or panel data analysis. In this

Nkurunziza and Bates (2003) note that it is strikingly counter-intuitive to conclude that political instability has no impact on economic performance as some studies have suggested. While empirical results on the relationship between economic performance and political instability may be inconclusive when analysing 'mild' cases of instability, there is no doubt that extreme political instability such as civil war has a significant negative impact on economic performance. Collier (1999) discusses why in his five-term summary of the main consequences of civil war on the economy: destruction, disruption, diversion, dissaving, and portfolio substitution. Each of these factors may individually affect economic performance suggesting that their combination compounds the effect.

The fact that the destruction of physical and human capital has direct consequences on the economy does not need elaboration. Furthermore, the disruption of social order and the accompanying suppression of civil liberties hamper service delivery and hence sustained economic activity. Social disorder also affects the capacity of institutions to maintain an optimally organised society. Moreover, the diversion of resources from output-enhancing activities to war and security services reduces productive investment, hurting the economy. In addition, wars usually induce agents to dissave as a response to losses resulting from the three factors above.

Generally, in response to an adverse economic environment created by political turmoil, economic agents engage in portfolio substitution. They switch to foreign currency denominated assets or simply transfer their assets abroad. When it is difficult to switch to foreign currency or foreign assets, agents may over-invest in non-productive sectors such as real estate. The direct

connection, Nkurunziza and Bates (2003) report that zeros represent 85 percent of all observations of the 'war duration' variable, suggesting that there is very little variation.

impact of these portfolio changes is a decline in a country's economy and its tax base. Faced with a dwindling tax base, a government may have no alternative but to increase inflationary tax to fund the war and to ensure continuity in delivery of basic services.⁵

The empirical literature on the use of inflation tax in politically unstable regimes points to a number of reasons why governments use this source of revenue. First, the adoption of policies that reduce inflation may not be incentive-compatible. During periods of political instability opportunistic governments may use inflation tax if reducing inflation is costly in the short term. As a government may not expect to remain in office to reap the benefits of low inflation, it has no incentive to adopt inflation-reducing policies [Edwards and Tabellini (1991)].

Secondly, a collapsing government may choose high inflation to leave a legacy of high instability that would create difficulties and destabilise subsequent governments [Cukierman, *et al.* (1992)]. Thirdly, high inflation may reflect a failure by a weak government to implement inflation-reducing policy reforms when it cannot form consensus within its ranks in favour of the reforms. Fourthly, inflation tax may be an optimal response to transitory unexpected budgetary shocks. In this case, inflation tax is used for tax smoothing purpose [Calvo and Guidotti (1993)]. These different hypotheses suggest that the reasons explaining the use of inflation tax in periods of political instability are context specific.

In Burundi, high inflation and frequent devaluations during the war period have reduced the real value of assets held in domestic currency. However, the cost of switching assets into foreign currency denominated assets is high due to government controls of capital account

⁵ Ending the war may be the first best choice for a government. However, once wars have started, the factors explaining their duration may be different from those explaining their onset. Therefore, even a willing government may be unable to put an end to a war after it has started [see Collier, *et al.* (2004)].

transactions, so it is not easy to move assets across currencies.⁶ Moreover, the single alternative foreign currency-denominated asset available within the economy is foreign cash obtained in the parallel market. Given this context, anecdotal evidence suggests that agents have heavily invested in real estate to protect themselves from the impact of inflation and the depreciation of the Burundi franc. This change in portfolio behaviour may have limited the extent to which the government could tax money holdings.

2.2. War Incidence and its Economic Impact in Burundi

Burundi represents a case of extreme political instability that has led to state failure.⁷ The country has experienced wars in 1965; 1972; 1988; 1991 and 1993 to date. In fact, given the way these conflicts have raised the same unresolved issues arising from previous wars, it is more appropriate to say that the country has experienced five episodes of one civil war. Only the war that started in 1993 has had dramatic consequences on the economy given its exceptional duration relative to all previous episodes. The current episode is in its tenth year, compared to a total duration of nine months for the previous four episodes.⁸

In the first four episodes, repressions shortened the duration of the conflicts to a few months, limiting economic but not human loss. From October 1993 to date, about 300,000 lives

⁶ The phenomenon of currency substitution was widely observed in Latin America during the 1970s and 1980s, a period of high political and macroeconomic instability in the region [see, for instance, Dornbusch, *et al.* (1983)].

⁷ A failed state is characterised by the inability of the central government to impose order and deliver positive political goods to its people [Rotberg (2002)].

⁸ For a detailed discussion of the reasons explaining this exceptionally long episode, see Ngaruko and Nkurunziza (2003).

have been lost, 700,000 people have become refugees and up to 900,000 have been internally displaced.

Table 1: Duration and Incidence of Civil War

Years	Duration (months)	Deaths (000)	Refugees (000)*	Yr. From previous episode	Provinces affected
1965	2	5	0	N.A.	Muramvya
1972	4	200	300	6	Whole country
1988	2	15	50	16	Ngozi, Kirundo
1991	1	1-3	38	3	Cibitoke, Bubanza, Bujumbura
1993...	127	300	687	2	Whole country
Total	30% time	10% populat.	-	-	

Source: Nkurunziza (2001a).

*: Number of Burundi refugees in DRC, Rwanda and Tanzania (UNHCR data). It is the difference between total refugees and refugees a year before the crisis.

One consequence of the pattern presented in Table 1 is that until the latest episode, Burundians had particular expectations of short wars. Despite their brutality, the first four episodes were short and had a relatively limited direct impact on the economy. When the current war erupted in October 1993, economic agents' expectations were that it would be another short war. It is only when it was felt that the army had failed to crush the rebellion as it had done before that people's attitudes changed. These expectational errors help explain why most economic variables reacted to the war onset with a lag.

The war has increased macroeconomic instability.⁹ For instance, the probability of a monthly inflation rate exceeding 2.5 percent was 0.13 between 1980 and 1989 but almost doubled to 0.23 between 1990 and 1999. As Agénor (2000) and Ali (2001) note, there is a negative relationship between macroeconomic instability and economic growth and the

⁹ Measures of macroeconomic instability include the exchange rate premium, the rate and volatility of inflation, real exchange rate volatility, volatility in the terms of trade and the ratio of the budget deficit to GDP.

relationship tends to be stronger the higher the instability. GDP per capita in Burundi has now declined to less than \$200, one-third lower than at independence 40 years ago. The economy recorded negative growth rates between 1993 (-6.0 percent) and 1996 (-8.4 percent), the latter being the lowest growth rate recorded in the last 25 years.

Macroeconomic and political instability have increased uncertainty, reducing investment and production. The rate of investment plummeted to 5.8 from 13.8 percent of GDP between 1993 and 1998 [Burundi (1999)]. The ratio of medium and long-term credit to GDP declined from 34 to 25 percent between 1992 and 1997, translating bankers' perception of high risk and uncertainty. During the same period, cash credit to firms increased by 71 percent as a result of rising input prices and difficult economic conditions facing the business community. War has also badly affected the government's ability to raise revenue, especially foreign aid. Being an aid dependent country, Burundi suffered from the decline in aid transfers that imposed a strong constraint on the government's ability to prosecute the war and carry out its traditional functions.

2.3. War, Fiscal Crisis and Inflation Tax

Although the fiscal revenue crisis in Burundi does not originate from the war of the 1990s [Ndikumana (2001)] it is clear that government revenue collapsed as a result of the war. As shown in Figure 1, Annex 1, the lowest value of tax revenue in 1997 corresponds to half of the value just before the war in 1991-92. Some factors specific to the war period help explain this decline. Firstly, the destructions resulting from the war reduced the tax base. Secondly, war disrupted economic and moral institutions, making tax compliance and tax collection difficult. Thirdly, the imposition of an economic embargo on Burundi in July 1996 reduced dramatically

import and export transactions, and hence taxes from international trade. Fourthly, the dwindling of international aid transfers starved Burundi of its main source of foreign currency.

Table 2 gives the evolution of the budget from 1992, just before the war started, to 2001.

Table 2: Principal Budget Components: GDP shares (1) and in Billions of Real Burundi Francs (2)

Revenue & Grants	1992		1994		1996		1998		2000		2001	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Tax on:												
Income & Profits	4.0	7.8	3.6	5.9	3.9	4.8	4.6	5.7	3.9	5.4	5.2	7.0
Goods & Services	6.6	13.0	7.6	12.5	6.2	7.7	6.3	7.9	9.2	12.7	8.9	12.1
Intern. Trade	3.7	7.5	5.4	8.8	2.7	3.4	4.6	5.7	4.5	6.1	3.9	5.3
Other Tax	0.1	0.4	0.0	0.2	0.1	0.2	0.0	0.1	0.8	1.0	0.7	1.0
Total Tax Revenue	14.5	28.8	16.7	27.4	13.0	16.0	15.6	19.5	18.3	25.3	18.8	25.4
Non-Tax Revenue	2.4	4.7	1.4	2.3	2.6	3.2	1.5	1.9	0.9	1.2	1.3	1.8
Grants	8.6	17.1	2.4	4.0	2.2	2.7	0.9	1.2	3.1	4.3	1.7	2.3
Grants (% total revenue)	34	34	12	12	12	12	5	5	14	14	8	8
Expenditure												
Salaries:	6.5	13.0	7.4	12.3	7.9	9.7	6.8	8.5	6.6	9.1	7.3	9.9
Civilian	4.3	8.5	4.9	8.2	4.9	6.0	3.7	4.7	3.5	4.9	3.9	5.3
Military	2.2	4.4	2.5	4.1	3.0	3.7	3.0	3.8	3.1	4.3	3.4	4.6
Goods & Services:	3.5	7.0	4.4	7.3	4.8	5.9	6.3	7.8	7.4	10.2	8.0	10.9
Civilian	2.4	4.8	2.6	4.3	2.4	2.9	2.7	3.4	4.5	6.3	3.3	4.5
Military	1.1	2.2	1.8	3.1	2.3	2.9	3.5	4.4	2.8	3.9	4.7	6.3
Transfers and subsidies	2.9	5.8	2.4	4.1	2.2	2.7	1.8	2.2	1.9	2.7	2.9	2.7
Interest payments (due):	1.8	3.6	1.5	2.5	1.9	2.3	2.4	2.9	2.9	3.9	3.4	4.5
Domestic	0.4	0.9	0.3	0.5	0.4	0.4	0.8	1.1	1.3	1.9	1.7	2.4
Foreign	1.4	2.7	1.2	2.0	1.5	1.8	1.5	2.0	1.5	2.1	1.6	2.2
Capital expenditure:	11.7	23.3	9.00	14.8	10.4	12.9	5.9	7.3	6.1	8.4	6.0	8.1
Domestic	1.1	2.2	1.7	2.9	3.1	3.8	1.4	1.8	1.7	2.4	3.4	4.5
External	10.6	21.1	7.3	12.0	7.3	9.0	4.5	5.6	4.4	6.0	2.6	3.6
Overall Balance:												
Including Grants	-2.9	-5.8	-4.3	-7.1	-10.1	-12.5	-5.2	-6.6	-1.9	-2.6	-5.2	-7.0
Excluding Grants	-11.5	-22.9	-6.7	-11.1	-12.4	-15.2	-6.1	-7.6	-5.0	-7.0	-6.8	-9.3
CPI (1990=100)		114		141		221		319		369		404
GDP Growth		0.7		-3.7		-8.4		4.8		-0.9		2.1

Source: Data from IMF (1997, 1999, 2002).

The revenue side of the budget suggests that in terms of their shares in GDP, most taxes did not change remarkably. This is misleading. As GDP itself steadily declined over the period, a

relatively constant share of tax in GDP implies that the actual amounts of taxes declined. Figure 1 in Annex 1 illustrates the discrepancy between scaled and un-scaled figures. Generally, un-scaled values (real Burundi francs) in the shaded columns of Table 2 show more decline than the shares in GDP. Almost all sources of government revenue, including grants, declined immediately when the war started in 1993. Although some of these revenue sources are recovering they have not reached their pre-war levels.

However, the most dramatic decline was with respect to grants. The main reason is the freezing of aid by the international community in reaction to a coup d'état that triggered the October 1993 war. Even using the ratio to GDP, the data show that from almost 9 percent of GDP in 1992, the share of grants had been divided by 5 in 2001. The lowest share in 1998 represented just one-tenth of the value in 1992, aid's lowest level in the country's post-independence history. The ratio of aid to GDP dwindled to a mere 4 percent in 1998 from 29 percent in 1992, while per capita aid dropped from its record high of \$54 in 1992 to its record low of \$ 9, translating an 83 percent decline. The government's misery was compounded by the fact that the country's export revenues showed no sign of recovery from their declining trend over many years.

With respect to the expenditure side of the budget, three points are worth noting. First, as expected, the military burden increased substantially as a result of the war. The share of the cost of military goods and services increased by more than 300 percent in less than ten years, while the salaries to the army increased by about 50 percent.¹⁰ Military spending increased from

¹⁰ This last figure is rather surprising and is most probably underestimated. The size of the army increased manifolds during the war. According to Balancie and LaGrange (1996), Burundi had a 6,000-soldier strong army before the 1993 war. By the year 2000 ICG (2000) reports that the number had swelled to 45,500. Because military expenditures are treated as state secrets even in the most open political societies [see Brzoska (1995)], and given that
(continued...)

an average of 7.2 percent of government spending in the 1980s to 25.8 percent in 1997. Secondly, the fact that domestic interest payments due increased by more than 300 percent between 1992 and 2001 suggests that the government was relying more and more on domestic debt to compensate for the loss of its revenue from traditional sources.

Thirdly, one of the victims of the drop in government revenue was capital expenditure. Between 1992 and 2001, total capital expenditure was halved and capital expenditures financed by external resources were divided by four. This, in a way, was a consequence of the decline in grants and the fact that capital expenditures had been traditionally financed by foreign resources explains the collapse in investment. Unsurprisingly, the overall government deficit, including grants, increased from -2.9 to -10.1 percent of GDP between 1992 and 1996 before decreasing to -5.20 percent in 2001.

In an attempt to reconcile the decline in revenue with the increase in military spending, the government operated some resource re-allocations. For instance, education expenditures declined from 4.2 percent of GDP in 1993 to 3.0 in 1998. Although the relative decline may seem modest, the absolute change and its impact on welfare are remarkable given that real GDP in 1998 was much lower than in 1993. Similarly, government expenditure on health decreased from 1.3 percent of GDP in 1993 to a mere 0.6 percent in 1998. However, budget reallocations could not, alone, compensate for the collapse in government tax revenue, foreign grants and export earnings. Inflation tax became an alternative source of revenue as Table 4 illustrates.

the donor community discourages the use of donor money to purchase weapons, it is very likely that the figures for Burundi are underreported.

Table 3 gives shares of seigniorage and inflation tax in total government revenue based on three aggregates: reserve money, money in circulation and the reserves of the banking sector.

Table 3: Shares of Seigniorage and Inflation Tax in Total Government Revenue (%)				
	Seigniorage to revenue		Inflation tax to revenue	
	Average	Change	Average	Change
Full Sample: 1980-2002				
Reserve money	5.6		6.4	
Money in circulation	4.7		5.4	
Reserves of the banking sector	0.8		0.5	
Pre-war Sub-sample: 1980-1993				
Reserve Money	5.1		4.5	
Money in circulation	3.9		3.6	
Reserves of the banking sector	0.7		0.3	
War Sub-sample: 1994-2002				
Reserve Money	6.5	27	9.5	111
Money in Circulation	5.8	49	8.2	128
Reserves of the banking sector	1.0	43	0.8	167

In Table 3, seigniorage increases whether one measures it based on reserve money or money in circulation. However, the most dramatic change is observed with respect to inflation tax. From the pre-war to the war period, inflation tax more than doubled. Reserves of the banking sector recorded the highest increase, suggesting that the government may have increased the reserve ratio to collect more taxes. However, there may also have been a genuine need to increase the reserves given the increase in risk and uncertainty brought about by war.

Although the absolute values of inflation tax may appear low relative to other countries, the changes were significant in a country that had traditionally enjoyed low levels of inflation tax and seigniorage. Between the 1970s and the early 1980s, inflation tax was 6.4 percent of revenue in Burundi while the rate was 10.3 in Rwanda, 25.5 in DRC and 55.6 in Uganda [Edwards and Tabellini (1991)]. The average inflation rate from 1970 to 1982 was 10.8 percent in Burundi relative to 12.7 in Kenya, 12.5 in Rwanda, 16.4 in Tanzania, 34.3 in Uganda and 42.8 in Democratic Republic of Congo (DRC). Over the same period, the level of seigniorage as a percentage of government revenue was 6.4 percent in Burundi in comparison to 4.5 for Kenya, 10.3 for Rwanda, 9.3 for Tanzania, 24.8 for Uganda and 15.5 for DRC [Cukierman, *et al.* (1992)]. The traditionally low level of inflation in Burundi suggests that economic agents inflation thresholds that trigger flight from currency may be relatively low than in other countries in the region.

A more structural reason explaining the flight from currency phenomenon at relatively low levels of inflation is the high share of the subsistence sector in Burundi's economy. Over the period 1965 to 1998, the average ratio of M2 to GDP was only 15 percent, which is 7 percentage points lower than the African average. The level of M2/M1 stands at 1.35, about half the average for Africa. These statistics show that Burundi is less monetised even in comparison with other poor economies. As a result, in a context where people have limited usage of money, they may be more sensitive to inflationary pressure.

2.4. War, Inflation and Exchange Rate Policy

Table 4 shows that significant changes in key macroeconomic variables have taken place during the war period.

Table 4: Change in Macroeconomic Variables before and after the Start of the War

	Mean (%)	Variation (%)	Peak Year
Full Sample: Period from 1980:1 to 2002:4			
Inflation	10.5		1997 (31%)
Official rate depreciation	12.0		1984 (29%)
Parallel rate depreciation	13.5		1999 (47%)
Exchange rate premium	36.0		1999 (67%)
Money in circulation as a share of GDP	6.5		1995 (8%)
First Sub-sample: Period from 1980:1 to 1993:3			
Inflation	7.0		1984 (14%)
Official rate depreciation	7.0		1984 (29%)
Parallel rate depreciation	11.0		1991 (44%)
Exchange rate premium	27.0		1992 (49%)
Money in circulation as a share of GDP	6.0		1981 (7%)
Second Sub-sample: Period from 1993:4 to 2002:4			
Inflation	14.0	100	1997 (31%)
Official rate depreciation	17.0	143	2000 (28%)
Parallel rate depreciation	16.0	45	1999 (47%)
Exchange rate premium	45.0	67	1999 (67%)
Money in circulation as a share of GDP	7.0	17	1995 (8%)

Source: Computed based on data from Burundi central bank and IMF (2004).

What explains the changes in inflation and exchange rates? A significant proportion of the increase in inflation was probably due to an increase in food prices. Food items account for 51

percent of the consumer price index (CPI) and 98 percent of the food items in the basket are domestically produced. As the country fell into chaos in October 1993, food markets collapsed and food prices rose sharply. As a result, inflation increased from an average 5 percent per annum over the period 1970-1989 to 16 percent in the period 1990-1999 (see Figure 1(a)). As Figure 2 in Annex 1 shows, it is noteworthy that the curve representing the food price index, indistinguishable from that representing general CPI before 1993 stochastically dominates the latter in the whole period post-October 1993. Hence, although the general CPI increased remarkably, food prices increased even faster.

Food inflation resulted from the drop in the production of food due to the killing of farmers or their displacement into cantonment camps. In 1997, the index of food production had declined by 20 percent relative to its 1990 level. In addition to the decline in food production, food inflation was the consequence of restricted trade due to instability. Rebels' ambushes on strategic roads and combats between them and the army hamper the movement of people and goods. This is especially the case in Bujumbura, the capital city, which is surrounded by hills in which the rebels have established their safe havens.¹¹

Another factor explaining the rise in inflation has been the increase in the prices of imported goods mainly due to devaluations. Faced with a foreign currency crisis, the government devalued regularly the official exchange rate as it could no more afford to defend it. The depletion of foreign reserves in 1998/1999 corresponded with the highest level of the premium and the highest devaluation rates of the official exchange rate over the sample period

¹¹ The rebels shell regularly the capital and ambush commercial and private vehicles going to or from Bujumbura. The main roads leading to the capital city are also often closed to traffic for many consecutive days when there are combats between the rebels and the army. It is during such periods that food prices surge in Bujumbura.

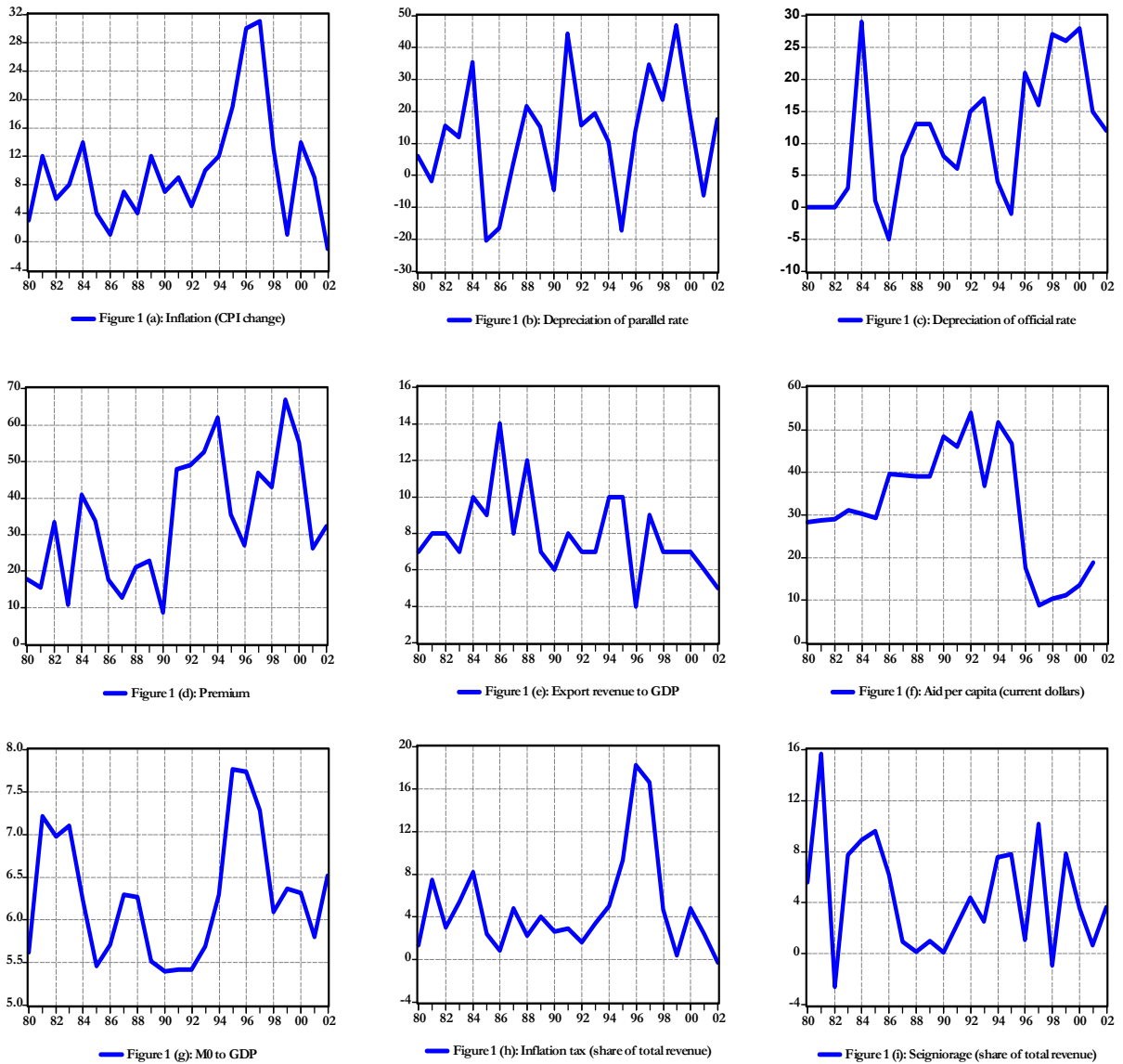
[see Figures 1(d) and 1(c), respectively]. Subsequently, the government was forced to adopt a more open foreign exchange policy.

A new law spelling out the modalities of foreign currency trading was enacted in November 1999. It was the first time since the mid-1960 that significant liberalisation measures were introduced in foreign currency trading even if important controls still remain. In the same context, under pressure from the donor community, the government accepted to allocate foreign currency through periodic auctions as a condition for the resumption of some level of aid. The first such auction was held on July 4th, 2000. Figure 1(d) shows that although the new policy of allocating foreign currency did not succeed to unify the two foreign exchange markets, it reduced the premium immediately, a result that has been lauded by the IMF [see IMF (2003)]. From the year 2000, the premium has dropped back to its pre-1990s level, oscillating between 20 and 40 percent.¹²

We should note that although the rate of inflation in Burundi could be considered low in comparison with other countries that have experienced similar or even less acute political crises, Burundi's inflation is high in relative terms. Before the 1990s, the country had kept inflation at a fairly low level. In the 1980s the rate of inflation was about 7 percent, a relatively low rate in comparison to other developing countries. In the 1990s inflation has been well above the 5 percent target usually advocated by World Bank-IMF programmes and even the higher 8 percent benchmark above which inflation is thought to reduce growth [Collier and Gunning (1999)].

¹² A detailed discussion of exchange rate policy and the determinants of the premium may be found in Nkurunziza (2001b).

Figure 1: Trends in Key Macroeconomic Variables



Inflation is computed as the relative change in the consumer price index using 1990 as the base year. An alternative measure of inflation that captures the capital loss due to inflation [see, for instance, Easterly, *et al.* (1995)] did not show notable differences with the simple measure used in

this study.¹³ The depreciation of the official and parallel exchange rates is the relative change in the level of the variable. Inflation tax revenue is obtained by multiplying the rate of inflation and the real value of money in circulation. Seigniorage revenue is the sum of inflation tax and the change in real value of money in circulation. Total government revenue includes seigniorage or inflation tax revenue, depending on which of the two measures is used as a numerator.

3. Methodology

The methodology seeks to determine the extent to which the government may rely on inflation tax as a source of revenue. Given that the capacity of the government to collect inflation tax depends on the semi-elasticity of money demand with respect to inflation, the determination of the maximum inflation tax rate is based on the parameters of a money demand model.¹⁴

3.1. Determination of the Revenue-Maximising Rate of Inflation

We outline a simple framework used for the determination of the revenue-maximising rate of inflation in the light of Rodriguez (1994) and Agénor and Montiel (1996). Consider a standard money demand equation of the form:

$$MV = pQ \tag{1}$$

¹³ The measure is given as $[(p_t - p_{t-1})/p_{t-1}]/[1 + (p_t - p_{t-1})/p_{t-1}]$. It has been argued that this is the “correct discrete-time measure of the alternative cost of holding money” [Easterly, *et al.* (1995: 590)].

¹⁴ Our objective is not to estimate a structural model of seigniorage. Edwards and Tabellini (1991) estimate such models.

where M is the stock of money, V is velocity, p is price level and Q is GDP. Issuing money allows the government to finance its current expenditure amounting to $(dM/dt)/p$. As a ratio of GDP, this revenue is equivalent to:

$$I_{tax} = \left[-(1/V)(dV/dt) + (\pi + g) \right] / V \quad (2)$$

where I_{tax} is inflation revenue, π is the rate of inflation and g is the rate of GDP growth. Assuming constant velocity consistent with the actual level of inflation and assuming that actual and expected inflation are identical equation (2) gives the steady-state level of inflation tax as:

$$I_{tax} = (\pi + g) / V \quad (3)$$

If velocity is of the standard form:

$$\ln V = V_0 + b\pi \quad (4)$$

where b is the inflation semi-elasticity of demand for money, we derive the optimal level of inflation tax by substituting (4) in (3) and maximising with respect to π . We have:

$$\begin{aligned} I_{tax} &= (\pi + g) e^{(-V_0 - b\pi)} \\ \Rightarrow d(I_{tax})/d\pi &= e^{(-V_0 - b\pi)} - b(\pi + g) e^{(-V_0 - b\pi)} = 0 \end{aligned} \quad (5)$$

Solving for π in equation (5) yields the maximum level of inflation, which is equal to:

$$\pi^* = (1/b) - g \quad (6)$$

3.2. Estimation of the Semi-elasticity of the Demand for Money

The parameter b , the semi-elasticity of the demand for money with respect to inflation, can be easily estimated on the basis of equation (4).¹⁵ However, as we are interested in contrasting the levels of pre-war and war inflation tax, we use quarterly data and estimate money demand models on both sub-samples and on the full sample. Agénor and Montiel (1996) propose an equation of money demand expressed as a partial adjustment mechanism of actual to desired levels of the stock of money:

$$m_t = \lambda a_0 + \lambda a_1 y_t - \lambda a_2 \pi_{t+j}^a + (1 - \lambda) m_{t-k} + e_t \quad (7)$$

where m_t is the log of the real stock of money, y_t is the log of real income as a scale variable;

π_{t+k}^a is the expected rate of inflation for period $t+k$, which proxies for the opportunity cost of

¹⁵ Using general-to-specific methodology, we have run velocity on GDP deflator using annual data covering 34 years (from 1966 to 1999) to estimate equation (4). The regression results are:

$VELO = 0.1725 + 0.0068DEFL + 0.8856VELO(-1)$ which gives a long run semi-elasticity of 5.94 and a maximum tax
s.e. [0.3602] [0.0030] [0.1638]
rate of 16.8 percent. These values are almost equal to the ones for M1 estimated using quarterly data (but not reported in this paper). We proceed and use quarterly data and estimate directly the semi-elasticity of inflation to money demand as the data allow us to have more degrees of freedom and estimate the model on the pre and post-war sub-samples.

holding money; $0 < \lambda < 1$ is the rate of adjustment and e_t is a disturbance term. The expected level of inflation is proxied by the actual inflation rate measured as the change in CPI. Given that y_t is not available in quarterly frequency and since we are interested in splitting the sample in two sub-samples, we estimate a model including inflation and the lagged values of real money.¹⁶

$$m_t = a_0 + \sum_{i=0}^k b_i \pi_{t-i} + \sum_{j=1}^p c_j m_{t-j} + e_t \quad (8)$$

The long-run semi elasticity of money is computed as:

$$\text{Semi-elasticity} = \sum_{i=0}^k b_i / (1 - \sum_{j=1}^p c_j) \quad (9)$$

Equation (8) is estimated using the general-to-specific methodology by which a general over-parameterised model is reduced to its most parsimonious specification. Given potential simultaneity and other general econometric issues posed by the estimation of money demand models [Goldfeld and Sichel (1990)] it is important to ensure that the error term e_t is well behaved.

¹⁶ Rodriguez (1994) estimates a similar model for Argentina.

4. Data Characteristics and Structural Change

The first sub-section discusses data sources, their units of measurement and the way the variables are constructed. The second sub-section focuses on the characteristics of the individual variables, their order of integration and the presence of structural breaks. Knowing the exact time a variable “breaks” and comparing the date to the time when the war erupted can give suggestions about economic agents’ expectations as we discuss below.

4.1. Data: Sources and Definitions

The sample period covers 23 years, from January 1980 to December 2002. We, therefore, have 55 quarters before October 1993 and 37 quarters after. The data on money aggregates, official exchange rate and prices is collected from IMF (2004) and Burundi central bank. The data on government revenue are from Burundi central bank. The data on the parallel exchange rate were collected from different issues of Currency Alerts and Burundi central bank. All the variables are computed from monthly observations.

In order to reduce the impact of outliers, money in circulation and government revenue were re-computed as three-month moving averages before their transformation into quarterly variables. For instance, M0 in January 1980 was computed as the simple average of the observations for January, February and March, and so on. There are three variables of focus in this section, namely M0, government revenue, excluding inflation tax, in real millions of Burundi francs, and inflation. The first two variables are deflated on the basis of the consumer price index, using 1990 as the base year.

4.2. Testing for Unit Roots and Structural Change

Unit root testing helps to identify a variable's 'data generating process-DGP', which is important for model building and inference. If the variables are integrated, their relationships are better modelled through cointegration and error correction methodology. If they are stationary, the long-run value of the dependent variable is just its mean so cointegration is ruled out. In such case, the relationship is best modelled using a simple OLS linear model.

The procedure for testing for the order of integration is as follows. First, we use an Augmented Dickey Fuller (ADF) test with drift and trend. If the null hypothesis of the presence of a unit root is rejected, we conclude that the variable is stationary. However, if the null is not rejected, we do not conclude that we have an integrated variable as the non-rejection of the null may be due to the low power of the ADF test [Enders (1995)]. Consequently, if ADF fails to reject the null, we use Phillips-Perron (PP) test. This non-parametric test is known to have more power than the parametric ADF. These two tests are the most commonly used in the literature.¹⁷

The presence of a structural break in the series may reduce even further the power of ADF and PP tests. As a result, the tests may fail to reject the null of unit root when the series are actually stationary, leading to wrong inference. For instance, in an interesting study on Nigeria, Ashworth, *et al.* (1999) show how the presence of a structural break in the official exchange rate misled researchers to conclude that the variable had a unit root, implying that there was no relationship between the stationary parallel rate and the official rate. It is through a careful testing strategy accounting for the structural break that Ashworth, *et al.* (1999) established that

¹⁷ Recent textbooks on time series econometrics discuss in detail the specifications of these tests [see, for instance, Enders (1995)].

the variable was stationary. Further tests for unit root are carried out should ADF and PP fail to reject the null.

To determine the dates of the breaks in a series, Perron (1989) estimates an autoregressive model including a drift, a time trend, a pulse dummy capturing a ‘crash’ effect in the dependent variable and a level dummy variable capturing a negative growth rate effect. Zivot and Andrews (1992) and Andrews (1993) have argued that the date of the break should be determined rather than fixed; they propose a methodology that endogenously determines the date of a break.

As we know exactly the quarter in which the war erupted, we follow Perron (1989) by specifying a simple autoregressive process that has a drift, a linear time trend, and two dummy variables.¹⁸ The first is a pulse dummy variable that takes value 1 in the fourth quarter of 1993, the time when the war erupted, and zero otherwise. This variable measures the “crash” effect in the variable. The second dummy is a level variable taking value zero before the fourth quarter of 1993 and 1 afterwards. A search process around the value when the crash is expected (1993:4) determines the date when the level dummy is significant and this corresponds with the date of the change in the trend of the variable.

¹⁸Unlike Perron (1989) who is interested in the coefficient of the lagged dependent variable, we are interested in the dummy variables. Mankiew, *et al.* (1987) use a maximum likelihood approach to determine the dates of structural change.

Table 5: Unit Root Tests and Structural Change

	Currency in Circulation	Government Revenue	Inflation
Augmented Dickey-Fuller	-2.647 [-3.465]	-2.046 [-3.462]	-8.356*** [-3.460]
Phillips-Perron	-6.390*** [-3.460]	-3.856** [-3.460]	
Trend	-0.00001 [-0.0181]	0.0030*** [3.0109]	-0.0003 [-1.3966]
Pulse dummy (1993:4=1)	0.0487 [0.8249]	-0.2810*** [-2.971]	0.0770** [2.335]
Level dummy	-0.0431* [-1.6806]	-0.1634*** [-3.2135]	0.0269** [2.0272]
Break date	1994:4	1994:2	1993:4

Note: The values in brackets in the first panel are 5 percent critical *t-statistics* for unit root testing. Bracketed values in the second panel are the usual *t-statistics*. All unit root tests include a drift and a time trend.

The tests show that all the three variables are stationary at 5 percent probability level or better. ADF and Phillips-Perron tests, despite their low power especially in the presence of structural breaks, highly reject the null of a unit root. This result implies that there is no need to proceed further and use additional tests.

In Table 5, the significance of the pulse dummy on government revenue and inflation imply that these variables reacted immediately to war outbreak. The negative (positive) sign of government revenue (inflation) means that revenue (inflation) declined (increased) immediately when war broke out. With respect to the significance and negative sign of the level dummy for government revenue and inflation, the meaning is that war led also to a long-term negative growth pattern for revenue and a positive growth for inflation.¹⁹

¹⁹ The long-term impact of war on currency in circulation is weaker; the dummy is significant only at 10 percent level.

5. Empirical Findings

To compute the maximum rate of inflation tax, we first estimate the parameter b in equation (6) from a money demand equation based on money in circulation. Three long-run semi-elasticities are computed. Firstly we restrict the sample to the period before the war, namely 1980:1 to 1993:3. Secondly, we compute the semi-elasticity corresponding with the war period from 1993:4 to 2002:4. Finally, we use the full sample from 1980:1 to 2002:4 and contrast the results of the three regressions. Once the semi-elasticity is estimated, its value is substituted into equation (6) to compute the level of inflation that maximises government revenue.²⁰ Following are the results of the most parsimonious models from an over parameterised equation including 12 lags.

Table 6.1: Estimation of Money Demand before the War (1980:1-1993:3)

Dependent variable is log real M0 estimated on lagged real M0, inflation and quarterly dummies.

Variable	Coefficient	Standard Error	P-value
Constant	0.463	0.542	0.398
INF	-0.780	0.224	0.001
M0(-1)	0.763	0.074	0.000
M0(-7)	0.124	0.056	0.033
Dummy Q2	0.302	0.017	0.000
<hr/>			
R-squared	0.881		
Adjusted R-squared	0.870		
Number of Observations	48		
Jarque-Bera (normality)	0.497		0.780
LM Breusch-Godfrey Test	9.699		0.206
ARCH Test	4.508		0.720
<hr/>			
Long-run semi-elasticity	-6.908		
Max-inflation tax rate	14.5%		

Note: *p-values* are based on White (1980) heteroskedasticity-consistent standard errors. A number of observations equal to the highest lag in the equation are 'lost' in the estimation. Dummy Q2 is second quarter dummy.

²⁰ We do not use the value of economic growth in the formulae, assuming that $g \approx 0$.

The diagnostic tests suggest that the model is well specified. The R-squared shows that the model explains 87 percent of the variation in M0. Jarque-Bera normality test, Breusch-Godfrey Serial correlation LM test and ARCH test all suggest that the error term is well behaved. Before discussing the implications of the results, we estimate the semi-elasticity for the war period and for the full sample to contrast the results.

Table 6.2: Estimation of Money Demand during the War Period (1993:4-2002:4)

Dependent variable is log real M0 estimated on lagged real M0, inflation and quarterly dummies.

Variable	Coefficient	Standard Error	P-value
Constant	-0.277	0.273	0.319
INF	-0.734	0.191	0.001
INF(-3)	-0.555	0.172	0.003
M0(-1)	1.297	0.121	0.000
M0(-2)	-0.354	0.122	0.007
M0(-8)	0.124	0.054	0.028
Dummy Q2	0.164	0.021	0.000
Dummy Q3	-0.114	0.034	0.002
<hr/>			
R-squared	0.951		
Adjusted R-squared	0.939		
Number of Observations	37		
Jarque-Bera (normality)	0.617		0.734
LM Breusch-Godfrey Test	10.990		0.202
ARCH Test	5.656		0.686
<hr/>			
Long-run semi-elasticity	-19.346		
Max-inflation tax rate	5.20%		

Note: *p-values* are based on White (1980) heteroskedasticity-consistent standard errors. A number of observations equal to the highest lag in the equation are 'lost' in the estimation. Dummy Q2 and Q3 are second and third quarter dummies.

As in the previous case, all the diagnostic tests suggest that the model is well specified. As expected, the long-run semi-elasticity increases during the war period. However, estimates in Tables 6.1 and 6.2 may be criticised as being inefficient as they are derived on the basis of few

degrees of freedom. To address this worry, we re-estimate the model using the full sample where we add a dummy variable (DUMWAR) taking value 1 during the war period and zero otherwise. We add to the specification an interaction term of the war dummy with inflation to capture the joint effect of war and inflation. Table 6.3 reports the results.

Table 6.3: Estimation of Money Demand for the Full Sample (1980:1-2002:4)

Dependent variable is log real M0 estimated on lagged real M0, inflation and quarterly dummies.

Variable	Coefficient	Standard Error	P-value
Constant	0.425	0.227	0.066
INF	-0.616	0.161	0.000
M0(-1)	0.821	0.061	0.000
M0(-4)	0.188	0.094	0.049
M0(-5)	-0.221	0.083	0.009
M0(-7)	0.114	0.039	0.005
Dummy Q2	0.198	0.030	0.000
INF(-3)*DUMWAR(-3)	-0.656	0.209	0.002
R-squared	0.907		
Adjusted R-squared	0.898		
Number of Observations	85		
Jarque-Bera (normality)	6.436		0.040
LM Breusch-Godfrey Test	12.21		0.094
ARCH Test	2.310		0.941
Long-run semi-elasticity full sample	-12.946		
Max-inflation tax rate full sample	7.7%		
Long-run semi-elasticity Pre-war sample	-6.270		
Max-inflation tax rate Pre-war sample	15.9%		

Note: *p-values* are based on White (1980) heteroskedasticity-consistent standard errors. A number of observations equal to the highest lag present in the equation are 'lost' in the estimation. Dummy Q2 is second quarter dummy.

Diagnostic tests in Table 6.3 show that the model fails the Jarque-Bera normality test²¹ but the other tests show no significant serial correlation or heteroskedasticity. This model is more efficient as it uses 85 quarters, double the sample size of each of the two previous models. It is relevant to note that computing the long-run semi-elasticity and the maximum inflation tax rate excluding the interaction term returns almost the same values as in the Pre-war period. These are -6.270 against -6.908 for the semi-elasticity and 15.9% and 14.5% for the maximum inflation tax rate, respectively. The value of the semi-elasticity for the full sample is $\left[(-6.908 - 19.346) / 2\right] = -13.127 \approx -12.946$, which is almost equal to the average of the Pre-war and War Period semi-elasticities.²²

These results show a clear effect of war on the long-run semi-elasticity of money demand. The doubling of inflation from a relatively low level of 7 percent before the war to 14 percent during the war changed economic agents' attitudes. Whether we consider the maximum rate of inflation for the full sample or for the war period, it is clear that inflation moved to the 'bad' side of the Laffer curve provoking a negative reaction towards holding domestic currency. The increase in the semi-elasticity from 6.9 before the war to 19.3 during the war illustrates this attitude. This phenomenon described in the literature as "flight from currency" eroded the

²¹ However, even when the error term fails the Jarque-Bera normality test, the coefficients of the model may be unbiased and consistent if the variance is finite. In the specific case under analysis, we know that the variance is finite since both money demand and inflation are stationary.

²² Computing the semi-elasticity based on M1 for comparison with other studies on African economies using the same variable, we found that the semi-elasticity is 5.23, a value that is comparable with Zambia's 5.30 [see Adam (1999)]. Randa (1999) finds a value of 5.43 for Tanzania, which is close to values for Burundi and Zambia. We deduce that our data and our methodology produce findings that are comparable with work done on similar economies.

government's capacity to maintain a high level of inflation tax revenue for a long time as illustrated in Figure 1(h).

Inflation tax increased for about four years after the war onset between 1994 and 1998 before declining back to its pre-war level. The increase was nevertheless significant given that the country had traditionally relied less on inflation tax revenue in comparison with other countries in the region.

The response of economic agents to increases in inflation may translate more than the attitude towards price changes. In Burundi, holding money has become dangerous. Those suspected of keeping money in their houses have been the victims of marauding rebels who loot them to finance their war. As rural households have no access to banking facilities where they could safely keep their cash, they may prefer to stay away from money.

People in cities, on the other hand, have switched to physical assets which are not easily preyed upon by government taxation or easily looted by rebels. To the best of our knowledge, there is no documented evidence of the type of assets economic agents invested in during the war. There is some anecdotal evidence that wealthy individuals in urban centres invested heavily in real estate. Many visitors to Bujumbura have been amazed by the boom in the construction sector during a period of war. Over the last ten years, more than three new estates have been developed in and around Bujumbura. New houses are mushrooming everywhere, pushing building material prices very high.

Additionally but to a limited extent, people with some spare cash may have exchanged Burundi francs for dollars using the parallel market.²³ Burundi may be experiencing portfolio

²³ The parallel market in Burundi is mostly used for current account transactions [Nkurunziza (2001b)]. This may explain why parallel market exchange rate variables were systematically insignificant in all the specifications of the

(continued...)

behaviour similar to Uganda's during the country's war in the 1980s and early 1990s when agents abandoned money for coffee as a store of value [Henstridge (1999)].

It is also possible that the situation in Burundi may have induced economic agents to transfer their wealth abroad, increasing capital flight. Information in Nkurunziza and Ngaruko (2002) shows that before the 1993 war, capital flight from Burundi represented 30 percent of revenue, on average. This rate was higher than in relatively stable countries such as Côte d'Ivoire (5 percent), Zimbabwe (13 percent), Mauritius (19 percent), Rwanda (20 percent), and Ghana (29 percent). However, the rate in Burundi was lower than in countries with traditionally high political instability such as Chad (91 percent), Uganda (57 percent), Nigeria (56 percent) and Mozambique (52 percent).

During the war period, between 1993 and 1997, the average ratio of capital flight almost doubled to 0.55, giving some credence to the hypothesis that capital flight may have been one way used by economic agents' to protect their wealth from inflation taxation and other war-associated vagaries.²⁴

models of money demand presented in Tables 6.1 to 6.3. The result may be also due to multicollinearity with inflation.

²⁴ We thank Anke Hoeffler for making available to us the data used to compute the averages.

6. Conclusion and Policy Implication

The paper has shown that the 1993 war has eroded the government's revenue from traditional sources, namely revenue from domestic taxes, foreign aid and export revenue. For example, the revenue from domestic taxes three years after the start of the war was about half of its value just before the war in 1992. Confronted with this unprecedented revenue erosion, the government attempted to raise revenue from inflation tax. From an average share in total revenue of less than 4 percent before the war, inflation tax shot to 18 percent in 1996 but declined back to its pre-war level in 1999.

The increase in inflation tax was just temporary. As the war persisted and the level of inflation remained in the 'wrong' side of the Laffer Curve, economic agents responded by holding less and less domestic currency. The increase in the long-run semi-elasticity of demand for money from 6.9 to 19.3 translated a phenomenon known as 'flight from domestic currency'. This portfolio strategy dented the government's capacity to generate revenue out of inflation. As a result, inflation tax could not be used as a dependable source of government revenue.

Although it is clear that economic agents became less interested in holding domestic currency in favour of other assets, there is no documented evidence on this portfolio substitution process. Anecdotal evidence suggests that wealthy individuals may have invested heavily in real estate while others may have preferred to hold foreign currency acquired in the parallel market. It is also possible that political and economic instability in Burundi increased capital flight, as descriptive statistics have suggested. More detailed research on portfolio behaviour during the war period would be a relevant extension to this study.

One policy conclusion arising from the analysis is that it is most probably cost effective for governments to invest in war prevention rather than prosecuting long wars they are not

certain to win. The loss in taxes, export earnings, aid transfers and diplomatic support had a heavy toll on government actors that had been, for a long time, used to repressions as a way of quelling previous rebellions. The government can no longer rely on repressions to resolve longstanding political issues. This latest war went out of government's control, and, for the first time in the country's history, the government, under duress, ended up engaging in political negotiations with the rebels.

Moreover, domestic economic agents' portfolio substitution and the freezing of international aid starved the government of the resources necessary to finance the war. The result was an increase in the likelihood that those in power would lose the war and consequently their power. Whereas war should be an act of last resort, a government uncertain of winning a war would probably be better off avoiding it. Burundi leaders should learn the lesson that the dividend from war prevention outweighs the cost of a long war they are likely to lose.

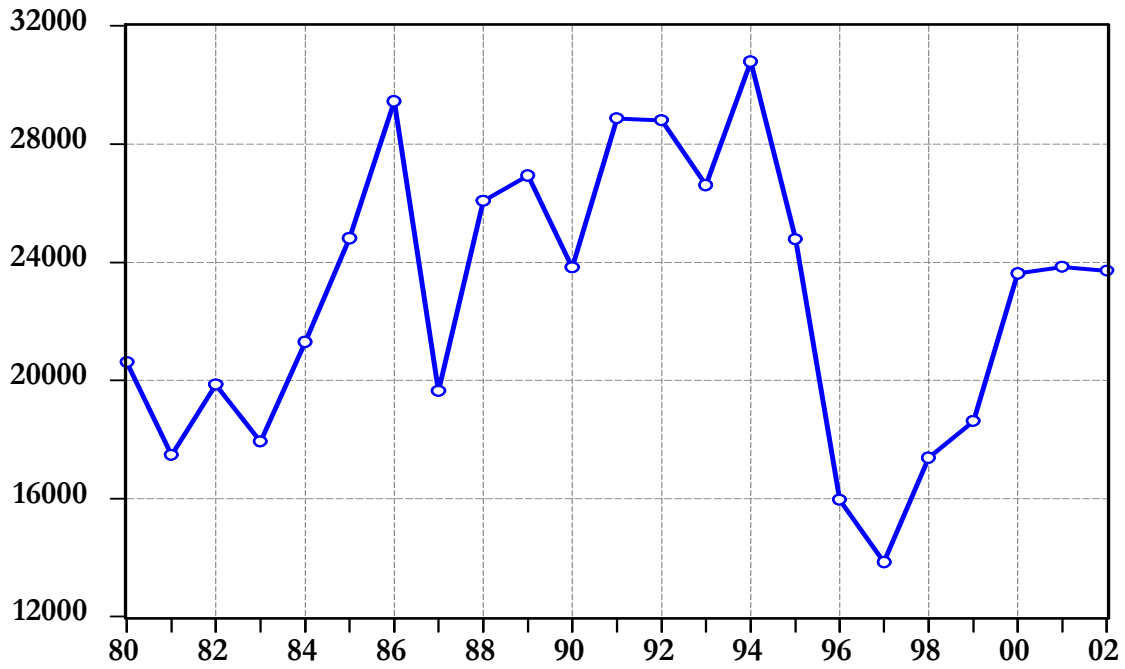
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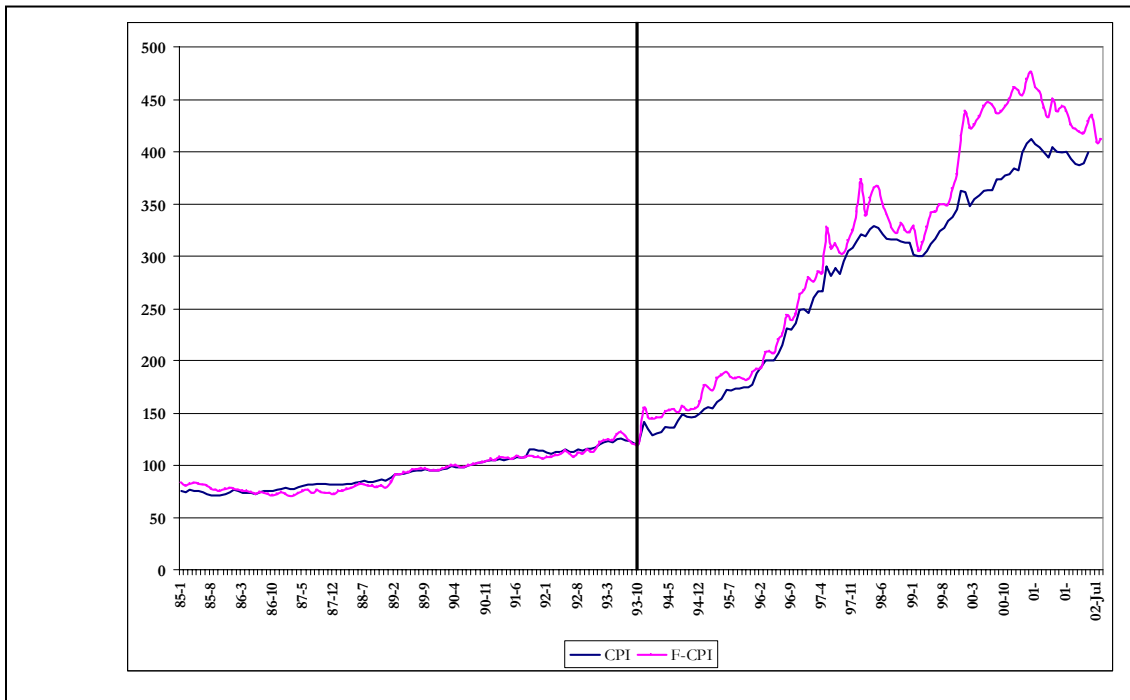
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Annex 1: Figure 1: Real Government Revenue Excluding Grants (millions of Burundi francs)



Annex 1: Figure 2: Food and General CPI



Annex 1: Figure 3: Variations in Food Prices

