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Purchasing Power Parities in Five East African Countries: Burundi, Kenya, Rwanda, Tanzania, and Uganda

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Abstract

In a case study of Burundi, Kenya, Rwanda, Tanzania, and Uganda, this paper finds that bilateral real exchange rates revert to a long-term equilibrium in line with purchasing power parities, implying that these countries constitute an integrated trading zone, their markets are interdependent and arbitrage works efficiently, and intraregional competitiveness is preserved. These findings are partly explained by the flexibility of nominal exchange rates and prices and the absence of long-term productivity differences among these countries. To strengthen market integration, foster private sector development, and enhance growth prospects, the paper emphasizes the importance of increased trade, competitive labor markets, flexible exchange rates, and convergence of macroeconomic and structural policies.

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Summary

This paper applies the purchasing power parity theory to study competitiveness among five East African countries—Burundi, Kenya, Rwanda, Tanzania, and Uganda—during 1979–96. These countries form a traditional trading zone, implying that market information in one country is relevant to traders in the other countries. Because the paper focuses on intraregional competitiveness, bilateral real exchange rates, instead of real effective exchange rates, are used to assess the competitive position of each country in relation to the other four countries.

The paper shows that bilateral real exchange rates revert to a long-term equilibrium in line with the theory following short-term real and monetary disturbances. Relaxing the homogeneity and symmetry conditions underlying the theory, the paper shows that a weaker version of purchasing power parity holds on a bilateral basis among the five countries. While nominal exchange rates have displayed faster adjustment, prices have been more flexible than expected in reestablishing long-term competitiveness. In addition to strong evidence in favor of arbitrage, the paper maintains that competitive wage policies, similar productivity levels, similar consumer preferences, similar technologies, convergence of macroeconomic and structural policies after 1986, and freer trade policies have all helped reestablish long-term parity.

The paper finds that the five countries constitute an integrated trading zone in which arbitrage works efficiently and each country has succeeded in preserving its long-term competitive position. To preserve intraregional competitiveness, the paper maintains that the wage and cost structure should remain in line with productivity levels and that labor markets should remain competitive. It also emphasizes the importance of convergence of macroeconomic and structural policies as well as the flexibility of the nominal exchange rates. The paper advocates increased intraregional trade in order to foster private sector development and enhance economic growth.

I. INTRODUCTION

This paper applies the purchasing power parity (PPP) theory to explore exchange rate and price interdependence among five neighboring East African countries: Burundi, Kenya, Rwanda, Tanzania, and Uganda. If PPP is valid, then bilateral real exchange rates among these countries will tend to revert to a certain equilibrium mean following some disturbances. By studying the movements of bilateral real exchange rates[2] for the period 1979:1 to 1996:12, the paper attempts to assess competitiveness across these five economies, the degree of integration of exchange and commodity markets, the degree of spatial arbitrage in goods and services markets, and the interdependence of prices in the region.

The five Great Lakes countries Burundi, Kenya, Rwanda, Tanzania, and Uganda constitute a traditional trading zone; based on trade data[3], their intra-regional trade represents most of their African trade. Moreover, these countries share many economic and structural features in common. They are at similar stages of development, have a labor surplus, and have approximately the same productivity and wage levels. They have an integrated transport network for merchandise and passengers, and participate jointly in a number of regional trade arrangements. Last but not least, these countries have similar economic and international trade structures, characterized by the importance of subsistence activities, primary exports, particularly coffee and tea exports, as well as similar consumption patterns. These common features tend to support the validity of cross-regional PPPs and the safeguarding of bilateral competitiveness. However, these countries have been differently affected by exogenous real shocks during the period under study (oil shocks, droughts, losses in the terms of trade, and civil conflicts) that could have had a destabilizing effect on PPPs across the region.

Section II describes the exchange regime in each country; the movements of nominal exchange rates, consumer prices, and real exchange rates; and the structure of intra-regional trade. Section III presents PPP theory and summarizes some main empirical findings regarding PPP. Section IV tests the hypothesis of the absolute version of PPP theory in the five East African countries. Section V presents empirical results about the weaker version of PPP theory after the homogeneity and symmetry conditions implied by the absolute version have been relaxed. Finally, Section VI presents some policy implications of the results of the paper; it emphasizes the convergence of both macroeconomic and structural policies, increased intra-regional trade, greater flexibility of exchange rates and factor and product prices, and reduced

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[2]Since real effective exchange rates measure overall competitiveness of a country vis-à-vis all trading partners, they will not provide information about each of the five countries' competitiveness vis-à-vis the other four trading partners. In this respect, bilateral real exchange rates are more appropriate for analyzing intra-regional competitiveness.

[3]See IMF Direction of Trade Statistics.

tariffs in the five countries with a view to strengthening cross-region competitiveness. Some selected macroeconomic indicators of these countries for the period 1979–96 are summarized in the Annex.

II. Descriptive Analysis of Nominal Exchange Rates, Prices, and Trade in Five East African Countries

A. Exchange Arrangements

Presently, except Burundi whose currency is pegged to a basket of currencies of some major trading partners, the remaining four countries have market-determined exchange rates. It should be noted that, during the sample period 1979:1–1996:12, exchange arrangements in these countries were not invariant, and had indeed been reformed many times before reaching their present status. For instance, the Burundi franc (Fbu) changed from an SDR peg to a currency composite peg in April 1992; the Kenya shilling (K Sh) changed from a currency composite peg to an independently floating arrangement in the fourth quarter of 1993; the Rwanda franc (RF) changed from an SDR peg to an independently floating arrangement in March 1995; and the Tanzania shilling (T Sh) and the Uganda shilling (U Sh) changed from a currency composite peg to an independently floating arrangement in the third quarter of 1993 and in the second quarter of 1992, respectively. These changes in the exchange regimes will have an impact on the empirical results of this study to the extent that greater flexibility in nominal exchange rate determination generally leads to a faster adjustment of the real exchange rate toward PPP equilibrium path.

B. Nominal Exchange Rates: A Historical Perspective

Developments in the nominal exchange rates of the five countries, expressed in units of local currency per U.S. dollar, are shown for the period 1979:1–1996:12 in Figure 1. In Table 1, average nominal exchange rates are computed for the subperiods 1979:1–1985:12, 1986:1–1991:12, and 1992:1–1996:12[4]. The table shows episodes of striking change in nominal exchange rates. All five currencies depreciated dramatically during the period 1979:1– 1996:12. Most noticeable is the depreciation of the Uganda shilling from an average of U Sh 1.9 per U.S. dollar during the period 1979:1–1985:12 to U Sh 1064 per U.S. dollar during the period 1992:1–1996:12. The depreciation of the Tanzania shilling was also remarkable, as it moved from an average of T Sh 11.1 per U.S. dollar during 1979:1–1985:12 to an average of T Sh 473.5 per U.S. dollar during 1992:1–1996:12. The depreciation of the Kenya shilling was also severe, but not of the same order as that of the Uganda or the Tanzania shilling. The currencies of Burundi and Rwanda depreciated considerably but not to the same extent as those of Uganda, Tanzania, or Kenya.

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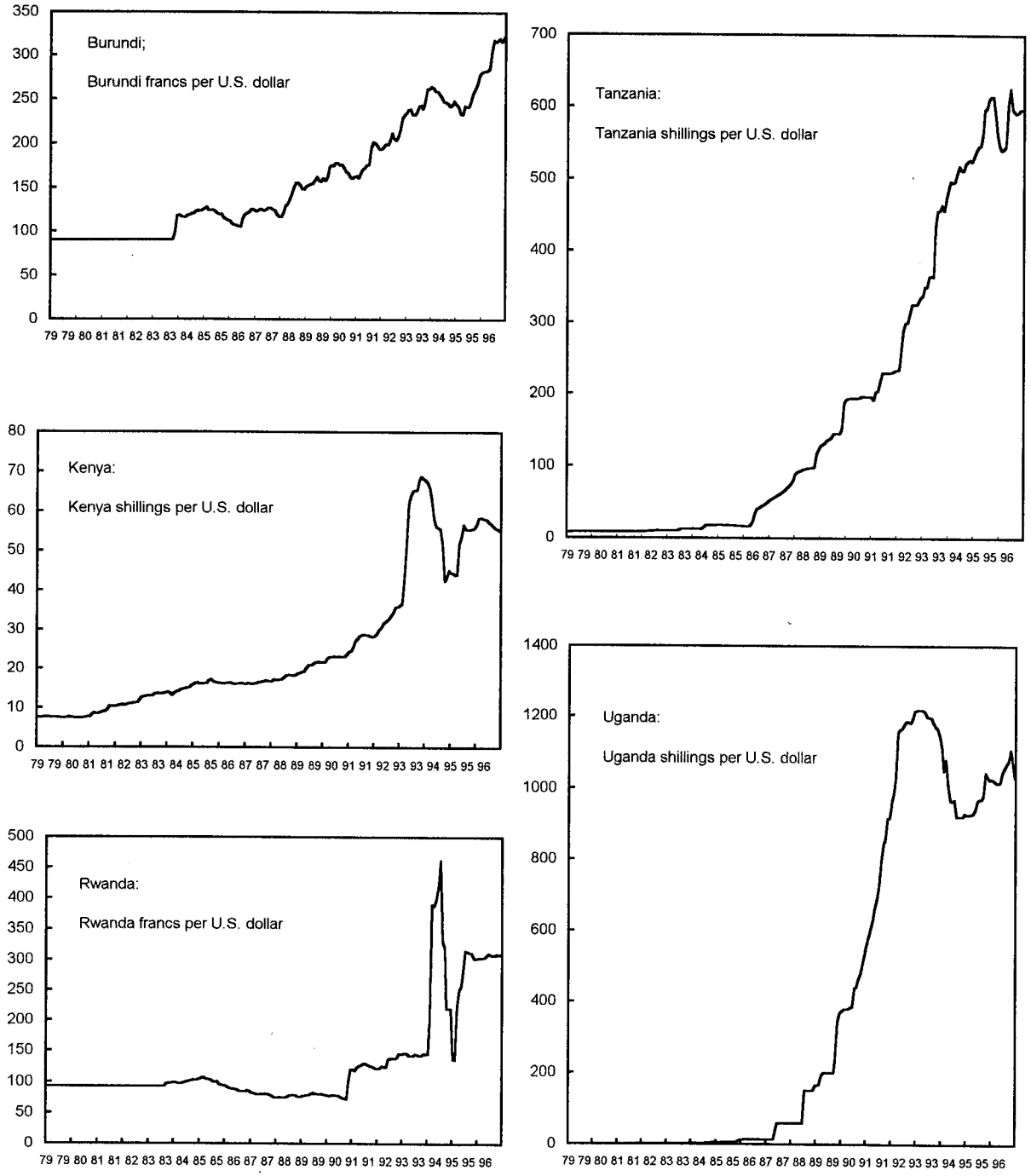
[4]The choice of the subperiods is explained by the beginning of the structural adjustment programs (Burundi 1986) and the beginning of market-determined exchange rate regimes (Uganda 1992).

Figure 1. Five East African Countries: Nominal Exchange Rates, Jan. 1979-Dec.1996.1/
Local Currency per U.S. dollar.



Source: IMF, International Financial Statistics.

1/ Exchange rates are monthly averages.

Table 1. Five East African Countries: Average Nominal Exchange Rates and Average Rates of Currency Depreciation, 1979:1–1996:12

	Average Nominal Exchange Rates (per U.S. dollar)			Average Yearly Rates of Currency Depreciation (in percent)		
	1979:1–1985:12	1986:1–1991:12	1992:1–1996:12	1979:1–1985:12	1986:1–1991:12	1992:1–1996:12
Burundi	99.0	148.3	251.2	3.5	9.5	10.3
Kenya	11.3	20.2	51.0	11.4	9.1	15.4
Rwanda	95.3	86.6	231.2	0.2	5.9	33.1
Tanzania	11.1	125.6	473.5	11.9	47.6	19.2
Uganda	1.9	258.2	1064.7	164.5	97.3	2.4

Source: IMF, International Financial Statistics. The exchange rates are monthly averages.

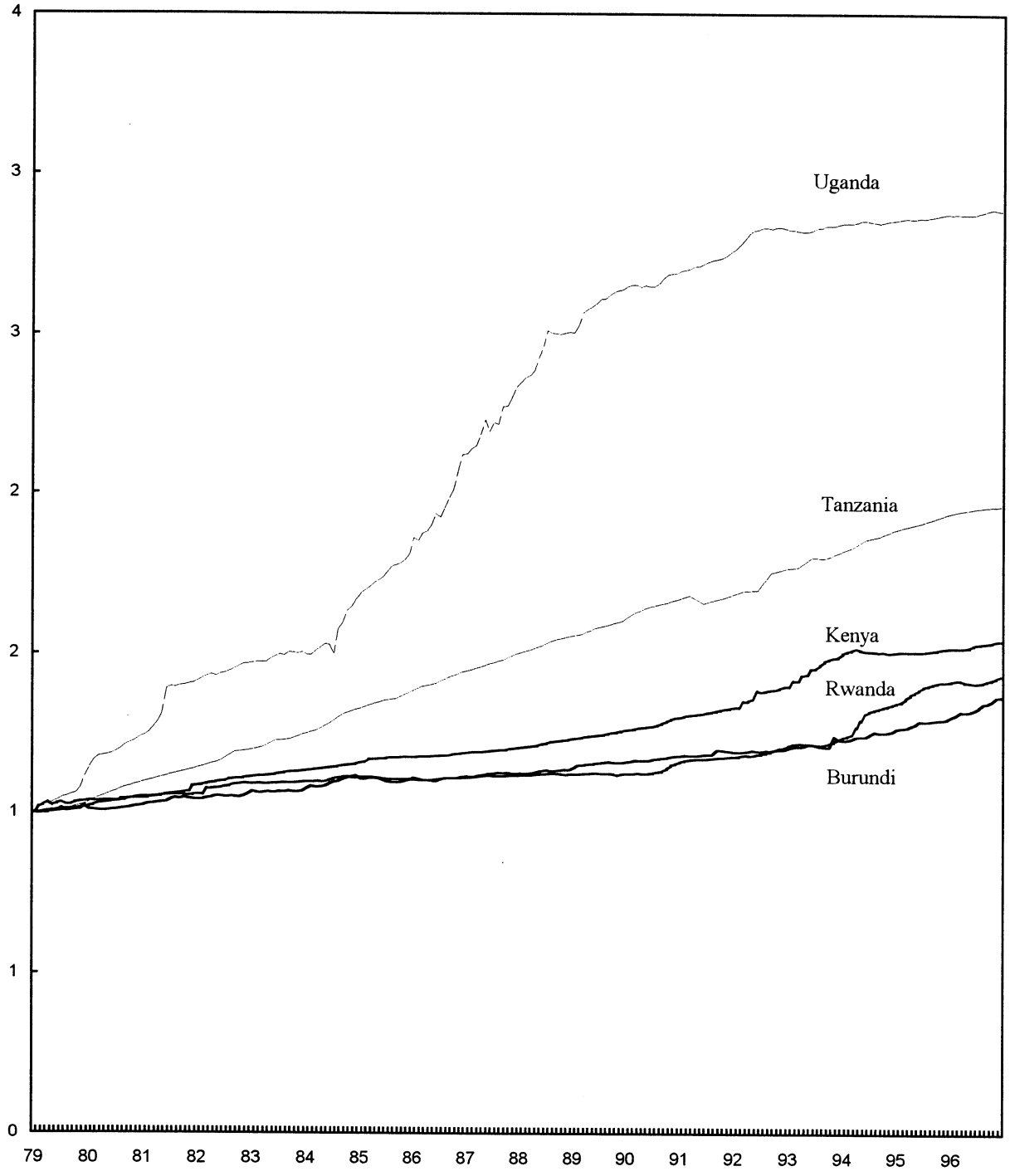
The rates of currency movements were quite disparate among the five countries. During 1979:1–1985:12, the Uganda shilling was depreciating quickly at a rate of 165 percent a year. The currencies of Tanzania and Kenya were also depreciating at a rate of about 11–12 percent a year. However, the currencies of Burundi and Rwanda were enjoying remarkable stability. During 1992:1–1996:12, the currencies of four countries were depreciating rapidly: Rwanda (33.1 percent a year), Tanzania (19.2 percent a year), Kenya (15.4 percent a year), and Burundi (10.3 percent a year). In contrast, Uganda was enjoying relative currency stability with a depreciation rate of 2.4 percent a year.

C. The Inflation Pattern

The price indices used in this paper are the consumer price indices (CPIs) (Figure 2). The choice of the sample period 1979:1–1996:12 is dictated by the uniform availability of data for the CPI indices for the five countries. CPIs are measures of prices of both traded and nontraded goods and services consumed by households in the five countries; no data are available for measuring the prices of traded and nontraded goods separately. Data on the CPIs yearly changes are shown in Table 2.

During 1979:1–1996:12, the five countries experienced disparate inflation patterns. Burundi had the lowest average inflation rate, about 9.7 percent a year, and Uganda, the highest inflation rate, about 52 percent a year. Rwanda, Kenya, and Tanzania experienced two-digit inflation, with average annual rates of 11.5 percent, 14.2 percent, and 25.1 percent, respectively. The analysis by subperiod shows that inflation decelerated drastically in Uganda from 57.6 percent a year during 1979:1–1985:12, to 12 percent a year during 1992:1–1996:12; it remained steady in Tanzania at about 25 percent a year throughout the period; and it accelerated in Kenya from 11.8 percent a year during 1979:1–1985:12, to 20 percent a year during 1992:1–1996:12. Burundi and Rwanda moved from relative price stability, with inflation rates of about 7 percent a year during 1979:1–1985:12, to higher inflation rates of 16.3 percent and 24.2 percent a year, respectively, during 1992:1–1996:12.

Figure 2: Five East African Countries: Consumer Price Indices,1/
January 1979-December 1996



Source: IMF, International Financial Statistics.

1/ In normalized logarithmic form.

Table 2. Five East African Countries: Average Yearly Changes in Consumer Prices, 1979:1–1996:12.				
Country	1979:1–1985:12	1986:1–1991:12	1992:1–1996:12	1979:1–1996:12
Burundi	7.1	7.3	16.3	9.7
Kenya	11.8	12.0	20.0	14.2
Rwanda	7.2	5.6	24.2	11.5
Tanzania	25.6	23.6	26.2	25.1
Uganda	57.6	78.0	12.0	52.2
Source: IMF, International Financial Statistics.				

Noticeable exogenous shocks, namely political instability and international coffee prices cycles, have influenced the movements of prices and nominal exchange rates. In this respect, the periods of political instability in Burundi (1993–96), Rwanda (1990–94), and Uganda (1979–85) were remarkably associated with faster rates of inflation and currency depreciation. As to coffee prices, these bottomed to a trough in 1981 and rose again to a peak in 1986. The subsequent coffee price cycle had its trough in 1992 and its peak in 1995.[5] An increase in coffee export prices tends to improve the country's external and fiscal positions as well as farmers' real incomes, and is generally accompanied by a slower rate of inflation and by some currency appreciation.[6] However, the downward trends in coffee prices have caused a deterioration in the external and fiscal positions, a loss in farmers' real incomes, and have generally been accompanied by pressure on prices and exchange rates. Econometric testing tended to show that changes in the rate of inflation and in the rate of currency depreciation are inversely related to changes in coffee prices, although with low coefficients of determination.

D. Bilateral Relative Prices and Nominal and Real Exchange Rates

Bilateral relative prices are computed as the ratio of the consumer price index of the foreign country to that of the home country. Bilateral nominal exchange rates, defined as the number of units of currency of the home country per one unit of currency of the foreign country, are computed from International Financial Statistics data, using the rate of each currency to the U.S. dollar. The real exchange rate is defined as the nominal exchange rate adjusted by the bilateral relative price.[7] Table 3 describes average yearly inflation differentials

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[5]See Selected Macroeconomic Indicators in the annex.

[6]As an illustration, the currencies of the five countries depreciated in 1992 when coffee export prices reached a historic low; in contrast, the currencies of Burundi, Kenya, and Uganda appreciated during 1994–95 when coffee prices rebounded sharply to very high levels (see selected macroeconomic indicators in the Annex).

[7]Following the general practice in the literature, all variables are expressed in logarithmic

(continued...)

and average rates of currency depreciation. Bilateral nominal exchange rates, relative prices, and real exchange rates are reported, in normalized logarithmic form, in Figures 3 and 4. In each of these figures, the first country is the home country, and the second country is the foreign country.

Table 3. Five East African Countries: Average Yearly Inflation Differentials and Average Yearly Rates of Depreciation of Nominal Exchange Rates, 1979:1–1996:12 1/ (In percent)

Home versus foreign country	Inflation Differentials (first row) and Rates of Currency Depreciation (second row)			
	1979:1–1985:12	1986:1–1991:12	1992:1–1996:12	1979:1–1996:12
Burundi–Kenya	4.7 –7.9	4.8 0.0	3.7 –3.3	4.5 –4.0
Burundi–Rwanda	0.1 3.0	–1.6 4.8	7.9 –8.6	1.7 0.4
Burundi–Tanzania	18.4 –8.0	16.1 –35.1	9.9 –8.6	15.3 –17.2
Burundi–Uganda	47.1 –70.1	65.5 –62.1	–3.9 7.7	39.0 –45.8
Kenya–Tanzania	13.6 –0.1	11.4 –35.2	6.2 –5.3	10.8 –13.2
Kenya–Uganda	42.3 –62.2	60.8 –62.2	–7.6 11.0	34.5 –41.8
Rwanda–Kenya	4.7 –10.9	6.3 –4.8	–4.2 5.3	2.7 –4.4
Rwanda–Tanzania	18.3 –11.0	17.7 –40.0	2.0 –0.1	13.5 –17.6
Rwanda–Uganda	47.0 –73.1	67.1 –66.9	–11.9 16.3	37.3 –46.2
Tanzania–Uganda	28.7 –62.0	49.4 –27.0	–13.9 16.3	23.7 –28.6

Source: IMF, International Financial Statistics.
1/ A positive inflation differential indicates higher inflation in the foreign country, and a positive change in nominal exchange rate indicates a depreciation of the home currency vis-à-vis the foreign currency.

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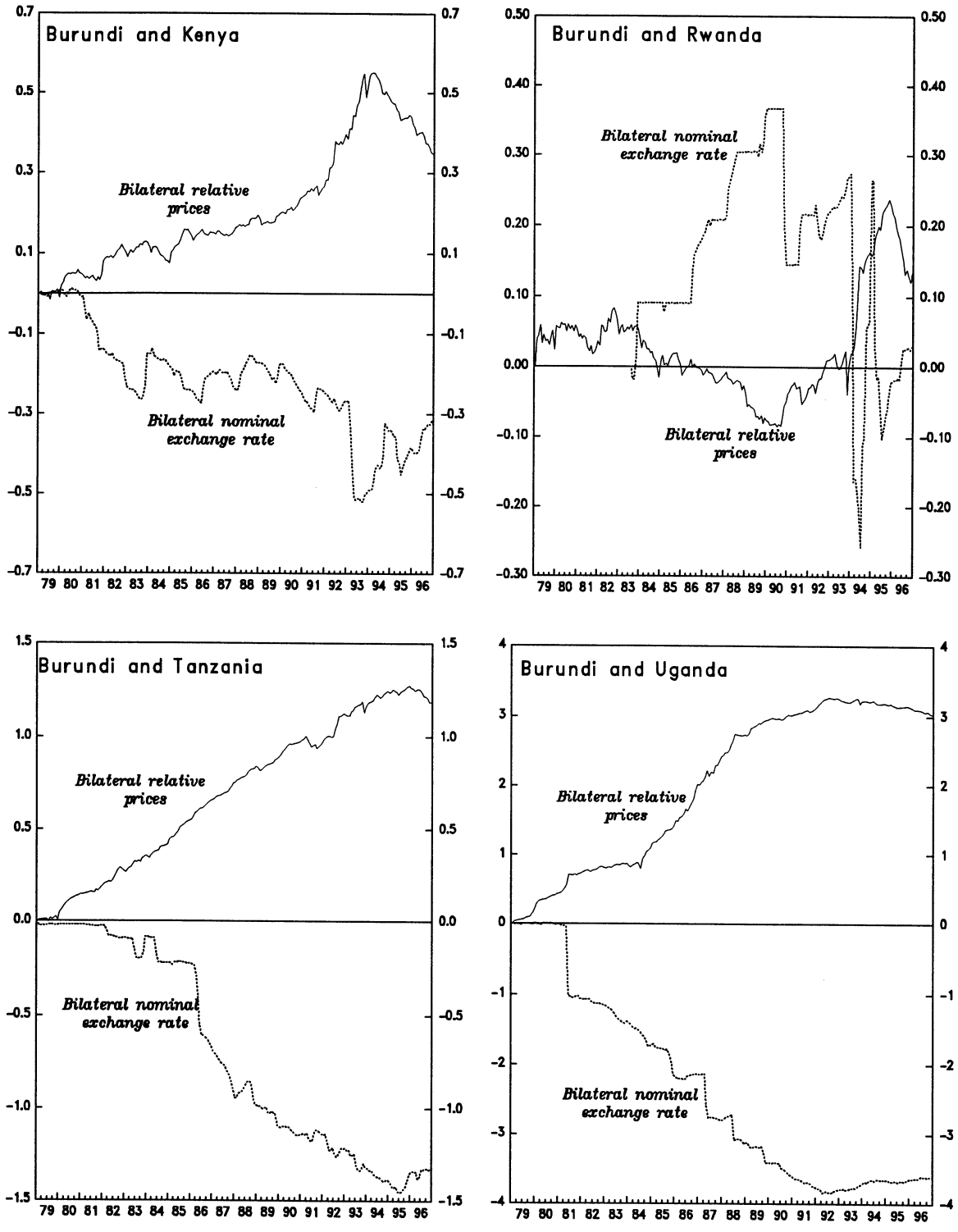
[7](...continued)
form. The inflation differential is therefore measured by the change in the logarithm of the relative price, whereas the rate of currency depreciation is measured by the change in the logarithm of the bilateral nominal exchange rate. In this paper, a positive inflation differential indicates higher inflation in the foreign country, whereas a positive change in the nominal exchange rate indicates a depreciation of the home currency with respect to the foreign currency. Similarly, a positive change in the real exchange rate indicates an improvement in competitiveness of the home country vis-à-vis the foreign country.

Figure 3: Five East African countries: Bilateral Nominal Exchange Rates and Relative Prices: January 1979-December 1996 1/ 2/



1/ Relative prices are defined as the ratio of the consumer price index of the foreign country to the consumer price index of the home country.
2/ Bilateral nominal exchange rate and relative prices are in normalized logarithmic form.

Figure 3: Concluded

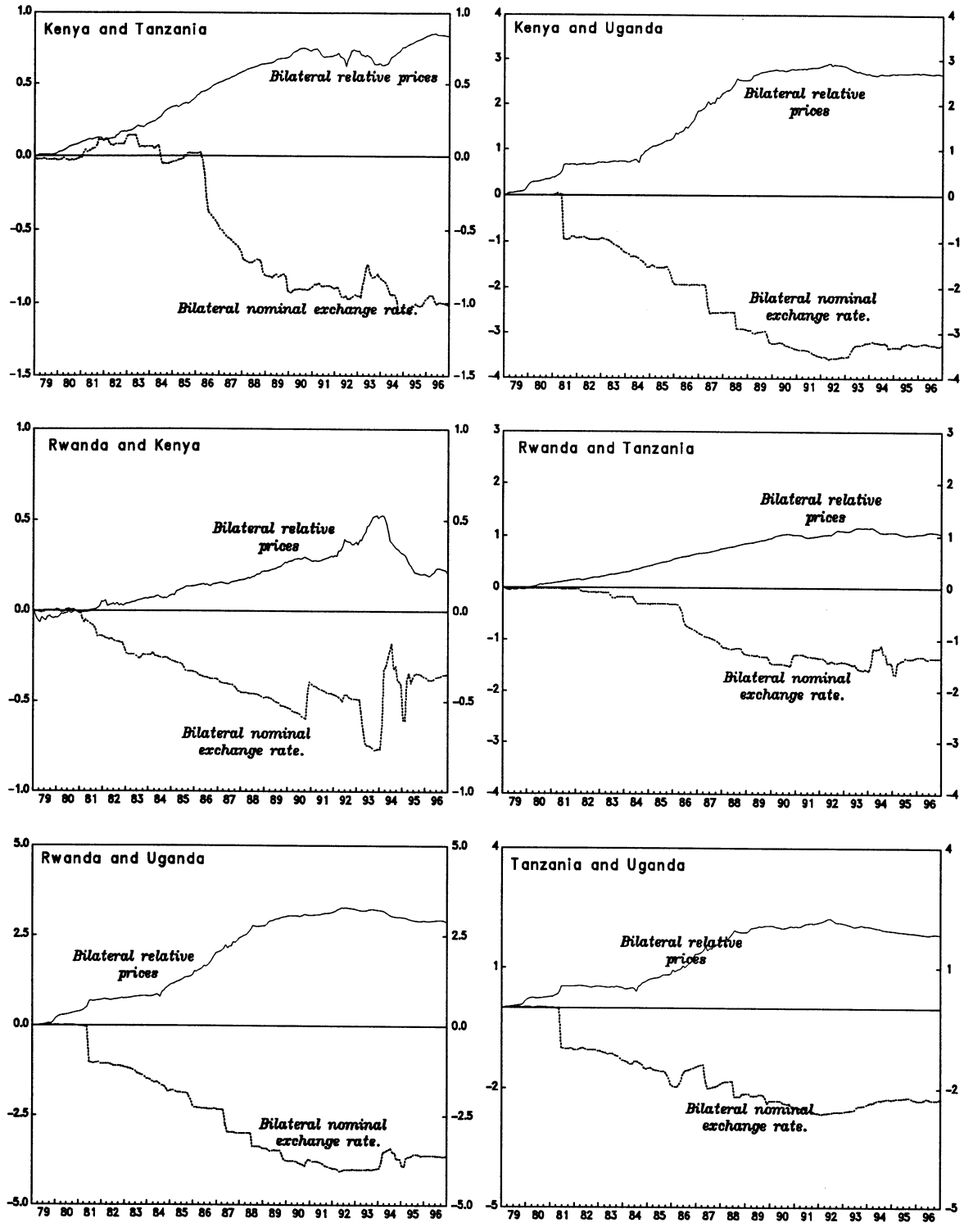
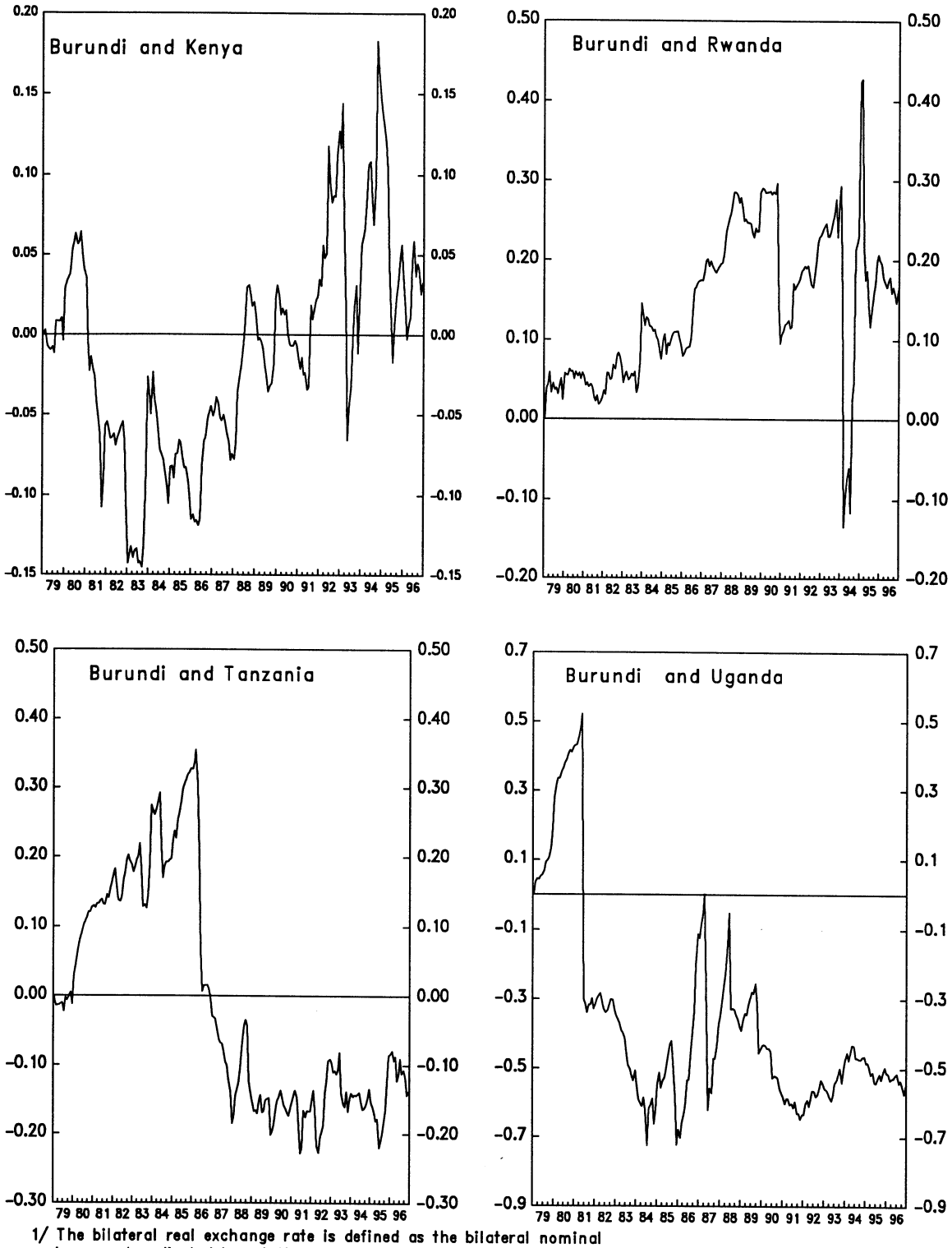


Figure 4: Five East African Countries : Bilateral Real Exchange Rates, January 1979-December 1996 1/ 2/



1/ The bilateral real exchange rate is defined as the bilateral nominal exchange rate adjusted by relative prices.

2/ In normalized logarithmic form.

Figure 4: Concluded

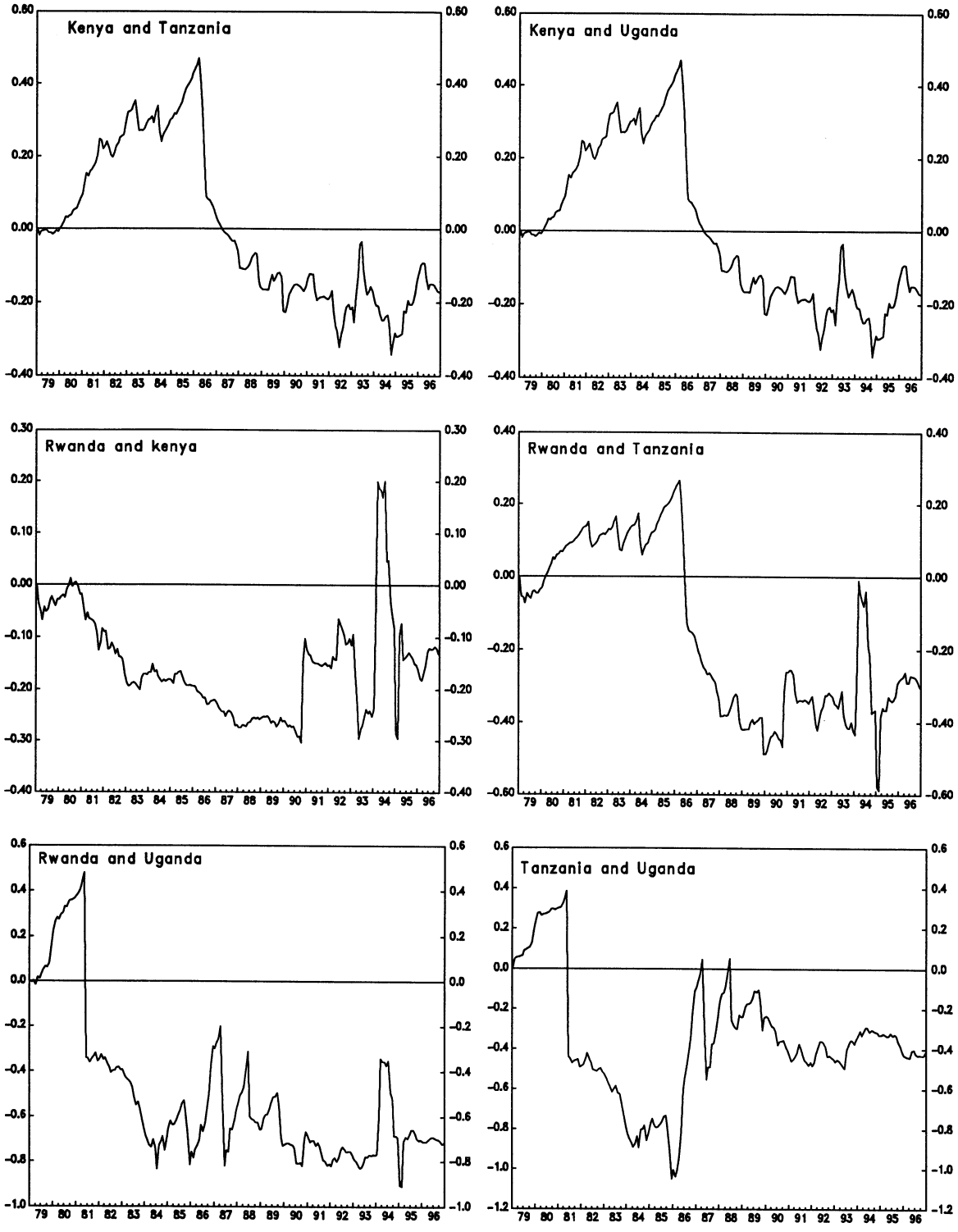


Table 4 shows correlations between monthly changes in nominal exchange rates and inflation differentials with lags and leads of up to three months. The same table reports correlations between contemporaneous changes in bilateral nominal and real exchange rates. The results indicate that short-run changes in nominal exchange rates and in inflation differentials are weakly correlated. Thus, changes in nominal exchange rates turn out to dominate changes in real exchange rates, as exemplified by high correlation coefficients between these two variables for all bilateral cases.

Table 4. Five East African Countries: Correlations Between Monthly Changes in Nominal Exchange Rates, Inflation Differentials, and Changes in Real Exchange Rates, 1979:1–1996:12

Home-Foreign 1/	Correlations: Changes in Nominal Exchange Rates and Inflation Differentials							Correlations: Changes in Nominal and Real Exchange Rates
	lag 3	lag 2	lag 1	0	lead 1	lead 2	lead 3	
Bdi–Ken	0.00	0.09	0.09	0.09	0.16	0.16	0.20	0.81
Bdi–Rwa	0.02	0.09	0.09	0.18	0.18	0.18	0.21	0.95
Bdi–Tza	0.15	0.08	0.04	0.10	0.08	0.02	0.00	0.89
Bdi–Uga	0.06	0.08	0.18	0.36	0.07	0.01	0.02	0.93
Ken–Tza	0.10	0.10	0.08	0.04	0.04	0.09	0.10	0.88
Ken–Uga	0.05	0.12	0.21	0.38	0.04	0.01	0.02	0.90
Rwa–Ken	0.00	0.06	0.06	0.18	0.28	0.32	0.32	0.95
Rwa–Tza	0.09	0.12	0.11	0.11	0.20	0.20	0.20	0.97
Rwa–Uga	0.05	0.10	0.20	0.38	0.02	0.05	0.06	0.94
Tza–Uga	0.05	0.09	0.16	0.35	0.09	0.06	0.04	0.94

1/ Bdi = Burundi; Ken = Kenya; Rwa = Rwanda; Tza = Tanzania; and Uga = Uganda.

E. Structure of Intra-Regional Trade

During the sample period, intra-regional trade ranged between 5.2 percent and 11.4 percent of the region's imports and 9.7 percent and 21.7 percent of the region's exports (Table 5). These ratios are important considering the trade and financing dependence of these countries on industrialized countries. Moreover, intra-regional trade increased over time both in terms of value and relative importance. Finally, the composition of trade included primary products, but was essentially dominated by manufacture as reflected by the predominant trade position of the relatively more industrialized countries Kenya and Tanzania.

Table 5. Five East African Countries: Intra-Regional Exports and Imports, 1979, 1986, 1990, 1995, and 1996 1/
(In millions of U.S. dollars)

Exports (in rows) Imports (in columns)	Burundi	Kenya	Rwanda	Tanzania	Uganda	Country Exports to Region (1)	Total Country Exports (2)	(1)/(2) (In Percent)
1979								
Burundi	...	3.1	1.8	1.1	0.4	6.4	104.0	6.1
Kenya	12.2	...	23.4	10.9	112.6	159.1	1,031.0	15.4
Rwanda	1.3	8.8	...	0.6	0.7	11.4	202.8	5.6
Tanzania	10.1	1.5	13.4	...	14.7	39.7	514.0	7.7
Uganda	0.3	2.2	1.2	1.5	...	5.2	439.0	1.2
						221.8	2,290.9	9.7
Country Imports from Region (1)	23.9	15.6	39.8	14.1	128.4	221.8		
Total Country Imports (2)	152.5	1,832.1	159.4	1,097.0	322.0	3,562.9		
(1)/(2), in percent	15.7	0.9	24.9	1.3	39.9	6.2		
1986								
Burundi	...	1.9	3.1	1.4	3.3	9.6	125.6	7.6
Kenya	23.0	...	41.1	42.0	171.4	277.5	1,212.5	22.9
Rwanda	1.7	3.7	...	0.4	0.3	6.2	184.3	3.4
Tanzania	10.9	4.5	1.3	...	2.0	18.7	348.0	5.4
Uganda	0.7	2.7	1.0	1.3	...	5.7	383.0	1.5
						317.7	2,253.5	14.1
Country Imports from Region (1)	36.3	12.8	46.5	45.1	177.0	317.7		
Total Country Imports (2)	185.1	1,454.6	258.8	1,050.0	494.0	3,442.5		
(1)/(2), in percent	19.6	0.9	18.0	4.3	35.8	9.2		
1990								
Burundi	...	6.0	2.0	1.1	1.6	10.7	72.5	14.8
Kenya	22.0	...	48.0	40.0	110.1	220.1	997.0	22.1
Rwanda	2.8	1.0	0.0	1.0	1.0	5.8	102.1	5.7
Tanzania	14.0	12.0	12.0	...	4.0	42.0	394.0	10.7
Uganda	1.0	4.0	3.0	1.0	...	9.0	175.5	5.1
						287.6	1,741.1	16.5
Country Imports from Region (1)	39.8	23.0	65.0	43.1	116.7	287.6		
Total Country Imports (2)	189.0	2,311.1	233.0	1,381.0	545.0	4,659.1		
(1)/(2), in percent	21.1	1.0	27.9	3.1	21.4	6.2		
1995								
Burundi	...	6.0	2.2	5.0	1.2	14.4	116.0	12.4
Kenya	21.7	...	38.0	246.0	297.0	602.7	1,875.1	32.1
Rwanda	2.0	1.0	...	1.0	4.0	8.0	51.2	15.6
Tanzania	17.6	12.0	40.0	...	9.0	78.6	659.0	11.9
Uganda	0.8	8.0	1.0	2.0	...	11.8	590.3	2.0
						715.5	3,291.6	21.7
Country Imports from Region (1)	42.1	27.0	81.2	254.0	311.2	715.5		
Total Country Imports (2)	209.2	3,066.8	237.3	1,538.8	1,218.3	6,270.4		
(1)/(2), in percent	20.1	0.9	34.2	16.5	25.5	11.4		
1996								
Burundi	...	2.0	4.0	4.0	1.0	11.0	98.8	11.1
Kenya	5.0	...	44.0	191.0	229.0	469.0	1,991.5	23.6
Rwanda	2.0	3.0	...	2.5	5.0	12.5	64.4	19.4
Tanzania	4.0	21.0	47.0	...	11.0	83.0	695.9	11.9
Uganda	0.7	9.0	4.0	3.0	...	16.7	588.1	2.8
						592.2	3,438.7	17.2
Country Imports from Region (1)	11.7	35.0	99.0	200.5	246.0	592.2		
Total Country Imports (2)	193.6	2,899.7	232.1	1,476.5	1,275.1	6,077.0		
(1)/(2), in percent	6.0	1.2	42.7	13.6	19.3	9.7		

Sources: Direction of Trade Statistics, Yearbook, 1979, 1986, 1990, 1995, and 1996; supplemented by data on the direction of trade from various countries' REDs.

1/ Data includes only customs' recorded trade. Informal cross-border trade, although important, is not estimated.

III. Purchasing Power Parity: Theoretical Model and Empirical Findings

A. Theoretical Model

PPP continues to serve as an equilibrium condition in the theory of exchange rate determination and in exchange rate policy.[8] [9] Initially, it constituted the adjustment mechanism in Hume's monetary approach to the balance of payments (1752).[10] It is well known that PPP is only a frame of reference, and according to Cassel's view (1922), a central tendency toward which prices and nominal exchange rates tend to converge in the long run following monetary and real disturbances. For reasons widely documented in the exchange rate literature.[11] PPP cannot be taken empirically as an instantaneous equality relating prices and nominal exchange rates between any pair of countries. Short-run deviations from PPP are quite common. Most compelling is the notion that prices are sticky and do not move rapidly enough to offset frequent changes in nominal exchange rates.

The building block of PPP is the law of one price. For any good, in the absence of quotas, tariffs, and other trade barriers, trade and arbitrage in goods markets should ensure identical prices across countries. The law of one price is stated as

$$P_i = E.P_i^* \qquad (1)$$

Here P_i is the price of good i expressed in domestic currency, P_i^* is the price of good i expressed in foreign currency, and E is the nominal exchange rate expressed in units of local

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[8]Many countries undertake corrective measures of their exchange rates based on inflation differentials with partner countries.

[9]While fundamental equilibrium exchange rates (FEERs), derived from medium-term internal-external macroeconomic balance conditions, are becoming more and more attractive for detecting misalignment in a country's real exchange rate (see Clark et al. 1994), PPPs remain much easier to compute. Moreover, deviations between FEERs and PPPs have not yet been analyzed in empirical studies.

[10]A gold outflow from home country reduced sequentially the quantity of money and prices of traded goods, thus improving competitiveness. Commodity arbitrage raised exports, causing a reflow of gold, a rise in money and in prices of traded goods, thus restoring PPP.

[11]These reasons include, among others, heterogeneity of goods, differences between countries in weighting coefficients entering the definition of consumer price indices, errors in measuring prices, heterogeneity of composition in terms of traded and nontraded goods, differentials in productivity growth between countries, price and exchange controls, and impediments to trade.

currency per one unit of foreign currency. When aggregated over all goods, the law of one price yields the purchasing power parity, which is stated as

$$P = E.\ P^* \qquad (2)$$

Here P is the price level in the home country and P* is the price level in the foreign country. Equation (2) is known as absolute PPP.[12] It is known that transportation costs, tariffs, and nontariff barriers will entail market segmentation and create a wedge among prices across countries. However, if these factors remain constant over time, PPP can be restated, using a positive constant A,[13] as

$$P = A.E.P^* \qquad (3)$$

The real exchange rate Q is defined as the nominal exchange rate adjusted by the relative price

$$Q = E.P^*/P \qquad (4)$$

In logarithmic form, this is expressed as

$$q = e + p^* - p. \qquad (5)$$

Here e, p, p*, and q are the logarithms of E, P, P*, and Q, respectively.

The definition of the real exchange rate in (5) is known to possess two properties: the homogeneity of degree one, which means that, if prices are multiplied by the same constant, PPP remains unchanged; and the symmetry condition, which means that p* and p have opposite coefficients, equal to +1 and – 1, respectively.

A weaker version of PPP, based on relaxation of the homogeneity and symmetry conditions, is also proposed in the literature. In this version, the relation between nominal exchange rate, domestic, and foreign price level can be stated as

$$e = a + v.p - v^*.p^* \qquad (6)$$

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[12]In contrast, relative PPP refers to the relationship between relative change in nominal exchange rate and the differential in relative changes in price levels, that is, $\Delta E/E = \Delta P/P - \Delta P^*/P^*$, or in logarithmic form, $\Delta e = \Delta p - \Delta p^*$. Here p and p* are the logarithms of P and P*, respectively.

[13]The use of a constant is also necessary when P and P* are expressed in terms of indices.

The coefficients a, v, and v* are non negative constants. The reasons for this relaxation are numerous.[14] First, the weights used for individual goods and services in compiling consumer or wholesale prices differ across countries;[15] moreover, these weights remain often unchanged over prolonged periods of time despite changes in consumption patterns and in relative prices among goods. Second, the composition of the price index in terms of traded and nontraded goods is different. Third, relative prices of traded and nontraded goods change over time. Finally, measurement errors affect the price levels. All these reasons would make observance of PPP in its pure form highly unlikely. Instead, many researchers were interested in testing whether a long-term linear combination of nominal exchange rate and price levels, as in equation (6), would be stationary over time.[16] If this unrestricted long-term relationship is borne out by the data, an additional step is taken to test whether the pure form of PPP—in which the coefficients of the nominal exchange rate, foreign price level and domestic price level are given by the vector (1, 1, –1)—could have a statistical link to the unrestricted relationship, in which the coefficients of these same variables are given by (1,v*,–v).[17]

B. Empirical Findings About Purchasing Power Parity

Empirical findings about PPP are reported in many surveys (see, for instance, Breuer (1994), Froot and Rogoff (1995), and Rogoff (1996)). Recent studies have provided some evidence for the Cassellian view according to which PPP holds as a long-run relationship and the real exchange rate tends to be mean-reverting. Examples of these studies are Abuaf and Jorion (1990), Cheung and Lai (1994), Diebold, Husted, and Rush (1991), Frankel and Rose (1995), Kim (1990), Lothian and Taylor (1994), Mark (1990), Patel (1990), and Taylor (1988). These studies have established that short-run deviations from PPP, triggered for example by monetary or real shocks, typically have a half-life of about 3–4 years; these studies have also found strong evidence of mean reversion of the real exchange rate.[18] Yet empirical evidence in favor of PPP is not unanimous. Several earlier studies have established the failure of PPP as a long-run relationship, and were not thus able to reject the hypothesis that the real exchange rate follows a random walk. Examples of these studies are Adler and Lehman

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[14]See Froot and Rogoff (1995), Johansen and Juselius (1990), and Patel (1990).

[15]Thus, even if prices of a given commodity basket change in the same percentage in both the home and foreign country, their impact on PPP will not be exactly symmetric because they are weighted differently .

[16]See for instance Froot and Rogoff (1995), Kugler and Lenz (1993), and Patel (1990).

[17]See Johansen (1988), Johansen and Juselius (1990), and Johansen and Juselius (1992).

[18]The use of longer-horizon data and econometric techniques that account for the endogeneity of exchange rates and prices were among the reasons advanced to explain why this group of studies was able to reject the hypothesis of a random walk in real exchange rates.

(1983), Hakkio (1984), and Meese and Rogoff (1988). Between those studies that have established the validity of PPP and those that have established its failure, a new group of studies has appeared that aims at reconciling the contradictory findings regarding PPP by using a model of real exchange rate determination based on the interaction of the current and the capital accounts of the balance of payments; namely, capital flows become important in explaining real exchange rate (MacDonald (1995), and MacDonald and Marsh (1997)).[19]

Short-run departures from PPP have been explained by Dornbusch (1976) in his seminal work, known as the sticky-price monetary model of exchange rate determination.[20] Because assets markets adjust faster than goods markets, a monetary shock—for instance, an unanticipated increase in money supply—will produce on impact an overshooting in nominal exchange rate above its long-run position given by PPP and therefore, by the same token, a movement of the same magnitude in the real exchange rate. As goods prices start to adjust in response to excess demand generated by lower interest rates and as the nominal exchange rate starts to adjust to an expected appreciation (or depreciation, in case of undershooting), the real exchange rate will adjust simultaneously to restore long-term PPP.

While Dornbusch's model explains short-term movements in PPP, it does not explain why real exchange rates sometimes deviate permanently from PPP's path. As monetary shocks are perceived to have temporary effects and are neutral in the long run, attention has focussed on real factors to explain permanent changes in the real exchange rate. Best known is the model offered by Balassa (1964) and Samuelson (1964) (see Froot and Rogoff (1995) for a proof). Consider a small open economy for which prices of traded goods are determined on international markets. Relatively higher factor productivity in traded goods sector of this economy compared to its partner countries will not only entail higher wages in the traded, but also in the nontraded goods sector of this economy. Assuming a more limited scope for productivity gains in nontraded goods sector—as is frequently the case—the only way for this sector to pay higher wages is through a higher markup on prices. The related increase in the price of nontraded goods will raise the internal real exchange rate, defined as the ratio of nontraded to traded goods prices. Balassa and Samuelson cite as an illustration of their model the generally observed fact that consumer prices are higher in industrialized countries than in developing countries. Furthermore, based on this model, real exchange rates will appreciate in faster growing countries—a hypothesis that is borne out by the case of the appreciation of the Japanese yen vis-à-vis the U.S. dollar. In the same vein, Froot and Rogoff (1995) have shown

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[19]According to this view, a change in the real exchange rate ($q_t - q_{(t-1)}$) is related to real interest rates differential ($r - r^*$), where r and r* are real interest rates in home and foreign country respectively. The real exchange rate follows a random walk when real interest rates are equalized across countries, that is $r = r^*$.

[20]Dornbusch's model could be seen as Mundell-Fleming model extended to assets markets through emphasizing the dynamics of goods prices, the differential in the speed of adjustment of goods prices and nominal exchange rate, and the role of exchange rate expectations.

that Argentina's real exchange rate has continuously depreciated vis-à-vis the U.S. dollar and the pound sterling over the period 1913–88, providing evidence that sectoral productivity shocks which result in permanent productivity differentials can induce a permanent deviation of the real exchange rate from PPP.[21]

IV. Testing the Hypothesis of Absolute Purchasing Power Parity in Five East African Countries

The test for the null hypothesis of real exchange rates following a random walk is based on the following autoregressive error correction model:

$$q_t = (1-\rho).q_{(t-1)} + \sum_{i=1}^{k} \alpha_i \,.\, \Delta q_{(t-i)} + \gamma.t + c + \epsilon_t \qquad t=1,.....,T. \qquad (7)$$

where q_t is the logarithm of the real exchange rate, Δq_t is the first difference of q_t , $\Delta q_{(t-i)}$ is the first difference of q_t at lag i, knowing that i=1,.., k is the number of lags, t is the time trend, c is a constant, and ϵ_t are white noises. The test for the null hypothesis of a unit root, i.e. ρ =1, is based on the augmented Dickey-Fuller statistic.[22]

The tests for unit roots in bilateral real exchange rates allow some important results to be established (Table 6). First, for the period 1979:1–1996:12, absolute PPP hypothesis is not rejected in the case of bilateral real exchange rates of Burundi and Kenya, Burundi and Rwanda, and Kenya and Rwanda. This result suggests that arbitrage and trade work efficiently between these countries, owing to the importance of their bilateral trade, the proximity of their markets, and the rapidity of transmission of information regarding prices and profit opportunities. Particularly, Burundi and Rwanda are small open economies with common borders where transport costs for merchandise are relatively low and differential profit opportunities would entail a higher volume of cross-border trade.

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[21]Besides the Balassa-Samuelson effect and the role of technical progress, other causes for permanent deviations of real exchange rate from long-term PPP have been suggested in the literature and include higher government spending, which would increase disproportionally the prices of nontraded goods, greater accumulation of net foreign assets, which would entail a permanent appreciation of the real exchange rate, pricing-to-market practices, and the appearance of new products.

[22]The number of augmentation terms was determined by examining the significance of the final lag and requiring the elimination of serial correlation as measured by the asymptotic F test for ARMA processes involving the regression of the residuals up to eight lagged residuals.

Table 6. Five East African Countries: Tests of Unit Roots in Bilateral Real Exchange Rates, 1979:1–1996:12. 1/

Home-foreign country	Full Period: 1979:1–1996:12		Subperiod 1986:1–1996:12	
	Trend	No trend	Trend	No trend
Bdi–Ken	k=2, ADF=–3.20* CV(10%)=–3.14	k=8, ADF=–2.39* CV(5%)=–1.94	k=3, ADF=–3.50* CV(5%)=–3.44	k=2, ADF=–2.62* CV(10%)=–2.57
Bdi–Rwa	k=4, ADF=–5.23* CV(5%)=–3.43	k=4, ADF=–4.16* CV(5%)=–2.87	k=4, ADF=–4.91* CV(5%)=–3.44	k=4, ADF=–4.93* CV(5%)=–2.89
Bdi–Tza	k=4, ADF=–2.21 CV(5%)=–3.43	k=4, ADF=–1.23 CV(5%)=–2.87	k=4, ADF=–3.79* CV(5%)=–3.44	k=4, ADF=–4.41* CV(5%)=–2.88
Bdi–Uga	k=4, ADF=–2.66 CV(5%)=–3.43	k=4, ADF=–2.19 CV(5%)=–2.87	k=4, ADF=–3.63* CV(5%)=–3.44	k=4, ADF=–3.47* CV(5%)=–2.88
Ken–Tza	k=4, ADF=–2.05 CV(5%)=–3.43	k=4, ADF=–1.02 CV(5%)=–2.87	k=2, ADF=–3.56* CV(5%)=–3.44	k=4, ADF=–4.01* CV(5%)=–2.88
Ken–Uga	k=4, ADF=–2.84 CV(5%)=–3.43	k=4, ADF=–1.96 CV(5%)=–2.87	k=3, ADF=–3.57* CV(5%)=–3.44	k=1, ADF=–2.88* CV(5%)=–2.88
Rwa–Ken	k=4, ADF=–3.61* CV(5%)=–3.43	k=4, ADF=–3.64* CV(5%)=–2.87	k=4, ADF=–4.22* CV(5%)=–3.44	k=4, ADF=–3.52* CV(5%)=–2.88
Rwa–Tza	k=4, ADF=–2.73 CV(5%)=–3.43	k=4, ADF=–1.77 CV(5%)=–2.87	k=4, ADF=–3.77* CV(5%)=–3.44	k=4, ADF=–4.01* CV(5%)=–2.88
Rwa–Uga	k=4, ADF=–2.77 CV(5%)=–3.43	k=4, ADF=–2.19 CV(5%)=–2.87	k=4, ADF=–4.53* CV(5%)=–3.44	k=4, ADF=–4.17* CV(5%)=–2.88
Tza–Uga	k=4, ADF=–2.29 CV(5%)=–3.43	k=4, ADF=–2.32 CV(5%)=–3.43	k=3, ADF=–4.57* CV(5%)=–3.44	k=3, ADF=–4.63* CV(5%)=–2.88

1/ Notes: k stands for the number of lags, **ADF** stands for the augmented Dickey-Fuller statistic, and **CV** stands for critical value. An **asterisk** means that the null hypothesis of a unit root is rejected, or equivalently, that the hypothesis of PPP cannot be rejected.

Second, the null hypothesis of a random walk during the period 1979:1–1996:12 in the case of all bilateral real exchange rates vis-à-vis Tanzania and Uganda cannot be rejected. Although PPP's failure is not surprising (see Section III above), the possibility of exchange rate misalignment in these two countries, reflected in short-run deviations from PPP, cannot be ruled out.[23] Particularly, it appears from Table 3 that, during the period 1979:1–1996:12, inflation differentials of each country in the sample with Tanzania and Uganda was not offset by equal rates of currency depreciation.

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[23]Misalignment of the real exchange rate based on short-term deviations from PPP is a narrow concept compared to misalignment in relation to fundamental equilibrium exchange rate (FEER) that is consistent with internal-external macroeconomic balances (see Clark, et al (1994)).

By focusing on the subperiod 1986:1–1996:12,[24] and running the unit-root tests for this subperiod, the hypothesis of absolute PPP vis-à-vis Tanzania and Uganda could not be rejected.[25] In fact, Table 6 shows evidence in favor of absolute PPP among the five economies during the period 1986:1–1996:12, meaning that bilateral real exchange rates tend to revert to their long-term equilibrium values and competitiveness losses or gains tend to be corrected.

From the above analysis, a number of important conclusions can be derived. First, nominal exchange rates in the five countries have adjusted to inflation differentials. Monetary shocks, reflected in high inflation rates in certain countries (e.g., Uganda, 1979:1–1985:12), have apparently been neutralized over the long run as real exchange rates were able to return to long-term paths in line with PPP. Thus, while short-run deviations from PPP have frequently occurred, long-term validity of absolute PPP could not be rejected in the case of any of the five countries in the sample, at least during the subperiod 1986:1–1996:12.

Second, these results may suggest that intra-regional trade has played a strong role in reestablishing competitiveness among the five countries. Third, even large real shocks have not had a lasting impact on competitiveness, owing to similar economic growth patterns and absence of persistent productivity differentials. Important may also be that the five economies have almost in parallel implemented comprehensive adjustment programs, under which they have adopted reforms that eliminated most price controls, liberalized trade, and—in the case of Kenya, Rwanda, Tanzania, and Uganda—introduced independently floating currencies. These reforms have helped increase the flexibility of prices and nominal exchange rates in adjusting to short-term deviations, and shortened the time period required for dampening these deviations.[26] Finally, the predictive power of these findings implies that exchange rate misalignment relative to PPP would eventually be corrected through commensurate movements in nominal exchange rates, as exemplified by the cases of Tanzania, and Uganda.

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[24]A reexamination of Table 1 and 2 reveals that high rates of inflation were not fully offset by currency depreciation in the case of Tanzania and Uganda during 1979:1–1985:12. Therefore, restricting the tests to 1986:1–1996:12 enables to remove the impact on PPP of misalignment in inflation and currency depreciation trends during 1979:1–1985:12.

[25]In the next section, the hypothesis of the weaker version of PPP vis-à-vis Tanzania and Uganda cannot be rejected for the full period 1979:1–1996:12, thus playing down the hypothesis of nominal exchange rates misalignment once a less restrictive specification of PPP theory is adopted.

[26]Empirical findings for developed countries suggest that the time period required for reestablishing PPP is shorter under floating exchange rate regimes; in this case, deviations from PPP could have a half-life as short as three to four years.

V. Testing the Hypothesis of the Weaker Version of Purchasing Power Parity in Five East African Countries

A. A Cointegration Model

The purpose of this section is to relax the homogeneity and symmetry assumptions of PPP and study the existence of unrestricted stationary relations linking bilateral nominal exchange rates and price levels in the five countries. If a stationary relation is shown to exist between nonstationary variables, this relation is called a cointegrating relation, and the nonstationary variables are said to be cointegrated. The search for cointegrating relations in models dealing with exchange rate determination has gained wide currency. Most recently, empirical work has expanded in the framework of Johansen's cointegration model (1988) which has the advantage of allowing for joint determination (endogeneity) of nominal exchange rates and price levels, takes into account short-term dynamics of these variables while allowing for the return of the system of variables to a long-term equilibrium in line with PPP theory. Johansen's model is applied to integrated variables of order one, but it is not a problem if some are stationary. The model to be fitted by the data is a vector autoregressive (VAR) model of order k expressed as

$$Y_t = A_1.Y_{t-1} + A_2.Y_{t-2}+.....+A_k.Y_{t-k} + C+ \epsilon_t,\ t=1,....., T. \qquad (8)$$

Y_t is an n-dimensional vector of variables (in this paper $Y_t = (e_t\ , p^*_t\ , p_t)$); k is the number of lags; C is a constant; and ϵ_t is a n-dimensional vector of random disturbances assumed to be identically and independently normally distributed $N_n(0,\Sigma)$. T is the number of observations. The coefficients A_i , i=1,....,k are coefficient matrices. Written in a vector error correction form, the above multivariate model becomes

$$\Delta y_t = \Gamma_1.\ \Delta Y_{t-1} + \Gamma_2.\ \Delta Y_{t-2} +.....+ \Gamma_{k-1}\ .\ \Delta Y_{t-k+1} + \Pi.Y_{t-1} + C + \epsilon_t \quad (9)$$

where ΔY_t is the first difference of Y_t ; ΔY_{t-1},..., ΔY_{t-k+1} are first differences of Y_t at lags 1,2,....,k–1; and Y_{t-1} is Y_t lagged one period. Equation (9) takes into account short-term dynamics via the effects of the first differences ΔY_{t-i} and long-term effects via the role of Y_{t-1}. The aim of the cointegration model is to determine the number of long-term stationary relations among the variables contained inY_t or, equivalently, the number of cointegrating vectors, by studying the rank of the matrix Π. If the rank of Π is n, then Y_t is stationary. If the matrix Π is the null matrix, then it means there is no long-run cointegrating relationship. If $0 < \text{rank}(\Pi) = r < n$, then the matrix Π can be decomposed into two full rank matrices: α (n,r) and β (n,r) with $\Pi = \alpha.\beta'$. The matrix β is called the matrix of cointegrating vectors, r is the number of cointegrating vectors, whereas the matrix α is called the matrix of adjustment or error correction coefficients, or equivalently the speed at which nominal exchange rates and prices return to equilibrium following a disturbance.

In sum, equation (9) postulates that Y_t moves in response to changes in itself, to deviations from r long-run equilibrium conditions (the cointegrating vectors), and to random disturbances. The long-run equilibrium relations can be stated as

$$\beta'. Y_t = 0 \qquad (10)$$

The rank of Π, or the number of cointegrating vectors, is determined by the number of canonical correlations between ΔY_t and Y_{t-1} that are significantly different from zero. The full-information maximum likelihood ratio statistic for testing the null hypothesis that r is less or equal r_0 against the alternative hypothesis that r is greater than r_0, is called the trace statistic; it is expressed as

$$\text{Trace} = -T \cdot \sum_{i=r+1}^{n} \text{Log}(1 - \lambda_i) \qquad (11)$$

where λ_i are the smallest canonical correlations between ΔY_t and Y_{t-1}. An alternative statistic for testing the null hypothesis that the cointegrating vectors are equal to r versus the alternative r+1 is called the maximum eigenvalue statistic and is expressed as

$$\text{Maximum eigenvalue} = -T.\text{Log}(1 - \lambda_{r+1}) \qquad (12)$$

The null hypothesis is rejected if the value of the statistic in (11) or in (12) is greater than the corresponding critical value.[27]

B. Application of the Cointegration Model to the Five East African Countries

Presentation of the econometric results

Equation (9) is applied to monthly data of the five countries for the period 1979:1–1996:12. Although in order to save space the results are not shown here, all bilateral nominal exchange rates and price indices are found to be integrated of order one, thus fulfilling a main requirement for the application of Johansen's model. The optimal number of lags was found to be five months for all the cointegration regressions.[28] Table 7 presents the results of the tests regarding the rank of Π for the ten pairs of countries using both the trace

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[27]Asymptotic critical values for the trace and the maximum eigenvalue statistics for a number of endogenous variables up to 11 are given in Osterwald-Lenum (1992).

[28]The number of lags k was determined by minimizing both the Akaike information criterion and the Schwarz criterion.

statistic and the maximum eigenvalue statistic. The estimated cointegrating vectors are normalized by the bilateral nominal exchange rate and are presented in Table 8, whereas the estimated adjustment coefficients are presented in Table 9.

Table 7. Five East African Countries: Test Statistics and Critical Values for the Hypothesis about the Number of Cointegrating Vectors in the Weaker Version of PPP, 1979:1–1996:12

Home-Foreign Country	k & C 1/	The null hypothesis, the likelihood ratio statistic (LR), and the critical value at 5 percent.		Rank 2/
		Trace	Maximum eigenvalue	
Bdi–Ken	k=5 C	r=0, LR=43.1, CV=34.91 r≤1, LR=14.6, CV=19.96 r≤2, LR =2.2, CV=9.24	r=0, LR=28.5, CV=22.00 r=1, LR=12.4, CV=15.67 r=2, LR=2.2, CV=9.24	r=1
Bdi–Rwa	k=5 C	r=0, LR=59.9, CV=34.91 r≤1, LR=24.3, CV=19.96 r≤2, LR =3.0, CV=9.24	r=0, LR=35.6, CV=22.00 r=1, LR=21.3, CV=15.67 r=2, LR=3.0, CV=9.24	r=2
Bdi–Tza	k=5 C	r=0, LR=54.9, CV=34.91 r≤1, LR=23.4 , CV=19.96 r≤2, LR =8.4, CV=9.24	r=0, LR=31.5, CV=22.00 r=1, LR=15.0, CV=15.67 r=2, LR=8.4, CV=9.24	r=1
Bdi–Uga	k=5 No C	r=0, LR=46.1, CV=24.31 r≤1, LR=15.7 , CV=12.53 r≤2, LR=6.1, CV=3.84	r=0, LR=30.3, CV=17.89 r=1, LR=9.8, CV=11.44 r=2, LR=6.1, CV=3.84	r=1
Ken–Tza	k=5 C	r=0, LR=36.8, CV=34.91 r≤1, LR=13.2, CV=19.96 r≤2, LR=5.9, CV=9.24	r=0, LR=23.6, CV=22.00 r=1, LR=7.3, CV=15.67 r=2, LR=5.9, CV=9.24	r=1
Ken–Uga	k=5 No C	r=0, LR=31.9, CV=24.31 r≤1, LR=11.5, CV=12.53 r≤2, LR=3.4, CV=3.84	r=0, LR=20.4, CV=17.89 r=1, LR=8.1, CV=11.44 r=2, LR=3.4, CV=3.84	r=1
Rwa–Ken	k=5 C	r=0, LR=45.3, CV=34.91 r≤1, LR=12.4, CV=19.96 r≤2, LR=4.3, CV=9.24	r=0, LR=32.9, CV=22.00 r=1, LR=8.1, CV=15.67 r=2, LR=4.3, CV=9.24	r=1
Rwa–Tza	k=5 C	r=0, LR=47.2, CV=34.91 r≤1, LR=16.7, CV=19.96 r≤2, LR =6.5, CV=9.24	r=0, LR=30.5, CV=22.00 r=1, LR=10.2, CV=15.67 r=2, LR=6.5, CV=9.24	r=1
Rwa–Uga	k=5 C	r=0, LR=42.6, CV=34.91 r≤1, LR=15.6, CV=19.96 r≤2, LR =5.5, CV=9.24	r=0, LR=27.0, CV=22.00 r=1, LR=10.1, CV=15.67 r=2, LR=5.5, CV=9.24	r=1
Tza–Uga	k=5 No C	r=0, LR=37.8, CV=24.31 r≤1, LR=11.7, CV=12.53 r≤2, LR=4.4, CV=3.84	r=0, LR=26.1, CV=17.89 r=1, LR=7.3, CV=11.44 r=2, LR=4.4, CV=3.84	r=1

1/ The notations k and C denote the number of lags and the use of a constant C in the cointegration regression, respectively. The notation No C means that no constant term was included in the cointegration regression model.
2/ The rank r stands for the number of cointegrating vectors.

Table 8. Five East African Countries: Normalized Cointegrating Vectors (Long-Run Weaker PPP), 1979:1–1996:12. 1/

Home-Foreign Country	Coefficient of the nominal exchange rate	Coefficient of the foreign price level	Coefficient of the domestic price level	Constant
Bdi–Ken	1.000	1.774	–0.5750	–4.853
		(2.748)	(2.926)	(7.831)
		(0.645)	(–0.196)	(–0.619)
Bdi–Rwa 2/	1.000	0.000	–1.0360	3.6097
			(0.3363)	(1.3208)
			(–3.0817)	(2.7329)
	0.000	1.000	–0.6066	–1.5378
			(0.2060)	(0.8092)
			(–2.9443)	(–1.900)
Bdi–Tza	1.000	1.886	–3.0340	7.955
		(0.661)	(2.215)	(7.654)
		(2.853)	(–1.369)	(1.039)
Bdi–Uga	1.000	0.919	–0.601	No constant
		(0.043)	(0.051)	
		(21.345)	(–11.861)	
Ken–Tza	1.000	4.913	–4.898	–28.910
		(26.687)	(30.073)	(222.898)
		(0.181)	(–0.163)	(–0.129)
Ken–Uga	1.000	1.231	–1.007	No constant
		(0.161)	(0.362)	
		(7.641)	(–2.785)	
Rwa–Ken	1.000	1.681	–1.703	–0.823
		(0.165)	0.229	(0.482)
		(10.174)	(–7.429)	(–1.709)
Rwa–Tza	1.000	1.652	–2.566	8.255
		(0.346)	(1.116)	(5.885)
		(4.768)	(–2.299)	(1.403)
Rwa–Uga	1.000	1.171	–1.448	8.758
		(0.314)	(2.159)	(13.513)
		(3.726)	(–0.671)	(0.648)
Tza–Uga	1.000	2.935	–4.687	No constant
		(2.538)	(4.903)	
		(1.156)	(–0.957)	

1/ The first number indicates the cointegrating coefficient, the second number in parentheses indicates the standard error of the cointegrating coefficient, and the third number in parentheses indicates the t-statistic.
2/ The cointegrating vectors are normalized in terms of the canonical orthonormal basis.

Table 9. Five East African Countries: Estimated Adjustment Coefficients Toward Long Run Weaker PPP, 1979:1–1996:12. 1/			
Home-Foreign Country	Coefficient of the nominal exchange rate	Coefficient of the foreign price level	Coefficient of the domestic price level
Bdi–Ken	0.0036 (0.0021) (1.7508)	0.0024 (0.0009) (2.7585)	0.0047 (0.0012) (3.9849)
Bdi–Rwa: (1):	–0.1570 (0.0466) (–3.365)	–0.0165 (0.0089) (–1.853)	0.0217 (0.0121) (1.7958)
(2):	–0.2264 (0.0796) (–2.8447)	–0.0162 (0.0152) (–1.0677)	0.0574 (0.0206) (2.7928)
Bdi–Tza	–0.0051 (0.0038) (–1.3391)	0.0037 (0.0008) (4.4153)	0.0043 (0.0017) (2.4882)
Bdi–Uga	–0.0388 (0.0281) (–1.3776)	–0.0149 (0.0091) (–1.6312)	0.0052 (0.0030) (1.7233)
Ken–Tza	0.0001 (0.0003) (0.3629)	–0.0002 (0.00006) (–4.1258)	–0.0002 (0.00009) (–2.6355)
Ken–Uga	0.0068 (0.0114) (0.5941)	–0.0133 (0.0036) (–3.6568)	–0.0021 (0.0009) (–2.3753)
Rwa–Ken	–0.0683 (0.0292) (–2.3397)	0.0093 (0.0054) (1.7318)	0.0213 (0.0049) (4.3544)
Rwa–Tza	–0.0063 (0.0055) (–1.1417)	0.0030 (0.0006) (5.3362)	0.0008 (0.0009) (0.9350)
Rwa–Uga	–0.0067 (0.0045) (–1.4751)	0.0049 (0.0013) (3.6132)	0.0011 (0.0003) (3.3769)
Tza–Uga	0.0018 (0.0033) (0.5336)	–0.0022 (0.0010) (–2.2222)	–0.0007 (0.0002) (–4.4879)
1/ The first number indicates the adjustment coefficient, the second number in parentheses indicates the standard error of the adjustment coefficient, and the third number in parentheses indicates the t-statistic.			

Maximum likelihood ratio tests based on Johansen's model (Table 7) point to an important finding: the hypothesis of at least one cointegrating relation between the nominal exchange rate and the price levels cannot be rejected for any pair of countries. Specifically, the test for Tanzania and Uganda indicates the existence of exactly one cointegrating vector. In

the case of Burundi and Rwanda, the two tests point to the existence of two cointegrating vectors, reflecting thus the strong linkages between these two economies. In sum, the validity of the weaker version of PPP as a long-run relation cannot be rejected; the nominal exchange rate and the price levels tend to revert to a long-run equilibrium relation determined by the cointegrating vector. These results reinforce the findings of the previous section and strongly support long-run PPP theory. Prices and nominal exchange rates are therefore found to be highly interdependent in the five countries. Interestingly, the coefficients of the cointegrating vectors have the expected signs for each pair of countries (Table 8); namely, the nominal exchange rate and the domestic price level are positively related, and the nominal exchange rate and the foreign price level are inversely related. While the statistical significance of the coefficients varies, the existence over the long run of a weaker PPP relationship for each pair of countries cannot be rejected. The estimation of cointegration regressions over the subperiod 1986:1–1996:12 has yielded even stronger results and more significant cointegration coefficients, suggesting that more recently, the interdependence of key economic variables has even increased between the countries in the sample.

A glance at the cointegration coefficients in Table 8 shows that these are not always close to unity, as postulated in the pure form of PPP theory. As mentioned in Section III, this result is likely to be primarily due to the heterogeneity of the weighting structure in the compilation of price indices, including changes in the base year and the structure of the price index in each of the five countries during the period under observation. The result may also be due to changes in relative prices between groups of goods and services included in the price indices. Nonetheless, the results in Table 8 can always be refined by testing whether the cointegrating vector associated with the pure form of PPP (1, 1, –1) belongs to the space of the cointegrating vectors associated with the weaker form of PPP, or whether the symmetry restriction is a valid hypothesis. Refinement along these lines will shed some light on how much different the weighting structure is among each pair of countries.[29]

The adjustment, or error correction, coefficients α can be interpreted as measuring the proportional change in nominal exchange rate, foreign or domestic price level in response to a 100 percent (log-difference of one) deviation of these variables from long-run PPP. A higher α means that the given variable converges at a faster pace toward its equilibrium value. In this respect, nominal exchange rates under a freely floating regime may be expected to display higher adjustment coefficients than price levels. Moreover, for the adjustment to be stabilizing, the sign of the error correction coefficient has to be the same as that of the corresponding integrating coefficient. Since restoration of long-term PPP is the combined result of

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[29] The technique for this test, illustrated in Johansen (1988, 1990, 1993), is consistent with imposing the linear restriction (1,1,–1) on the matrix of cointegrating vectors. The test statistic is the ratio of the likelihood ratio of the unrestricted model to that of the restricted model and is distributed as a chi-square with degrees of freedom equal to r.(n-s), where n is the dimension of Y_t , r is the rank of Π, and s is the number of linear restrictions.

movements in three variables, unmatched signs indicate that the brunt of adjustment was borne by the variables with error correction coefficients having signs matching those of the cointegrating coefficients.

The adjustment coefficients of the nominal exchange rates turn out to be higher on average than those of the price levels (Table 9). Nonetheless, the adjustment coefficients of the price levels are quite significant in most cases, demonstrating the important role played by arbitrage and the considerable flexibility of prices in restoring long-term PPP. All the adjustment coefficients display the correct sign in the case of Burundi and Rwanda, and Burundi and Uganda. For the pairs Burundi and Kenya, Kenya and Tanzania, and Tanzania and Uganda, the nominal exchange rate is the significant variable in the cointegrating vector and turns out to have the correct adjustment sign. For Burundi and Tanzania, and Rwanda and Uganda, the foreign price level is the significant variable in the cointegrating vector and has also a matched sign in the adjustment coefficient. However, for the pairs Kenya and Uganda, Rwanda and Kenya, and Rwanda and Tanzania, both domestic and foreign price levels were significant in the cointegrating vector, yet one of these variables failed to have a matched sign in the error correction vector. In these three cases, the adjustment was effected by a move of the nominal exchange rate in the right direction in order to reestablish long-term PPP, reinforced by a correct sign of the foreign price level in the case of Kenya and Uganda and Rwanda and Tanzania and a correct sign of the domestic price level in the case of Rwanda and Kenya. In these three pairs, the adjustment coefficients of the nominal exchange rate turn out on average to be much higher than those of the price levels.

Economic interpretation of the econometric results

Notwithstanding important real shocks and episodes of macroeconomic instability, the five countries have maintained over the long run their competitiveness with respect to each other.[30] The evidence in favor of PPP theory confirms the idea of a large traditional trading zone to which the five countries belong. Indeed, there has been a tradition of commerce among the five countries; moreover, efficient arbitrage and transmission of information about prices and profit opportunities seem to prevail, helping to maintain long-run PPP. Many important economic intra-regional relationships could be inferred.

First, the paper provides evidence that arbitrage works and market information in one country in the sample is relevant to traders in the other countries. Instances of commodity price equalization are numerous. For example, a significant margin in the producer price of a commodity (say coffee in Burundi) would lead to increased trade of this commodity to neighboring markets where its price is higher, thereby forcing a realignment of its home price. Second, wage policy seems to have helped maintain cross-region competitiveness. Indeed, the five countries have a labor surplus and wages in the private sector are determined by similar

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[30] One implication of these results could be a broad long-term equilibrium in their bilateral trade accounts.

productivity levels. Instances of factor price equalization are numerous, particularly for farmers' wages. Third, consumer preferences are similar; subsequently, the import content as well as the domestic product content of CPIs tend to be similar. This aspect of consumption pattern would tend to reflect the same impact of international inflation on these five countries' CPIs. Fourth, production possibilities sets are similar with some economies being characterized by the importance of subsistence activities and small manufacturing. Thus, production costs tend to be similar and may have helped restore PPPs.

Besides these economic similarities, convergence of macroeconomic and structural policies was also influential in restoring cross region PPPs and maintaining bilateral competitiveness. This convergence has been strengthened over the more recent period as a result of structural reforms that the five countries have undertaken in parallel. Under these reforms, they have lifted many price controls and liberalized trade and exchange regimes. Together with the adoption of freely floating exchange arrangements in four of the five countries, these reforms have increased the flexibility of prices and exchange rates in line with the requirements for maintaining competitiveness. Ability to restore long run PPP in a broad sense seems to have insulated to a significant extent each of these countries from losses in real income[31] and foreign reserves that could have arisen from slippages in their own domestic macroeconomic policies. Using the results of the study as a predictive basis, it seems that unsustainable fiscal and monetary policies will bring about subsequent and commensurate adjustments in nominal exchange rates in order to restore PPPs across the five countries. While this apparent automaticity is encouraging, it has to be remembered that there may be high transitional costs involved in the process. Thus, the need for prudent and responsible financial policies will always be emphasized even under self-correcting conditions.

Finally, trade policy could have also played a significant role in reestablishing PPPs. It is important to note that the five countries are members of several regional trade arrangements and have recently become participants in the Cross-Border Initiative for South-East Africa. As the aim of these arrangements was to reduce regional tariffs, increase regional trade, and promote private investment, it can inferred that greater regional integration and related intensification of commodity arbitrage may have contributed to restore the region's PPPs.

VI. Conclusion

This study suggests that each of the five East African countries is mindful about its external competitiveness and has managed to maintain this competitiveness on a bilateral basis with the four other trading partners. The paper finds that the five countries do constitute an integrated trading zone where arbitrage works efficiently, and where each country has broadly succeeded to preserve its competitive position. Many policy implications follow.

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[31]These losses arise in a Keynesian national income model via the multiplier effect when imports are not sufficiently offset by exports.

First, in order for each country not to loose ground to its trading partners, wage and cost structure should remain in line with productivity levels, and labor markets should remain competitive. Second, macroeconomic and structural policies should converge along the same line as those of its partners. Each country, like its partner countries, needs to introduce timely reforms that enhance economic efficiency and trade. Moreover, a sufficient degree of flexibility is needed in nominal exchange rate in order to insulate economies against losses in real income that would otherwise emanate from slippages in macroeconomic policies. Third, interdependence of markets and auto-correction mechanisms in the five countries can even be strengthened further by still greater economic integration and more liberal trading regimes. Indeed, Adam Smith's notion that wider markets will promote economic growth is fully relevant. By promoting intra-regional trade through, inter alia, reduced tariffs and elimination of nontariff barriers, the five countries will also be able to foster private sector development and enhance economic growth. Indeed, greater volume of regional trade and greater integration are essential for achieving these two objectives, given the limited size of each country's domestic market. Fourth, in respect to monetary policy, the close relationship between the monetary approach to the balance of payments and PPP appears to be confirmed. Broadly, by managing to realign real exchange rates and reestablish competitiveness, some countries (Kenya, Rwanda, Tanzania, and Uganda) have succeeded in reversing losses in foreign reserves and even rebuild these reserves to comfortable levels.[32] Finally, the findings of this paper tend to confirm the notion of PPP as a long-term anchor; namely, nominal exchange rates will tend to adjust to inflation differentials. Indeed, the apparent validity of long-term PPP at the regional level might warrant testing more elaborate exchange rate models that allow for a well-specified role of main macroeconomic variables, including real income and money supply.

[32]See selected macroeconomic indicators in the Annex.

Five East African Countries: Selected Macroeconomic Indicators, 1979-96.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Period Averages			
																			1979-85	1986-91	1991-96	1979-96
Nominal GDP (in billions of local currencies)																						
Burundi	71.4	82.8	87.2	91.2	100.7	118.2	138.8	137.2	139.8	152.0	176.7	193.9	211.9	226.4	228.2	245.4	265.0	293.6	98.6	168.6	251.7	164.5
Kenya	45.4	52.6	60.5	70.3	78.5	88.8	100.7	117.5	131.2	151.2	171.7	196.4	224.2	264.5	333.7	414.8	467.9	535.6	71.0	165.4	403.3	194.7
Rwanda	97.8	121.6	138.1	147.3	159.9	178.9	195.3	191.5	193.3	198.5	216.8	214.1	239.3	271.8	284.4	165.1	327.5	408.1	148.4	208.9	291.4	208.3
Tanzania	36.3	39.3	47.0	56.8	65.7	77.5	98.8	130.3	176.1	285.5	475.8	671.2	832.7	1,032.8	1,282.1	1,635.5	2,284.3	2,998.3	60.2	428.6	1,846.6	679.2
Uganda	0.2	0.3	3.4	5.0	9.8	19.9	42.5	124.4	390.5	894.9	1,375.6	1,829.5	2,744.3	3,870.3	4,366.7	5,273.3	6,077.0	6,840.6	11.6	1,226.5	5,285.6	1,881.6
Real GDP (percent change)																						
Burundi	3.2	1.8	9.6	-1.1	3.7	0.2	11.8	3.2	5.5	5.0	1.3	3.5	5.0	2.7	-5.8	-6.7	-3.7	-3.6	4.2	3.9	-3.4	2.0
Kenya	4.0	4.0	4.1	1.8	1.0	2.1	4.4	7.1	5.9	6.0	5.8	4.5	1.4	-0.8	0.4	2.7	4.4	4.2	3.1	5.1	2.2	3.5
Rwanda	4.3	4.9	5.2	-2.5	6.0	13.0	4.4	5.5	-0.3	0.3	-5.7	0.4	-4.3	6.6	-6.8	-49.0	24.6	13.3	5.0	-0.7	-2.3	1.1
Tanzania	5.5	3.6	1.2	0.0	-0.9	0.5	4.0	5.6	6.2	5.9	3.9	4.6	6.4	4.7	3.9	3.5	3.8	4.5	2.0	5.4	4.1	3.7
Uganda	-7.8	-9.2	6.0	8.2	4.3	-3.0	0.9	4.0	8.3	6.4	6.5	5.6	3.4	8.3	6.3	11.5	9.8	7.0	-0.1	5.7	8.6	4.3
Money supply (in billions of local currencies)																						
Burundi	10.2	12.9	15.9	15.3	19.4	20.2	24.0	25.1	26.5	26.9	30.1	34.2	35.0	36.1	38.7	52.3	50.3	55.7	16.8	29.6	46.6	29.4
Kenya	16.2	16.1	18.3	21.4	22.8	25.8	28.4	36.2	40.7	44.1	53.3	61.5	74.3	99.3	124.8	162.7	193.0	221.9	21.3	51.7	160.4	70.1
Rwanda	14.1	15.2	16.0	16.2	18.1	19.9	23.4	26.6	29.2	31.4	30.1	31.7	33.5	37.7	39.4	36.5	62.6	67.9	17.5	30.4	48.8	30.5
Tanzania	11.5	15.0	18.3	22.2	26.4	26.7	32.2	39.8	48.6	66.0	86.2	125.3	159.1	223.5	321.5	469.1	641.2	744.2	21.8	87.5	479.9	170.9
Uganda	0.0	0.0	0.0	0.0	0.1	0.1	0.2	13.9	27.2	60.5	94.4	138.6	212.6	301.9	402.5	504.4	609.1	700.5	0.1	91.2	503.7	170.3
Change in money supply (in percent)																						
Burundi	7.4	25.8	23.4	-3.6	27.0	4.0	18.8	4.6	5.4	1.5	12.1	13.6	2.3	3.1	7.2	35.1	-3.8	10.8	14.7	6.6	10.5	10.8
Kenya	13.1	-0.6	13.3	17.2	6.6	12.9	10.2	27.6	12.4	8.3	20.8	15.4	20.9	33.6	25.7	30.4	18.6	15.0	10.4	17.6	24.7	16.7
Rwanda	26.0	7.9	4.9	1.2	11.9	10.0	17.7	13.7	9.8	7.5	-4.1	5.3	5.7	12.5	4.5	-7.4	71.6	8.3	11.4	6.3	17.9	11.5
Tanzania	46.9	30.3	22.0	21.3	18.9	1.1	20.6	23.6	22.1	35.8	30.6	45.4	27.0	40.5	43.8	45.9	36.7	16.1	23.0	30.7	36.6	29.4
Uganda	55.1	32.8	87.3	11.4	41.3	104.9	89.5	6,479.9	95.6	122.4	56.0	46.8	53.4	42.0	33.3	25.3	20.8	15.0	60.3	1,142.4	27.3	411.8
Velocity (GDP/broad money)																						
Burundi	7.0	6.4	5.5	6.0	5.2	5.8	5.8	5.5	5.3	5.7	5.9	5.7	6.1	6.3	5.9	4.7	5.3	5.3	6.0	5.7	5.5	5.7
Kenya	2.8	3.3	3.3	3.3	3.4	3.4	3.5	3.2	3.2	3.4	3.2	3.2	3.0	2.7	2.7	2.5	2.4	2.4	3.3	3.2	2.5	3.1
Rwanda	6.9	8.0	8.6	9.1	8.8	9.0	8.3	7.2	6.6	6.3	7.2	6.8	7.1	7.2	7.2	4.5	5.2	6.0	8.4	6.9	6.0	7.2
Tanzania	3.2	2.6	2.6	2.6	2.5	2.9	3.1	3.3	3.6	4.3	5.5	5.4	5.2	4.6	4.0	3.5	3.6	4.0	2.8	4.6	3.9	3.7
Uganda	12.6	17.6	9.8	13.0	18.1	17.9	20.1	8.9	14.4	14.8	14.6	13.2	12.9	12.8	10.8	10.5	10.0	9.8	15.6	13.1	10.8	13.4
Overall fiscal deficit (in percent of GDP)																						
Excluding grants																						
Burundi	-10.0	-9.9	-11.5	-12.4	-18.8	-12.3	-10.2	-8.4	-16.7	-11.7	-9.5	-10.8	-8.9	-11.5	-12.8	-7.1	-7.2	-1.6	-12.2	-11.0	-8.0	-10.6
Kenya	-7.0	-8.7	-9.1	-6.7	-4.8	-6.1	-7.3	-7.3	-6.4	-6.2	-6.9	-7.3	-6.3	-8.4	-9.1	-4.6	-1.9	-1.3	-7.1	-6.7	-5.1	-6.4
Rwanda	-7.2	-5.8	-6.8	-6.1	-6.7	-4.8	-5.1	-5.6	-8.4	-7.3	-5.2	-10.0	-11.5	-14.0	-14.5	-12.4	-14.1	-14.3	-6.1	-8.0	-13.9	-8.9
Tanzania	-17.7	-9.2	-10.1	-11.2	-10.7	-8.2	-7.2	-5.6	-11.4	-15.8	-9.8	-8.0	-5.2	-5.0	-14.0	-9.9	-8.4	-6.6	-10.6	-9.3	-8.8	-9.7
Uganda	-23.6	-34.0	-8.6	-5.0	-2.3	-3.9	-4.4	-4.1	-5.5	-4.9	-5.8	-7.1	-14.4	-11.3	-10.4	-7.6	-6.0	-5.2	-11.7	-7.0	-8.1	-9.1
Including grants																						
Burundi	-6.4	-6.2	-6.4	-8.5	-15.1	-8.3	-6.8	-4.8	-12.8	-9.3	-2.7	-2.7	-0.2	-2.9	-3.7	-4.7	-3.6	3.2	-8.2	-5.4	-2.4	-5.7
Kenya	-6.4	-8.0	-8.0	-5.3	-3.7	-4.9	-6.0	-6.3	-4.7	-3.9	-4.5	-5.1	-4.3	-6.8	-7.9	-3.5	-0.7	-0.2	-6.0	-4.8	-3.8	-5.0
Rwanda	-3.8	-3.3	-4.7	-3.6	-4.3	-2.8	-3.1	-3.6	-6.7	-4.4	-2.8	-7.2	-6.9	-7.9	-8.2	-11.5	-2.4	-6.6	-3.6	-5.3	-7.3	-5.2
Tanzania	-12.7	-6.6	-7.6	-9.5	-9.2	-6.6	-5.7	-4.8	-9.7	-10.2	-5.4	-3.9	-2.4	-1.9	-9.4	-5.2	-6.1	-4.1	-8.3	-6.1	-5.3	-6.7
Uganda	-23.1	-32.3	-7.5	-3.8	-1.8	-3.5	-3.2	-3.7	-3.8	-3.3	-4.4	-3.3	-7.3	-3.2	-3.8	-2.9	-1.9	-1.0	-10.8	-4.3	-2.6	-6.3

Five East African Countries (concluded): Selected Macroeconomic Indicators, 1979-96.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Period Averages			
																			1979-85	1986-91	1991-96	1979-96
External current account deficit, excluding grants (in millions of U.S. dollars)																						
Burundi	-90.9	-127.5	-124.8	-175.5	-178.5	-156.0	-120.5	-140.3	-202.2	-157.7	-156.1	-230.1	-214.9	-218.5	-189.1	-174.6	-178.0	-163.2	-139.1	-183.6	-184.7	-166.6
Kenya	-477.1	-1,202.2	-766.4	-350.2	-157.6	-232.2	-210.9	-187.3	-634.4	-722.1	-852.9	-683.9	-295.3	-320.5	71.4	-13.8	-487.2	-168.6	-485.2	-562.7	-183.8	-427.3
Rwanda	-81.5	-155.4	-172.6	-183.5	-150.2	-128.5	-175.3	-171.4	-254.0	-266.4	-270.5	-224.6	-195.0	-249.6	-295.3	-400.0	-245.8	-215.0	-149.6	-230.3	-281.2	-213.0
Tanzania	-507.0	-606.2	-587.1	-562.8	-506.4	-435.3	-514.4	-537.0	-524.7	-580.2	-696.7	-763.9	-817.6	-1,067.7	-1,114.7	-1,075.8	-861.7	-674.9	-531.3	-653.3	-959.0	-690.8
Uganda	57.0	-246.0	-292.0	-235.0	-205.0	-74.0	-128.0	-102.0	-293.0	-361.0	-431.0	-449.3	-337.7	-380.6	-309.0	-444.3	-398.4	-379.9	-160.4	-329.0	-382.4	-278.3
External current account deficit, excluding grants (in percent of GDP)																			0.0	0.0	0.0	0.0
Burundi	-11.5	-13.9	-12.9	-17.3	-16.5	-15.8	-10.5	-11.7	-17.9	-14.6	-14.0	-20.3	-18.4	-20.1	-20.1	-18.0	-16.8	-16.8	-14.0	-16.1	-18.4	-15.9
Kenya	-7.8	-16.9	-11.5	-5.4	-2.7	-3.8	-3.4	-2.6	-8.0	-8.5	-10.2	-8.0	-3.6	-3.9	1.2	-0.2	-5.4	-1.8	-7.4	-6.8	-2.0	-5.7
Rwanda	-7.7	-11.9	-11.6	-11.6	-8.9	-7.9	-9.1	-7.8	-10.5	-10.3	-10.0	-8.7	-10.2	-12.2	-15.0	-53.3	-21.8	-16.1	-9.8	-9.6	-23.7	-13.6
Tanzania	-11.5	-12.7	-10.3	-8.6	-7.5	-7.1	-9.3	-7.7	-15.2	-16.7	-17.5	-19.7	-19.8	-25.9	-29.6	-31.4	-20.2	-13.1	-9.6	-16.1	-24.0	-15.8
Uganda	2.4	-5.7	-4.3	-4.4	-3.2	-1.3	-2.0	-1.1	-3.2	-4.3	-7.0	-10.5	-9.0	-11.1	-8.5	-8.3	-6.4	-5.8	-2.7	-5.9	-8.0	-5.2
External debt (in millions of U.S. dollars)																						
Burundi	111.7	158.3	177.4	211.7	300.0	344.3	435.0	548.9	748.2	809.1	879.6	885.0	940.0	993.5	1,040.5	1,132.2	1,164.3	1,176.1	248.3	801.8	1,101.3	669.8
Kenya	1,715.8	2,093.9	4,931.4	5,242.5	5,474.7	5,542.2	5,534.9	5,503.2	5,643.2	6,063.2	6,580.2	6,767.9	6,865.7	6,652.2	6,666.5	6,477.6	6,514.8	6,483.4	4,362.2	6,237.2	6,558.9	5,597.4
Rwanda	122.6	189.8	196.5	226.1	208.7	244.0	339.2	430.4	611.1	656.2	636.6	681.5	755.6	796.3	853.5	946.2	1,062.8	1,117.4	218.1	628.6	955.2	559.7
Tanzania	1,203.0	2,234.0	2,487.7	2,656.4	2,841.6	2,983.7	3,222.5	3,937.1	4,843.4	5,312.3	5,451.0	5,902.5	6,274.9	6,388.9	6,483.2	6,868.2	7,201.6	7,409.5	2,518.4	5,286.9	6,870.3	4,650.1
Uganda	698.4	794.4	841.4	867.3	991.5	1,001.0	1,154.9	1,120.8	1,310.5	1,438.4	1,570.0	2,591.6	2,647.5	2,638.0	2,992.4	3,387.0	3,461.0	3,445.0	907.0	1,779.8	3,184.7	1,830.6
External debt (in percent of GDP)																						
Burundi	14.1	17.2	18.3	20.9	27.7	34.9	37.8	45.7	66.1	74.8	79.0	78.2	80.5	91.4	110.7	116.6	109.7	121.3	24.4	70.7	109.9	63.6
Kenya	28.2	29.5	73.8	81.5	92.8	90.0	90.3	76.0	70.8	71.2	79.0	78.8	84.8	80.9	115.9	87.5	71.6	69.1	69.4	76.8	85.0	76.2
Rwanda	11.6	14.5	13.2	14.2	12.3	15.0	17.6	19.7	25.2	25.3	23.5	26.3	39.5	39.0	43.3	126.1	94.1	83.8	14.1	26.6	77.3	35.8
Tanzania	27.3	46.7	43.5	40.4	42.2	48.7	58.3	56.3	140.7	153.1	136.8	152.6	152.1	154.9	172.0	200.6	169.1	143.7	43.9	131.9	168.1	107.7
Uganda	29.2	18.5	12.4	16.3	15.5	18.1	18.2	12.6	14.4	17.1	25.5	60.8	70.8	77.3	81.9	62.9	55.2	52.7	18.3	33.5	66.0	36.6
Debt service (in percent of exports of goods and services)																						
Burundi	8.5	11.2	8.5	8.9	12.6	16.0	22.9	25.6	43.7	34.7	46.3	45.5	32.6	40.3	42.0	27.4	30.5	38.0	12.6	38.1	35.7	27.5
Kenya	10.0	8.0	10.2	13.4	11.3	11.6	27.0	24.6	29.6	26.7	27.6	29.8	30.0	33.0	26.2	25.0	24.8	23.4	13.1	28.1	26.5	21.8
Rwanda	8.9	10.8	12.6	7.6	6.4	6.2	7.9	8.0	17.6	15.6	15.8	18.2	18.4	25.6	30.8	80.4	56.6	47.8	8.6	15.6	48.2	22.0
Tanzania	5.9	15.4	16.9	18.4	24.6	32.6	46.7	55.3	61.3	68.5	57.2	72.1	69.6	63.4	87.2	61.5	43.3	41.1	22.9	64.0	59.3	46.7
Uganda	25.0	40.0	45.6	31.7	42.6	46.9	54.2	53.5	56.7	68.7	81.7	95.9	127.7	73.8	54.3	25.8	23.1	24.3	40.9	80.7	40.3	54.0
Gross foreign exchange reserves (in millions of U.S. dollars)																						
Burundi	90.0	94.5	61.3	29.5	26.9	19.7	29.5	69.1	60.7	69.4	99.6	105.0	141.4	174.2	163.0	204.7	209.5	139.6	50.2	90.9	178.2	99.3
Kenya	627.7	491.7	231.1	211.7	376.0	389.8	390.6	413.3	255.8	263.7	284.6	205.4	116.9	53.0	405.6	557.6	353.4	746.5	388.4	256.6	423.2	354.1
Rwanda	152.3	186.6	173.1	128.4	110.9	106.9	113.3	162.3	164.2	118.3	70.4	44.4	110.1	78.7	39.0	32.0	125.8	154.8	138.8	111.6	86.0	115.1
Tanzania	68.0	20.3	18.8	4.8	19.4	26.9	16.0	61.1	31.8	77.7	54.2	192.8	203.9	327.3	203.3	332.1	270.2	440.1	24.9	103.6	314.6	131.6
Uganda	22.8	3.0	30.0	78.3	106.5	67.9	27.3	29.2	54.6	49.3	14.1	44.0	58.9	94.4	146.4	321.4	458.9	528.4	48.0	41.7	309.9	118.6
Exchange rates (local currency per U.S. dollar, period averages)																						
Burundi	90.0	90.0	90.0	90.0	93.0	119.7	120.7	114.2	123.6	140.4	158.7	171.3	181.5	208.3	242.8	252.8	249.8	302.8	99.1	148.3	251.3	157.7
Kenya	7.5	7.4	9.0	10.9	13.3	14.4	16.4	16.2	16.5	17.8	20.6	22.9	27.7	32.2	58.0	56.0	51.4	57.1	11.3	20.3	51.0	25.3
Rwanda	92.8	92.8	92.8	92.8	94.3	110.2	101.3	87.6	79.7	76.5	80.0	82.6	125.1	133.0	144.3	220.0	290.0	306.0	96.7	88.6	218.7	127.9
Tanzania	8.2	8.2	8.2	8.6	9.8	12.6	17.9	18.6	51.2	82.3	119.4	173.5	201.8	250.5	340.1	477.6	536.4	581.4	10.5	107.8	437.2	161.5
Uganda	0.1	0.1	0.5	0.9	1.5	3.6	6.7	14.0	42.8	106.1	223.1	428.9	734.0	1,133.8	1,195.0	979.4	968.9	1,046.1	1.9	258.2	1,064.6	382.5
Coffee prices (U.S. cents per pound)																						
Other milds	194.7	173.0	143.7	156.7	147.7	161.7	163.3	216.2	126.0	151.5	120.0	100.0	95.4	71.4	78.5	166.6	167.6	134.9	163.0	134.9	123.8	142.7

Sources: Various staff reports for the year 1979, and World Economic Trends for Africa (WETA) for the period 1980-96. IFS for coffee prices.

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