AGRICULTURAL PRICE POLICY IMPLICATIONS OF MACROECONOMIC POLICIES IN ZAMBIA: 1964-1990

By

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OF MACROECONOMIC POLICIES

IN ZAMBIA: 1964-1990

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CHAPTER I

INTRODUCTION

Zambia's economic performance has been poor since the mid -1970s. The agricultural sector's contribution to GDP has been on the decline and the rate of growth of agricultural output has lagged behind the rate of growth of population.

From a relatively self-sufficient country in terms of staple food production, Zambia has been compelled, in recent years, to import increasing quantities of food to meet its domestic needs. With the rise of copper prices in the world market in the early 1970's, Zambia's export earnings rose rapidly. The political philosophy of "Humanism" prevalent at the time, and the desire to acquire control of the economy led to nationalization of most domestic industries and to import - substitution policies designed to protect the newly nationalized industries from foreign competition. The same political philosophy led to huge consumer subsidies and price control schemes designed to protect consumers from "exploitative" pricing. Administered prices and high tariffs have since been elements of economic policy.

The economic downturn of the last 15 years has been attributed to the low prices of copper, the main export commodity, on the world market. Copper exports accounted for more than 90 percent of export earnings between 1964 and 1971. If the fall in the price of copper has drastically affected the terms of trade that Zambia faces today, the failure of macroeconomic policies, especially

the exchange rate and fiscal and pricing policies, has exasperated Zambia's poor economic performance.

Price formation from 1964 until recently was controlled by the government through the national marketing board, and for nearly two decades pan-annual and pan-territorial pricing schemes were used for agricultural commodities. These issues have not yet found satisfactory solutions and debate on whether prices of agricultural commodities should be left to the administration or to market forces continues (Zambia Daily Mail, July 1993). The real prices received by farmers are further distorted by economic and other policy decisions made outside the agricultural sector.

Zambia is in the process of redefining its economic strategy, particularly as it relates to agricultural policy. This strategy is centered on letting market forces determine prices of commodities within the economy. This study attempts to show that freeing prices alone will not necessarily improve agricultural performance unless adequate macropolicies are instituted so as not to offset gains obtained from a free market strategy.

1.1 Problem Situation

Agricultural policy formation has been essentially sectoral and has virtually ignored the linkages between agricultural prices and macroeconomic policies. The performance of agriculture is dependent upon prices received by farmers and these in turn, tend to be affected by developments in other sectors of the economy including monetary and fiscal policies that affect the overall level of economic activity (aggregate supply and demand) through inflation, real exchange rate, real interest rate, trade balance, and level of income.

The mining sector remains the dominant sector of the economy in terms of its investments, its contribution to GDP, and to the trade balance. The drastic fall in copper prices in 1975 revealed the fragility of Zambia's development strategy of the early years and should have refocussed planners and the government bureaucracy towards finding an alternative to copper. Agriculture represents the only other viable sector in view of its already high level of output (at least in the commercial sector), its readiness to provide employment to the rural population without major additional capital investment, and, especially, because mining, as it is undertaken currently, is only expected to continue for up to two more decades. Moreover, the existing know-how and infrastructure in agriculture are capable of producing remarkable results as shown in recent years, given adequate incentives and a favorable policy environment.

Pricing policies adopted in 1972, macroeconomic policies of the last 20 years, and trade policies have all influenced agriculture's performance. Intersectoral terms of trade have not encouraged agriculture, especially as related to prices of other non-tradable goods and the price of copper. An export boom resulting from increases in the price of copper induces some adjustments in the economy. Through changes in government expenditures, in money supply, and in the exchange rate these increases have implications for agricultural price policy. Increased government expenditures affect tradable good prices whether those expenditures are in the tradable sector or in the non-tradable sector. In Zambia, mineral revenue represented between -0.1 and 65.9 percent of government expenditures between 1968 and 1985. Increased export revenue appeared to have been translated into increased government expenditures. Fiscal policy, particularly government expenditure and budget deficits have had effects on the level of aggregate prices in general and the level of agricultural tradables in particular (Hafer, 1986).

Between 1970 and 1988 the export of agricultural products was virtually eliminated, except for tobacco and cotton. Exchange rate policies made agricultural exports to world markets non-profitable, principally because of overvaluation of the domestic currency. From 1964 to 1982, the exchange rate of the Zambian currency was fixed (with only minor adjustments) despite the drastic deterioration in the terms of trade, a perpetual negative balance of payments, and a domestic inflation relative to external inflation that pointed to a relative overvaluation of the domestic currency. Moreover, between 1964 and 1975, the foreign exchange component of the money supply increased steadily along with its domestic counterpart. The increase in money supply negatively affected the exchange rate of the Zambian Kwacha and the terms of trade between the tradable and non-tradable goods in general, and in particular between agricultural tradables and the service sectors of the economy.

Schuh (1974) has hypothesized that the exchange rate plays a predominant role in the growth of the agricultural sector, particularly with regard to expansion of export markets and the level of domestic prices. Increased money supply, on the other hand, results in the appreciation of the domestic currency and discourages agricultural production [(Frenkel, 1980; Bilson, 1978)]. Inflationary pressure affects the cost structure of prices and raises the nominal interest rate and the nominal exchange rate and generally has a negative impact on agriculture [(Tatom, 1990; Dornbusch, 1988)]. Though the level of inflation remained relatively low in the 1970's, Zambia has experienced high levels of inflation in the 1980's.

1.2 Research Objectives and Hypotheses

The recent development strategy in Zambia gives the agricultural sector a greater role in economic growth of the country. Policy overtures in the framework of Zambia's structural adjustment program seeks to place agriculture in its proper context within the macroeconomy.

The objective of this study is to show that Zambia's poor performance of the agricultural sector was, among other things, a consequence of the failure of macroeconomic policies to adjust the economy to changes of foreign trading partners such as the U.S. to which the Zambian currency was pegged. Despite the overvaluation of the dollar itself during certain periods, Zambia maintained its peg of the Kwacha to the dollar at a relatively high level.

The study estimates the linkages between agricultural relative prices and macroeconomic policy.

The specific hypotheses to be evaluated are:

1. High copper prices of the late 1960's and the 1970's resulting in increased government revenues and expenditures contributed to decreased relative price of agricultural commodities and eroded competitiveness of the agricultural sector.
2. Fiscal expansion resulted in increased prices for non-tradable goods and reduced incentives to produce tradable goods, especially agricultural tradables.
3. High copper prices increased demand for non-tradables and bid-up their price.

4. Increased government fiscal gap and increased price of copper appreciated the real exchange rate of the Zambian currency and reduced agricultural and other tradable exports.
5. Government fiscal policy contributed to increased real interest rates and thus the cost of production in agriculture.
6. Government monetary policy led to inflation and distorted economic activity.

Another objective of this study is to simulate the effects of different levels of fiscal and monetary aggregates on the level of agricultural relative prices, the price of non-tradables, the real interest rate, and inflation.

1.3 Organization of the Study

This introductory chapter is followed by a background note on the general economic conditions of Zambia and an assessment of agricultural policies between 1964 to 1989 (Chapter II).

Chapter III contains the conceptual and analytical framework which constitutes the basis of the study. Chapter IV reviews the literature pertaining to agricultural supply response, interest rate, inflation and exchange rates and their impact on agricultural output. Chapter V describes the empirical model used in the analysis, while Chapter VI provides estimates of the econometric model. These estimates are used for policy experiments performed in Chapter VII. Chapter VIII summarizes the results of the study and provides insights to policy changes undertaken in the last two years. Suggestions for future research and methodological refinements conclude the chapter.

CHAPTER II

ECONOMIC AND AGRICULTURAL PERFORMANCE AND POLICIES IN ZAMBIA, 1964-1989

This chapter describes the policy context and the economic performance of Zambia from 1964 to 1989. The focus is on the evolution of macroeconomic aggregates, on prices in the agricultural sector, and policy actions which determined the course of economic development during the period.

2.1 Economic Performance

The years following independence in 1964 were marked by high rates of growth and by a booming mining sector due mainly to favorable economic conditions in OECD countries. The agricultural sector grew at a modest rate and continued, as in the pre-independence era, to be viewed as a subservient sector destined principally to provide sufficient food for the urban mine-working population. The manufacturing sector on the other hand experienced unprecedented growth, growing at an average annual rate of 9.8 percent between 1965 and 1973. During the early years, real GDP growth was high with the economy growing at 13.0 percent and 29.3 percent, respectively, in 1964 and 1965. This performance slowed in the following years, but remained at a reasonable 3.5 percent between 1967 and 1970. From 1971 to 1988, however, the average rate of growth was below 1 percent, with several years of negative or zero growth.

The substantial decline in copper prices and the ensuing trade account deficits plunged Zambia into deep and severe economic difficulties that have persisted to date. From 1975, Zambia has experienced a sustained deterioration of aggregate output combined with high rates of inflation. Table 1 summarizes the growth of output in the different sectors of the economy.

TABLE I

AVERAGE ANNUAL GROWTH RATES
(CONSTANT PRICES) BY SECTOR,
1965 - 1989, ZAMBIA

Sector	1965-73	1973-80	1980-88	1988	1989
GDP	2.4	0.3	0.6	6.3	0.1
Agriculture	2.0	1.6	4.1	20.5	0.0
Mining	2.7	-0.3	0.3	6.5	5.0
Manufacturing	9.8	0.5	2.5	15.0	1.5
Services	2.3	0.4	0.0	1.7	1.5

Source: World Bank, Trends in Developing countries, 1990, p. 614.

The period 1965-73 was characterized by relatively high growth, while the post 1973 period showed stagnation. The agricultural sector, like other sectors of the economy, suffered during the latter period. Growth of agriculture in the first half of the 1980's was more indicative of growth in the subsistence

TABLE II

PERCENTAGE CONTRIBUTION OF DIFFERENT SECTORS TO GDP
AT MARKET PRICES, 1965 - 1989, ZAMBIA

Sector	1965	1970	1973	1975	1977	1979	1980	1981	1982	1983	1984	1985	1987	1989
1. Agriculture	13.7	10.6	11.4	13.1	16.4	14.9	14.2	15.9	13.7	14.2	14.5	14.5	11.0	17.6
Commercial Sector	2.6	3.2	4.0	4.0	5.5	4.6	4.0	6.0	5.3	6.3	--	--	--	--
Subsistence Sector	11.1	7.4	7.4	9.1	10.9	10.4	10.2	9.9	8.4	7.9	--	--	--	--
2. Mining and Quarrying	41.0	36.6	32.8	13.7	11.8	17.6	16.4	14.0	11.0	15.3	13.7	14.2	13.6	12.0
3. Manufacturing	6.8	10.0	12.3	15.9	17.8	18.3	18.5	19.6	20.6	17.8	20.4	22.0	28.0	36.5
4. Services	38.5	42.8	43.5	57.3	51.6	46.9	49.0	48.6	52.7	48.9	49.9	48.1	48.2	33.0
Construction	5.8	7.2	6.5	9.6	5.7	3.8	4.5	3.2	3.5	3.2	3.1	2.1	2.0	1.5
Wholesale & Retail Trade	11.3	9.5	8.7	8.6	9.5	9.3	9.8	9.4	9.9	9.6	10.6	10.2	14.0	8.5
Transport & Communications	4.6	3.9	4.1	5.6	6.6	5.6	5.3	4.9	5.4	5.4	5.1	6.8	4.2	4.8
Other Services	16.8	22.2	24.2	33.5	29.8	28.2	29.4	31.0	33.9	30.7	31.1	29.0	29.6	18.2

Source: Monthly Digest of Statistics, Various Issues.
National Accounts Statistics Bulletin, No. 1, 3, 4.

sector rather than of market agriculture. Table II gives the contribution of different sectors to GDP.

The mining sector has been and remains the most important sector of the economy in terms of its share of GDP and in terms of its share in government revenues. From a high of 41 percent in 1965, its contribution to GDP has, however, dwindled to 12 percent in 1989. The mining sector's contribution to GDP has declined steadily from 1975 and its share has averaged 15 percent in the 1980's as opposed to an average of more than 40 percent between 1964 and 1970. Likewise, its contribution to total employment in the economy and to government revenues has also been reduced. In 1968, taxation of the mining sector represented 58 percent of total government revenues. In 1981, it represented a mere 0.1 percent. Before 1970, on average 60 percent of government expenditures came from the mining sector; this proportion declined drastically between 1975 and 1983 and increasingly larger portions of government expenditures had to be financed either by money creation or by borrowing. In 1977 and 1979, the mining industry had to be subsidized by government funds to keep it operating. The situation has improved for the better since 1984, nevertheless, its contribution to government revenues and expenditures is negligible compared to its early 1970's level.

The relative importance of the mineral sector as a source of government revenues and expenditures is shown in Table III. The period until 1974, which corresponds to the period of expansion in mineral exports, is characterized by a sizeable portion of government expenditures originating from the mining sector. Starting with 1975, the price of copper dropped significantly and the role of the mineral sector as provider of government resources declined.

The higher prices of copper in the 1960's was accompanied by a concomitant increase in government revenues and expenditures. In nominal

TABLE III

MINING INDUSTRY CONTRIBUTION TO TOTAL GOVERNMENT REVENUES, 1968-1985, ZAMBIA

(Percentage)

Year	Mineral Revenue as proportion of Total Government Revenues	Mineral Revenue as proportion of Total Government Expenditures
1968	57.6	57.6
1970	58.1	65.9
1971	31.6	26.5
1972	17.7	15.3
1973	21.1	13.0
1974	44.1	49.6
1975	12.5	7.0
1976	1.8	1.2
1977	-0.2	-0.1
1978	0.0	0.0
1979	-1.5	-1.0
1980	5.2	2.5
1981	0.1	0.1
1982	0.0	0.0
1983	4.9	3.6
1984	8.4	6.4
1985	8.1	5.9

Source: M. J. Kelly, p. 17.

terms, revenues increased on average 20 percent between 1964 and 1970 while expenditures increased by 22.5 percent. Overall, fiscal execution resulted in surplus for five years except for 1967 and 1968, with deficits representing respectively 4 percent and 9.9 percent of GDP in those two years. From 1970 onwards, fiscal implementation resulted in a deficit every single year except 1974 and a significant increase in government expenditures while the revenue basis declined. During the period 1971 - 1980, government expenditures grew at an annual rate of 16 percent while revenues increased by 9 percent. The fiscal gap represented 18 percent of GDP by 1980.

In the mid 1960's, the pace of economic activity had accelerated. The export sector was buoyant. Between 1964 and 1970, the annual rate of nominal export growth stood at a solid 15 percent. Starting with 1971, a moderate fall in the price of copper relative to its 1970 level led to a fall in the value of exports. Copper prices continued to fall throughout the 1970's and the economic activity was characterized by cycles of growth followed by stagnation. The growth rate of real GDP averaged 1.2 percent between 1971 and 1980. In the 1980's, the rate of growth of real GDP was negative from 1981 to 1987.

As a consequence of the fall in export earnings and the slow-down of economic activity, the external position of Zambia deteriorated. From a surplus of $108 million in 1970, the current account showed a deficit of $537 million in 1980 (Table IV). The overall balance of payments deficit worsened during the same period as Zambia's outside obligations outstripped receipts of external funds and this had a serious impact on capital development in the economy.

Imports of goods and services, and particularly imports of intermediate inputs necessary to maintain domestic production in the manufacturing and agricultural sectors, followed the downward trend of the BOP. In nominal terms, imports of goods and services had risen by an average annual rate of 16

percent between 1964 and 1970. Between 1970 and 1980, this rate fell to 11 percent, with very large inter-year variations. The years 1974, 1979 and 1980 saw significant increases in imports of 46.8 percent, 22.3 percent and 47.3 percent, respectively. Between 1980 - 1985, imports of goods decreased 12 percent on average each year. Recent trends have, however, been on the rise and show better prospects (Table IV). The decline in imports were translated into shortages of spare parts, of consumer goods and inputs into the productive sectors of the economy, and capacity utilization of less than 50 percent in some sectors. Despite restrictive import policies and other administrative measures to reduce the demand for foreign exchange the overall balance of payments continued to deteriorate. The slow down in economic activities and the increasingly higher levels of current account deficit resulted in a rise in government deficit and borrowing.

The budget deficit was partly financed by money creation, by domestic banking system borrowing, by increased outside indebtedness, and by running down of international reserves. Starting from 1968, to cover the growing size of government expenditures, the government resorted to outside borrowing more than to domestic financing. This trend was reversed in 1972 and the domestic market became the largest deficit financing source. This shift was probably due to difficulties in the export market and to reluctance on the part of the government to increase its external obligations vis-a-vis a worsening BOP situation. From 1971 to 1980, nearly 50 percent of all deficit financing came from the domestic market (Table V). Between 1980 and 1987, 52 percent of deficit financing came from the domestic market. A large proportion of the borrowing came from the central bank. Did this shift affect the interest rate and the level of prices in the economy?

TABLE IV

ZAMBIA'S BALANCE OF PAYMENT, 1964 - 1989
(MILLIONS OF U.S. $)

Year	Exports	Imports	Trade Balance	Current Account Balance	Overall BOP
1964	489	221	268		--
1965	514	313	201		18
1966	625	370	255		7
1967	651	446	205		-19
1968	748	500	248		17
1969	1194	439	755		171
1970	942	487	455	108	137
1971	671	562	109		-264
1972	670	566	194		-146
1973	1130	539	591		-14
1974	1396	791	605		-3
1975	803	947	-144		-345
1976	1029	668	360		-191
1977	897	683	214		-256
1978	831	618	213		-341
1979	1408	756	652		69
1980	1457	1114	343	-537	-222
1981	996	1065	-69		-467
1982	942	1004	-61	-565	-391
1983	923	711	212	-271	-22
1984	893	612	280	-153	-89
1985	797	571	226	-399	-169
1986	692	518	175	-350	-101
1987	852	585	267	-248	-258
1988	1189	687	502	-295	-232
1989	1340	774	566	-183	-105

Source: International Financial Statistics Yearbook, 1992
World debt tables, 1991.

TABLE V

GOVERNMENT DEFICIT FINANCING,
1964 - 1988, ZAMBIA
(MILLION KWACHA)

Year	Total Deficit (surplus)	Net domestic borrowing	Domestic[1] borrowing % of total	Foreign borrowing	Foreign[1] Borrowing % of total
1964	29	--	--	--	--
1965	24	--	--	--	--
1966	30	--	--	--	--
1967	-39	--	--	--	--
1968	-105	56	53.3	20	19.0
1969	35	11	31.4	21	60.0
1970	23	3	13.0	13	56.5
1971	-194	8	4.1	36	18.6
1972	-176	129	75.0	15	8.0
1973	-266	119	67.6	147	55.3
1974	64	--	0.0	37	57.8
1975	-341	267	78.3	59	17.3
1976	-270	240	88.9	30	11.1
1977	-261	243	93.1	19.	7.3
1978	-325	298	91.7	21	6.5
1979	-325	298	91.7	21	6.5
1980	-568	--0	0.0	270	47.5
1981	-450	161	35.8	247	54.9
1982	-668	532	79.6	112	16.8
1983	-327	215	65.7	120	36.7
1984	-414	290	70.0	129	31.2
1985	-1073	457	42.6	600	55.9
1986	-2805	1649	58.8	1156	70.1
1987	-2549	--	0.0	1401	55.0
1988	-3466	2101	60.6	1125	32.5

Source: IMF. International Financial Statistics Yearbook, 1992.

(1) Note: proportions do not necessarily add to 100 percent since cash balances held over at the end of one budgetary year are carried over to the next.

Balance of payment deficits increased government borrowing from the international market. However, on average the size of the borrowing from the international market was below domestic financing.

The total external public debt increased from U.S. $184.65 million in 1967 to $7,223 million in 1990. The debt service ratio increased considerably between 1970 and 1990 to reach 50 percent of export revenues in 1986. The total debt as a proportion of GNP represented 414.6 percent in that year, implying that the burden of the debt represented four times the GNP of 1986. This ratio increased steadily in the 1970's and 1980's due mostly to the slackening level of economic activity and to the increased reliance on the international market to finance the increasingly larger size of the budgetary gap. The debt - GNP ratio has however shown some improvement in the second half of the 1980's due to increased export revenues.

Besides domestic and international financing, the government of Zambia used its foreign reserves to offset the larger and larger budget and current account deficits. From 1965 to 1970, the international liquidity position of Zambia improved steadily from a position of U. S. $196 million to $508 million. This position worsened from 1971, as the rate of decline of international reserves reached an annual average of 12.8 percent. Only in 1979 did the total reserve show an increase relative to the preceding year. This worsening of the international reserve position continued during the first half of the 1980's.

Zambia maintained a fixed exchange rate relative to the currencies of its major trading partners, despite balance of payment difficulties and growing budget deficits. To what extent did the running down of foreign reserves translate into increased money supply in the economy?

A cursive look at monetary aggregates shows the extent to which the money supply increased during the period under investigation (Table VI). The

rate of real money supply increased by more than 20 percent annually between 1965 and 1970. This period of intensive growth in money supply was also characterized by rapid growth in the rate of real GDP and by relatively low levels of inflation. The 1971-1980 period saw a significant reduction in the rate of money supply except for 1979. Overall the real money supply in 1980 was below its 1970 level by nearly 11 percent. This drastic reduction in money supply would tend, among other things, to explain why the level of prices remained at "acceptable" levels despite the increase in oil prices, in prices of intermediate inputs, and other rigidities in the economy which led to serious shortages of consumer goods.

Another explanation would be the use of official prices (government administered prices) in calculating the price indices of consumer goods, ignoring the higher prices of the rent-seeking parallel market. Between 1971 and 1980, inflation remained below 5 percent each year (2.6 percent on average), but as stated earlier, these figures should be viewed in the context of price control and other government mechanisms in place at the time. Moreover, the price of items such as gasoline obtained on the official market hardly reflected the price on the world market. In 1975, Zambia used about 8 percent of its foreign exchange earnings to purchase oil for the domestic market. In 1985, this proportion represented 33 percent of export earnings (Kelly, p. 19). The rise in the price of oil on the international market was not reflected in the price paid by domestic consumers and a large proportion of its cost had to be subsidized directly by lower prices to oil distributors and indirectly through exchange rate overvaluation.

The period 1981-1990 was characterized by a significant rise in nominal money supply offset by a rising inflation. The real money supply continued to decline during the first half of the period (1981 - 1985) and increased slightly

during the remaining half. Starting with 1981, inflation picked-up and in recent years the level of general price increase has been extremely high, further disrupting the domestic economy. Between 1985 and 1990, the average annual rate of increase in the CPI has been more than 266.9 percent.

Confronted with declining real GDP, declining export earnings, dwindling foreign reserves, increasing balance-of-payment deficits, mounting external debt, rising budget deficits and accelerating inflation, the Zambian government turned to the IMF for BOP support in 1983. Since then, successive structural adjustment programs have attempted to tackle macroeconomic and policy related problems. Table VI shows the evolution of monetary aggregates and inflation in the economy.

2.2 Origin of the Economic Crisis

The oil shocks of 1973 and 1978, the fall of copper prices in 1974, and the world recession of the mid 1980's have been singled out as determinants of the macroeconomic results of Zambia in the 1970's and 1980's. To what extent did the deterioration of the economic situation in Zambia depend on external factors and/or internal factors such as government fiscal, monetary and commercial policy?

While acknowledging the fact that severe external shocks have had serious repercussions on the balance of trade and the economy in general, these alone do not explain the lack of policy response or the inadequacy of its magnitude on the part of the Zambian government.

TABLE VI

EVOLUTION OF MONEY SUPPLY AND THE PRICE LEVEL, 1964 - 1989, ZAMBIA (KWACHA MILLIONS)

Year	(1) M_1	(2) Quasi Money	(3) M_2 Total Money Supply	(4) Real Money Supply	(5) Percent Growth in Real Money Supply	(6) CPI 1985=100	(7) Percent Growth in CPI
1964	--	--	--	--	--	9.47	--
1965	76	31	108	10.55	--	10.24	0.77
1966	105	40	145	12.84	21.7	11.29	1.05
1967	122	48	169	14.25	11.0	11.86	0.57
1968	161	58	219	16.68	17.1	13.13	1.27
1969	181	100	282	20.97	25.7	13.45	0.32
1970	186	170	356	25.76	22.8	13.82	0.37
1971	199	120	319	21.77	-15.5	14.67	0.83
1972	201	140	341	22.16	1.8	15.39	0.74
1973	259	152	411	25.08	13.2	16.39	1.00
1974	266	175	441	24.90	-0.7	17.71	1.32
1975	331	163	494	25.32	1.7	19.51	1.80
1976	400	223	623	26.89	6.2	23.17	3.70
1977	393	306	699	25.18	-6.4	27.76	4.60
1978	397	243	639	19.79	-21.4	32.29	4.50
1979	517	316	832	23.48	18.6	35.43	3.10
1980	519	388	907	22.93	-2.3	39.55	4.10
1981	564	415	979	21.90	-4.5	44.69	5.10
1982	689	620	1,309	25.79	17.8	50.76	6.10
1983	795	659	1,454	23.95	-7.1	60.71	9.90
1984	870	834	1,704	23.39	-2.5	72.86	12.20
1985	1231	870	2,102	21.02	-10.1	100.0	27.10
1986	2304	1758	4,062	26.38	25.5	154.00	51.90
1987	3225	3041	6,266	27.94	5.9	224.30	65.31
1988	5244	4882	10,126	29.20	4.5	346.90	120.60
1989	7947	8781	16,728	21.08	-27.8	793.50	325.70

Source: IMF, International Financial Statistics Yearbook, 1992.

(1) M_1 = Currency outside banks plus demand deposits.
(2) Quasi money = time deposits + savings + foreign currency deposits.
(3) $M_2 = M_1$ + Quasi money.
Column (3) does not add up to (1) + (2) due to rounding.

The impact of these external shocks were felt almost immediately in the national economy and policy responses were undertaken in the short-run to offset or counter these effects. Using Bacha's (1986) accounting methodology to assess the impact of external shocks and domestic policy responses on the current account deficit, the work of Helleiner (1986) showed that the deterioration in the terms of trade played an important role in the current account deficit for the period 1973-75, which corresponds to the fall in the price of copper and increase in the price of oil (Table VII). Its impact during this period represented 35.7 percent of GNP, while total external shocks reduced actual GNP by 35.2 percent. During the period 1975-78, further deterioration in the terms of trade continued to adversely affect Zambia reducing its GNP by 41.1 percent. In the 1973-75 period, exports increased while they decreased substantially in the 1975-78 and 1978-82 periods. Imports on the other hand increased in the 1973-75 period but decreased significantly thereafter as the government instituted import control measures in an attempt to stem the outflow of foreign exchange and reduce the deficit in the current account.

By 1978, the impact of the fall in the terms of trade had not eased and policies initiated in the 1973-75 period were continued. Import intensity of investment spending was reduced. Consumption, on the other hand, decreased in import intensity during the 1973-78 period but increased again in the 1978-82 period, which adversely affected the current account deficit.

During the period 1978-82, the current account improved due to an improvement in the terms of trade, an improvement in export competitiveness, and a significant reduction in investment despite an increase in import for consumption compared to the previous (1973-78) period.

In summary, Zambia's economic problems originated in large part from external shocks which affected negatively the current account through its terms

of trade. Policy responses have, however, also played an important role; in particular, the increased import of consumption goods in the make-up of total imports, the reduction in capital investments in the economy, and decreased exports probably due to rigidities in the economy such as price incentives, and reduced capacity to use existing installations. In an attempt to control the current account deficit, contraction of domestic investment in the periods 1973-78 and 1978-82 was partly offset by an increase in the imports for consumption and a decrease in exports. Table VII provides a decomposition of external shocks and domestic policy impacts on the current account deficit.

To what extent did favorable terms of trade of the 1960's and early 1970's affect agricultural output? An attempt to recap agricultural performance and policy is made in the following section in light of macroeconomic considerations of this section.

2.3 Performance and Policies in the Agricultural Sector

The agricultural sector has remained, for all practical purposes, the most controlled sector of the economy. Despite the decline of the mining sector, the agricultural sector has not grown and its contribution to GDP and to overall economic growth has remained minimal. Despite its contribution to employment in the rural areas, agricultural activities have been mostly geared toward subsistence.

The agricultural sector, despite its low contribution to GDP, has, been the sector that has contributed the most to economic growth during the period of economic downturn. From 1965 to 1973, the period corresponding to the export boom in the mining sector, agriculture averaged 2.0 percent annual growth while mining and manufacturing grew at 2.7 and 9.8 percent annually,

TABLE VII

DECOMPOSITION OF CURRENT ACCOUNT DEFICIT AND
DOMESTIC POLICY RESPONSE IN ZAMBIA
(AS PERCENTAGE OF ACTUAL GNP)

		External Shocks[a]					Domestic Policy Actions[c]					
							Domestic[d] Spending			Trade Ratios[e]		
Period	Observed Deficit	Total	Terms of Trade	Interest Rate	World Trade	Other[b] External Variables	Total	Gross Investment	Consumption	Export Ratio[f]	Import Ratio[g]	Residual
1973-75	37.6	35.2	35.7	-2.6	2.2	1.7	0.6	0.5	0.2	-1.0	0.8	0.0
1975-78	16.6	29.9	41.1	-5.1	-6.1	1.4	-15.9	-6.1	-2.0	5.0	-12.9	1.3
1978-82	6.3	10.0	15.7	-2.6	-3.2	-0.8	-3.2	-6.3	8.7	8.6	-14.2	0.2

Source: G. Helleiner, World Development Vol 14, No 8. Tables A1, A2, A3.

Notes:

(a) Postive sign denotes an adverse external shock such as terms-of-trade deterioration, interest rate increase, or a deceleration of world trade. A negative sign denotes a favorable external shock.

(b) A positive sign denotes an unfavorable movement of other external variables such as a net accumulation of foreign indebtedness. A negative sign denotes a favorable movement.

(c) A positive sign denotes a deficit increasing policy action. A negative sign denotes a deficit-reducing policy action.

(d) A positive sign denotes an expansion of domestic spending which increases the deficit. A negative sign denotes a contraction of domestic spending which reduces the deficit.

(e) A positive sign denotes a movement of the trade ratios which increases the deficit. A negative sign denotes that the trade ratios moved to reduce the deficit.

(f) A positive sign denotes a reduction of the exports to world trade ratio . A negative sign denotes an increase of the export ratio.

(g) A positive sign denotes an increase of the import content of domestic spending. A negative sign denotes a reduction of the import ratio.

respectively (see Table I). The rate of growth of the agricultural sector was well below the overall annual GDP growth rate (2.4 percent) during the period. This is probably an indication of economic policy orientation during the period which favored industrial production vis-à-vis agriculture. The deep crisis that intervened between 1974-80 affected all sectors of the economy, but the agricultural sector faired better than the other sectors and provided the strongest source of economic growth in most of these years. In the 1980's agriculture had the strongest source of economic growth, especially during the second half of the decade, presumably as a result of policy reforms. The country's deteriorating macroeconomic situation required a shift in emphasis from the mining and manufacturing sectors to the agricultural sector to foster economic growth.

The dualistic structure of the agricultural sector resulted in different rates of growth between the commercial sector and the subsistence sector. Due to their diverging reliance on the market for inputs and for disposal of output, production in the commercial sector dropped by a greater margin than the subsistence sector during the period 1977-1980 (27 percent and 6 percent, respectively). Thus, the emphasis in policy in the 1980's was more on small farm production rather than large scale farming as was the focus in the early 1970's.

Moreover, the nature of policies has led to diverging patterns of production between the commercial and small farm sectors. Policies (price fixation for most agricultural commodities) adopted in the pre-independence era and continued after independence, were designed to favor urban consumers more than encourage productive activities by shifting the terms of trade towards consumption. Thus, commercial farming developed faster in non-staple crops,

where relatively less control was exercised by the government, than in the staple food sub-sector.

Several reasons could be advanced in an attempt to explain the apparent decline of food production in Zambia. Not withstanding the negative impact of climatic conditions (sporadic drought is a recurrent phenomenon in southern Africa), the role played by domestic agricultural, industrial and commercial policies in the distribution of productive activities between the different sectors of the economy has been enormous.

Agricultural pricing policies were influenced by the perceived need to keep urban food prices low and were generally set below import or export parity prices. The agricultural sector was seen as subservient to mining and urban interests. This was realized through state monopolization of agricultural marketing activities, especially of the staple foods, and through fixation of the producer and retail prices of maize by the state marketing board. Though limited to the area along the line-of-rail in early times, this policy of price fixation was applied nationally in 1971 with uniform pricing of agricultural products, regardless of transportation and other marketing costs and of local demand and supply conditions which could have resulted in different spatial prices (Katongo, 1991).

The pricing policy of the marketing board (NAMBOARD) based on cost-plus method ignored the international market as an alternate provider of agricultural products since import and export parity prices were not taken into account in determining the producer prices.

Wood (1990) states that the erratic nature of changes in agricultural producer prices and their low level led to reduced acreage in the commercial sector, especially for maize. The declared objective of self-sufficiency in maize production led to government prices for other crops such as sorghum and millet.

Prices for the latter crops remained unchanged for long periods of time and thus relative prices within the agricultural sector tended to favor maize production despite the absolute low level of maize price.

Price policy as designed encouraged surplus production in remote areas, especially the eastern province, and a negative incentive to producers in deficit areas (Jansen, 1990). Production and marketing costs were higher for the eastern province and surplus production would have resulted in lower local prices had the policy of uniform pricing not been adopted.

Jansen (1990) compared domestic prices resulting from government pricing policies to border prices (free trade prices) and found that maize, groundnuts, and cotton were all subjected to an implicit tax during the period 1966-84 with nominal rates of protection (NRP) being -23.3, -31.3 and -20.7 percent, respectively. Rice showed initially negative NRP from 1966 to 1974 but this trend was reversed starting in 1975. These direct effects of government administered prices resulted in implicit taxation of agricultural production for those crops that represented more than 90 percent of total value added in agriculture. Measures of effective rates of protection (ERP) showed that both maize and cotton had negative ERP's. The implication of such findings show that despite the fertilizer subsidies, agriculture did not receive enough protection but instead was taxed substantially to provide cheap food for the cities.

A review of historical prices between 1965 and 1989 shows the limited adjustments in domestic prices of maize (Table VIII). From 1965 to 1968, nominal prices of maize decreased from K 3.72 to K 2.90. This decrease in official price reflects the extent to which local deliveries to the grain marketing board exceeded the level of internal sales by the board and the government strategy to encourage diversification away from maize towards other crops and

livestock (Jansen, 1988). The price of maize remained static or changed very little between 1971 and 1974 but was raised by 16 percent in the 1975 season. Other annual adjustments were made between 1975 and 1987 to reflect the anticipated shortfalls or excesses in deliveries by the board. But in general the nominal price of maize remained below the import parity price or what would have been the equilibrium free market price. In real terms, prices throughout the period were below their 1965 level despite a significant rise in costs of production.

Relative prices of agricultural products also reveal the nature of the effects of price intervention in the structure of incentives in the sector. Analysis of export crop and food prices relative to non-agricultural prices by Jansen (1988) shows that pricing policy favored maize, especially from the mid 1970's. Export crops such as tobacco and cotton have seen their relative price fall for most of the period under consideration. For tobacco, this trend was partially reversed starting from 1982, while cotton prices have remained lower relative to non-agricultural prices. This tends to indicate the preferential treatment received by the manufacturing sector and by the food sector, particularly maize. Policies discouraged export crop production relative not only to food production but also relative to other non-agricultural and non-mining activities. Thus, the structure of incentives in relation to the domestic economy tended to favor more the food, manufacturing and service sectors.

Viewed in terms of import or export parity prices, Jansen has also shown that government administered producer prices were below their border equivalent prices for crops such as maize, cotton and groundnuts. Exceptions were tobacco, rice and wheat which exhibited positive protection compared to

TABLE VIII

GOVERNMENT ADMINISTERED PRODUCER CROP PRICES, 1965 - 1986 (1)

Harvest Year (2)	Maize K/90 kg (3)	Shelled Groundnuts K/80 kg (4)	Sunflower K/50 kg	Soybeans K/90 kg	Paddy Rice K/80 kg	Wheat K/90 kg	Seed Cotton K/kg (5)	Virginia Tobacco K/kg
1965	3.72	9.60	NA	NA	--	--	0.14	0.00
1966	3.32	10.20	NA	NA	--	--	0.14	0.65
1967	3.10	9.90	2.45	3.70	--	--	0.15	0.94
1968	2.90	10.20	2.45	3.20	--	--	0.15	0.65
1969	3.20	10.20	2.45	3.20	--	--	0.15	0.75
1970	3.50	10.20	2.45	3.20	--	--	0.17	0.81
1971	4.00	10.20	8.40	8.40	--	--	0.17	0.81
1972	4.30	10.20	6.00	8.40	--	--	0.17	0.88
1973	4.30	12.60	6.64	8.40	--	--	0.17	0.88
1974	4.30	17.00	8.95	13.20	12.00	--	0.25	0.96
1975	5.00	17.00	8.40	13.20	12.00	16.00	0.30	0.84
1976	6.30	25.00	10.00	17.00	14.40	16.00	0.40	0.97
1977	6.30	25.00	10.00	17.00	14.40	16.00	0.40	1.10
1978	6.80	28.60	12.50	21.50	14.40	20.00	0.46	1.25
1979	9.00	32.00	13.70	25.00	16.00	20.00	0.46	1.47
1980	11.70	35.00	16.40	32.00	18.00	20.00	0.46	1.52
1981	13.50	42.70	17.60	36.30	18.60	26.00	0.46	1.59
1982	16.00	48.00	20.75	42.21	28.00	32.00	0.47	2.33
1983	18.30	55.00	21.50	45.30	40.00	35.75	0.52	2.57
1984	24.50	71.50	21.50	52.50	50.00	42.50	0.58	2.72
1985	28.32	91.67	27.88	60.90	40.00	45.20	0.67	3.35
1986	55.00	131.35	41.95	112.10	55.57	86.40	0.97	5.12
1987	78.00	162.00	60.00	148.00	83.00	111.00	1.60	6.25
			Real 1980 Prices (6)					
1965	14.36	37.04	NA	NA	--	--		
1966	11.65	35.79	NA	NA	--	--		
1967	10.33	33.00	8.17	12.33	--	--	0.50	
1968	8.73	30.72	7.38	9.64	--	--	0.45	
1969	9.41	30.00	7.21	9.41	--	--	0.44	
1970	10.13	29.23	7.02	9.17	--	--	0.49	
1971	10.81	27.57	22.70	22.70	--	--	0.46	
1972	11.05	26.22	15.42	21.59	--	--	0.44	
1973	10.39	30.43	16.04	20.29	--	--	0.41	
1974	9.60	37.95	19.98	29.46	26.79	--	0.56	
1975	10.14	34.48	17.04	26.77	24.34	32.45	0.61	
1976	10.75	42.66	17.05	29.01	24.57	27.30	0.68	
1977	8.99	35.66	14.27	24.25	20.54	22.82	0.57	
1978	8.33	35.05	15.32	26.35	17.65	24.51	0.56	
1979	10.06	35.75	15.31	27.93	17.88	22.35	0.51	1.64
1980	11.70	35.00	16.40	32.00	18.00	20.00	0.46	1.52
1981	11.84	37.46	15.44	31.84	16.32	22.81	0.40	1.40
1982	12.48	37.44	16.19	32.93	21.84	24.96	0.37	1.82
1983	11.93	35.85	14.02	29.53	26.08	23.31	0.34	1.68
1984	13.31	38.84	11.68	28.52	21.73	23.09	0.32	1.48
1985	11.19	36.23	11.02	24.07	15.81	17.87	0.26	1.32
1986	13.96	33.34	10.65	28.45	14.10	21.93	0.25	1.26

Notes:

(1) Guaranteed minimum prices offered by official marketing organization. Unless otherwise specified, prices are for Grade A.
(2) Harvest year refers to the year in which the bulk of the harvest takes place. For example, crops grown in the agricultural year 1983-84 are shown against harvest year 1984.
(3) From 1965 to 1971 price of maize refers to Kwacha/200 lbs.
(4) Chalimbana. From 1965 to 1971 price of shelled groundnuts refers to Kwacha/180 lbs.
(5) Hand-picked, Lusaka ginnery.
(6) Deflated by consumer price index.

Sources: D. Jansen, 1988, p. 63.

their border equivalents. Despite the relative protection, wheat production is not widespread in Zambia because of its technological exigencies (it has to be grown under irrigation) and its share of total agricultural value added is negligible. Likewise rice has not been taken up as an alternative cash crop by many smallholders because it is not a major part of the local diet. Table VIII shows the evolution of producer prices relative to prices of non-agricultural commodities.

In summary, the Zambian government agricultural price policies have greatly contributed to the distortion of incentives within the agricultural sector in favor of maize the staple food crop, and against other industrial and export crops. Viewed in terms of world market prices, both the food and export crop sectors have generally received lower prices than their border equivalent, except for tobacco. It is not surprising that the export of agricultural products has not taken off.

2.4 Policies in Other Sectors

Linkages of agriculture with other sectors of the economy resulted in sectoral and macroeconomic policies affecting resource allocation in agriculture. Monetary and fiscal policies through their impact on the level of economic activity in the economy are expected to have affected agricultural production.

Development strategies adopted in the late 1960's emphasized import-substitution and industrial development through investment and production subsidies, import restrictions, direct government control of productive activities and overvalued exchange rate.

At independence in 1964, Zambia's economy was dominated by foreign-owned companies with a relatively small manufacturing sector. After independence, this changed drastically with the acquisition of majority interests in manufacturing companies and the nationalization of the mining industries and other processing companies. By 1970, the state controlled more than 30 percent of GDP and more than 50 percent of industrial production. The development strategy consisted in producing locally most basic consumer goods in an effort to reduce imports and save foreign exchange by redirecting it towards more capital investment.

The government increased its direct expenditures for development and assumed a more social-oriented approach through price controls, in the sectors not directly controlled by the government, and through direct government intervention in production and distribution. The approach seemed to have worked in the early years, if output and prices are used as indicators of performance. From 1964 to 1975, real GDP grew at 5.4 percent per annum, the general price level within the domestic economy remained relatively low, and the government deficit was relatively small. The whole economic system, however, was tainted by inefficiencies (Gulhati, p. 15) and was dependent upon a fragile relationship based essentially on budgetary support, which in turn depended on good performance by the mining sector in terms of rising export prices. As long as the mining sector flourished, the government could provide the necessary subsidies to keep the manufacturing sector producing despite its inefficiencies.

Pricing policies, whether applied to industrial or agricultural goods created distorted incentives and led to low profitability in the non-mining tradable sector while favoring consumption at the expense of investment. Table IX provides the producer prices of agricultural commodities relative to

non-agricultural prices from 1965 to 1984. Katongo (1991) affirms that consumer prices of maize meal and wheat flour were set below producer prices which resulted in huge subsidies to the milling industry and contributed to the large budget deficit, which in 1986 reached 28.5 percent of GDP.

Government subsidies were applied to inputs as well. Fertilizer is the major agricultural input in Zambia. The commercial agricultural sector which produces 40 percent of all maize and nearly all the tobacco relies heavily on subsidized fertilizer. Attempts have been made to link the heavy dependence on capital intensive techniques in the commercial farm sector to the structure of costs which favor the use of subsidized fertilizer and machinery (with its implicit subsidization through direct pricing, exchange rate and tariff system). The national marketing board (NAMBOARD) has estimated that in some years, the subsidy on fertilizer represented more than 80 percent of its acquisition, handling and distribution cost (Katongo, 1991).

These subsidies have high budgetary implications because such losses by NAMBOARD were covered by direct government outlays. The total amount of subsidies for fertilizer has grown from 6.2 percent of total agricultural subsidies to more than 25 percent and the latter represented nearly 24 percent of total government expenditures in 1988 (computed from Government Finance Statistics, 1992).

Another instrument of policy that has been extensively used to meet socioeconomic objectives is the exchange rate. The fixed exchange rate of the 1960's and early 1970's seemed to reflect a relatively stable currency and,

TABLE IX

PRODUCER PRICES RELATIVE TO NON-AGRICULTURAL PRICES EXPRESSED AS INDICES (1975=100), 1965 - 1984, ZAMBIA

Year	Maize	Shelled Ground nuts	Sun-flower	Soy-beans	Paddy Rice	Wheat	Sorghum	Seed Cotton	Virginia Tobacco
1965	147.8		--	--	--	--	--	32.7	--
1966	124.5	112.5	--	--	--	--	--	87.5	145.5
1967	103.5	97.2	48.7	46.8	--	--	130.7	83.4	186.6
1968	89.8	92.9	45.2	37.5	--	--	121.3	77.4	120.2
1969	92.4	86.6	42.1	35.0	--	--	113.1	72.2	129.4
1970	95.5	81.9	39.8	33.1	--	--	106.9	77.3	132.0
1971	103.7	77.7	129.6	82.5	--	--	101.5	73.4	125.3
1972	106.2	74.1	88.2	78.6	--	--	96.7	70.0	128.9
1973	101.2	87.3	93.1	74.9	--	--	92.2	66.7	122.9
1974	92.4	107.4	114.5	107.4	--	--	89.5	89.5	122.3
1975	100.0	100.0	100.0	100.0	100.0	--	100.0	100.0	100.0
1976	114.3	133.4	108.0	116.8	108.9	90.7	90.7	121.0	105.1
1977	98.3	114.7	92.9	100.5	93.6	78.0	78.0	104.0	101.7
1978	94.4	116.8	103.3	113.1	83.3	86.8	69.4	106.5	103.2
1979	112.1	117.2	101.6	117.9	83.0	77.8	62.3	95.5	108.7
1980	127.6	112.3	106.5	132.2	81.8	68.2	54.5	83.6	98.8
1981	135.8	126.3	105.4	138.3	78.0	81.7	75.4	77.1	95.3
1982	143.3	126.4	110.6	143.2	104.5	89.6	67.2	70.2	124.1
1983	143.7	127.0	100.5	134.7	130.8	87.7	104.7	68.0	120.1
1984	166.0	142.4	86.7	134.7	112.9	90.0	105.3	65.5	109.5

Source: D. Jansen (1988).

according to Jansen (1988), approached the equilibrium exchange rate, as reflected by a relatively hefty positive balance of payments and the lack of administrative restrictions to trade. However, starting with the mid 1970's, restrictive measures relative to foreign exchange purchases and trade restrictions through licensing suggest that the demand for foreign exchange heavily outpaced its supply at the prevailing exchange rate. In an effort to maintain low prices of domestically produced manufactured goods, which contained a high proportion of imported inputs and capital, foreign exchange

restrictions were set up. This resulted in an artificially overvalued currency which in turn encouraged the use of foreign imports as inputs and discouraged exports. Sharply devaluing the Kwacha (K) in the face of balance of payment deficits would have signaled to actors in the economy to economize on imports and develop new export markets. Thus import-substitution strategy led to increased demand of foreign exchange and thus compounded its shortage. Estimates of equilibrium exchange rates show from 1973 onwards, the nominal exchange rate has been below its equilibrium level every single year, and in some years the differential has been more than 500 percent with the nominal rate representing less than 20 percent of its equilibrium value. Table X shows the nominal and equilibrium exchange rates.

Estimates of real effective rates in recent years tend to confirm results obtained form equilibrium exchange rate measures and affirm that the Zambian Kwacha has been overvalued throughout the 1970s and 1980s. If the exchange rate is assumed to be in equilibrium in 1969-71, the rate of overvaluation is estimated to have been 10 percent in 1973-75, 21 percent in 1978-80 and 14 percent in 1981-83 (World Bank, World Development Report 1986). Using 1985 as the base, the rate of overvaluation was estimated at 51.8 percent in 1986, 49.2 percent in 1987 and 21.2 percent in 1988. Thus despite introduction of reforms epitomized by the auctioning of foreign exchange, the Zambian currency remained well above its parity level during the IMF reform period (1985-1987) and after Zambia's adoption of its own reforms in May, 1987 following its rejection of the IMF prescriptions.

Another consequence of the overvalued exchange rate was a distortion in factor prices in favor of imported capital goods. This tendency to apply capital intensive techniques and relatively "cheapened" imported inputs affected domestic employment and growth. Applegate (1990) measured this distortion

TABLE X

NOMINAL, REAL AND ESTIMATES OF EQUILIBRIUM EXCHANGE RATES VIS-A-VIS THE U.S. DOLLAR, ZAMBIA, 1964-1986

	Nominal Exchange (K/US$)	Real Exchange Rate (K/US$)	Equilibrium Exchange Rate (K/US$)
1964	0.714	0.873	0.57
1965	0.714	0.778	0.70
1966	0.714	0.778	0.70
1967	0.714	0.749	0.70
1968	0.714	0.694	0.70
1969	0.714	0.699	0.65
1970	0.714	0.714	0.71
1971	0.714	0.711	0.81
1972	0.714	0.708	0.91
1973	0.714	0.734	0.86
1974	0.652	0.748	1.05
1975	0.643	0.764	1.29
1976	0.713	0.810	1.57
1977	0.790	0.818	1.66
1978	0.800	0.781	1.72
1979	0.793	0.811	2.00
1980	0.789	0.831	2.50
1981	0.868	0.845	3.52
1982	0.928	0.872	4.02
1983	1.251	1.038	3.91
1984	1.794	1.313	3.66
1985	3.139	--	--
1986	7.682	--	--

Source: D. Jansen, 1988

due to overvaluation by assessing the impact of the 1985 devaluation initiated by the auctioning of foreign exchange on sectoral prices. His analysis shows that the service sector costs were least affected by the devaluation. Looked at

in another way, it implies that prices in the tradable sector (agriculture, manufacturing) were distorted most by exchange rate policies applied before 1985. Using the equilibrium exchange rate to adjust producer prices in the estimation of nominal protection coefficients, Jansen (1988) found that "indirect price intervention" in agriculture, particularly for cotton, tobacco and maize resulted in substantially negative nominal protection coefficients. She concluded that pricing reforms of the "direct type" initiated in 1984 to correct structural imbalances within the economy could not have helped protect agriculture as long as simultaneous policy initiatives relating to exchange rate and commercial policy were not undertaken together with the direct price adjustment (Table XI).

We noted earlier that the development of the manufacturing sector was promoted through import - substitution. This included high tariffs on import goods, import restrictions and no or little duty assessed on inputs for the functioning of domestic industries. Indirect support was also provided through an overvalued exchange rate which made imported inputs necessary for the production of consumer goods cheaper than they would have been, had the market for foreign exchange been allowed to adjust to demand and supply conditions. These strategies were pursued as long as the balance of the current account did not show any sign of systematic deterioration (until 1975). Following the decline in foreign exchange earnings in 1975, trade policy took the form of restrictions on imports through licensing and administrative allocation of foreign exchange. The aim of the shift in policy was to ration the limited foreign currency available and at the same time continue to provide protection to the domestic manufacturing sector. Government strategists believed that the crisis was temporary and that copper prices would rebound. Copper prices continued their downward trend. Following structural adjustment

TABLE XI

INDEX OF THE REAL EXCHANGE RATE OF THE ZAMBIAN KWACHA RELATIVE TO THE U.S. DOLLAR (1985=100)*, 1965 - 1990

Year	Real Exchange Rate	Index of Bilateral Real Exchange Rate
1965	2.2709	83.67
1966	2.1262	78.34
1967	2.0468	75.42
1968	1.9011	70.05
1969	1.9264	70.98
1970	1.9395	71.46
1971	1.8852	69.46
1972	1.8502	68.18
1973	1.7298	63.74
1974	1.8241	67.21
1975	1.8318	67.49
1976	1.7870	65.84
1977	1.7587	64.80
1978	1.6518	60.86
1979	1.6589	61.12
1980	1.6775	61.81
1981	1.7828	65.69
1982	1.7461	64.34
1983	1.9996	73.68
1984	2.4389	89.86
1985	2.7140	100.00
1986	4.6750	172.25
1987	3.9990	147.02
1988	2.4454	90.10
1989	1.7639	64.99
1990	1.9505	71.87

Source: Author's calculations.

$BRER = E \frac{WPI\ US}{CPI\ ZAM}$ where E is nominal official exchange rate, WPI US is the U.S. wholesale price index and CPI ZAM is Zambia consumer price index, BRER is bilateral real exchange rate.

* A decrease in the index indicates an appreciation while an increase reflects a depreciation.

reforms in 1985, the tariff structure was revised and a more liberal foreign exchange allocation system was adopted.

Table XII is indicative of the direction trade policy has taken in Zambia. The manufacturing sector is heavily dependent on imported inputs and on protection to operate. It is also revealing of some of the reasons why agriculture has not taken off, particularly with regard to the negative effective rate of protection and the diversion of resources from agriculture to the other sectors of the economy. Maize, the largest crop in terms of output and domestic agricultural value-added, has had negative protection coefficients throughout the period as shown in Table XIII.

2.5 Recent Changes in Economic and Agricultural Policies

Upon realization that Zambia's economic problems could not be tackled without bold policy reforms and especially under intense pressure from international funding agencies, the Zambian government undertook a series of reforms starting in 1983 aimed at reducing the structural imbalances in the economy. These reforms included a systematic review of fiscal, monetary and commercial policies. With regard to fiscal and monetary policy, steps were taken to reduce the huge burden of the budgetary deficits and to further reduce the rate of growth of money supply. With regard to commercial policy, price liberalization of agricultural commodities was initiated, the tariff on imports was readjusted, and the price of foreign currency decided through an auction system. With regard to agricultural policy, the measures taken included, among others:

- increased ceiling on producer prices in an attempt to give farmers border price equivalents.

TABLE XII

EFFECTIVE RATES OF PROTECTION, 1975, ZAMBIA

Category	Unweighted Average	Range Minimum	Maximum
1. Consumer goods			
- Food products	67.35	-21.65	240.17
- Other non-food	342.45	-1.06	1251.1
- Durables	472.87	116.79	1018.48
2. Light intermediates	182.49	-1.189	505.82
3. Heavy intermediates	29.77	7.89	85.29
4. Capital goods	59.71	-11.78	407.03
5. All goods	160.90	-21.65	1251.10

Source: R. Gulhati, 1989.

TABLE XIII

NOMINAL AND EFFECTIVE RATE OF PROTECTION FOR MAIZE (USING THE OFFICIAL EXCHANGE RATE), 1966 - 1985, ZAMBIA

	Nominal %	Effective (Commercial %	Maize)
1966	3.0	7.6	
1967	-14.5	-13.6	
1968	-3.2	-6.2	
1969	-45.8	-45.6	
1970	-57.1	-59.6	
1971	-51.0	-60.8	
1972	-38.0	-52.7	
1973	13.8	14.8	
1974	-37.0	-47.1	
1975	-26.0	-13.9	
1976	-16.3	-26.9	
1977	-21.4	-44.5	
1978	-15.2	-37.1	
1979	-29.9	-55.6	
1980	-21.9	-47.4	
1981	-34.0	-52.8	
1982	-19.8	-42.8	
1983	-16.0	-48.6	
1984	-12.2	-44.1	
1985	-23.9	--	

Source: D. Jansen, 1988.

- bonus to commercial farmers (in foreign currency) for maize production and for soybeans produced above a certain tonnage.
- reduced government subsidies to the agricultural sector.
- incentives for development of other cash crops for exports such as tea, coffee, and citrus.
- accelerated depreciation allowance for farm machinery.
- lower taxes for agricultural income.
- reorganization of marketing activities from NAMBOARD to regional cooperative unions.

2.6 Conclusion

The review of the economic conditions has attempted to highlight the macroeconomic and policy environment during the period 1965 - 1989. The account has emphasized macroeconomic conditions as they relate to agricultural performance. The information provided will be used in Chapter VI in the evaluation of fiscal and monetary impact on the relative price of agriculture, the price of non-tradables, the real interest rate, the real exchange rate and on the general level of prices in the economy.

CHAPTER III

CONCEPTUAL AND ANALYTICAL FRAMEWORK

3.1 Introduction

The setting of agricultural prices below their equivalent free market level is often used as a policy instrument aimed at achieving food distribution and nutritional objectives in developing countries. This policy was extensively pursued in Zambia between 1971 and 1989. Agricultural price fixing creates a set of relative prices between agricultural and non-agricultural products which determine resource allocation within the economy. Low relative agricultural prices aimed principally at satisfying food consumption needs of urban dwellers will shift resources out of agriculture towards the service and other sectors of the economy.

Likewise, distortions in relative prices created by external factors, such as an exogenous increase in export prices, will result in adjustment within the economy. Prices of copper increased drastically in the late 1960's, while agricultural prices decreased relative to non-traded goods, thus resulting in decreased incentives to produce agricultural commodities. This external shock in the economic system was reinforced by domestic pricing policies, and macroeconomic policies which precluded an "appropriate" adjustment in the system.

The terms of trade faced by agriculture will also be negatively affected as a result of increasing protectionism that raises the consumer prices of domestic

manufacturers or when the economy is plagued with high rates of inflation unaccompanied by corresponding adjustments in the exchange rate of the currency (De Wilde, 1984). The overvalued exchange rate thus contributes indirectly in depressing agricultural prices since it provides a measure for the real terms of trade between the tradable and the non-tradable sectors of the economy.

3.2 The Theoretical Model

Following Dornbusch (1974) and Edwards (1985), the model assumes that the Zambian economy is a small open economy that produces three goods.

- copper (tradable C)
- agriculture and manufactures (other tradables T)
- services (non-tradable goods or NT)

This assumption allows world prices of tradables to be taken as exogenously given and the prices for non-tradables to adjust to clear the domestic market, thus the price of non-tradables is internally determined.

It is also assumed that the copper industry uses factors that are sector specific and very little or none of the copper is consumed locally. This implies that excess demand for non-tradables is a function of the relative prices of tradables to non-tradables $\frac{P_T}{P_{NT}}$ and of real income. In equilibrium, the excess demand for non-tradable goods is zero.

$$(3.1) \quad NT = NT\left(\frac{P_T}{P_{NT}}, Y\right) = 0$$

$$= NT\ (q_T\ , Y) = 0$$

where $q_T = \frac{P_T}{P_{NT}}$

Y = income

The third assumption relates to balanced trade at the beginning, such that national real income is equal to expenditure.

(3.2) $Y = E$

We also assume that tradable and non-tradable goods are gross substitutes implying that

$$\frac{\partial_{NT}}{\partial q_T} > 0 \quad \bullet$$

3.3 Effects On The Real Sectors Of An Increase In The Price Of Copper

We have posited an economy represented by three aggregated sectors:

- the mining sector (C)
- the other tradable sector (T), referred to simply as tradable sector in the discussion that follows.
- and the non-tradable good sector (NT)

(3.3) $NT^d = NT^d (q_T , Y)$ demand for non-tradables

(3.4) $NT^s = NT^s (P_{NT} , W)$ supply for non-tradables

where W = vector of other variables

(3.5) $T^d = T^d (q_T , Y)$ demand for other tradables.

The assumption that no copper is consumed domestically (which in the case of Zambia is not far from factual) permits the non-traded sector and the

traded sector alone to compete for resources and thus the excess demand for non-tradables and for tradables is not affected by the relative price of copper:

(3.6) $T^s = T^s (P_T , W)$ supply of tradables

Total revenue generated by the mining industry is given by:

(3.7) $Z = P_C \bar{C}$ with $\bar{C}$ being constant

The nominal income generated by the three sectors of the economy is given by:

(3.8) $Y = P_{NT}NT^s + P_T T^s + P_C\bar{C}$

The income equation above could be expressed in terms of P_{NT} (using P_{NT} as the numeraire) and reduces to

(3.9) $y = NT^s + q_T T^s + q_C \bar{C}$

with $y = \frac{Y}{P_{NT}}$ real income in terms of P_{NT}

$q_T = \frac{P_T}{P_{NT}}$ and $q_C = \frac{P_C}{P_{NT}}$ representing prices of, respectively, tradables and mines relative to the price of non-tradables.

Following the assumptions of gross substitutability between tradable goods and non-tradables, equilibrium in the non-traded goods market (equation 3.1) could be shown as in Figure 1.

Figure 1 shows the equilibrium situation in the non-tradable goods market. The equilibrium relative prices are respectively given by q_T^0 and q_C^0 for the other tradable goods market and the copper market. The ray 0X represents the price of other tradables relative to copper prices $\frac{P_T}{P_C}$.

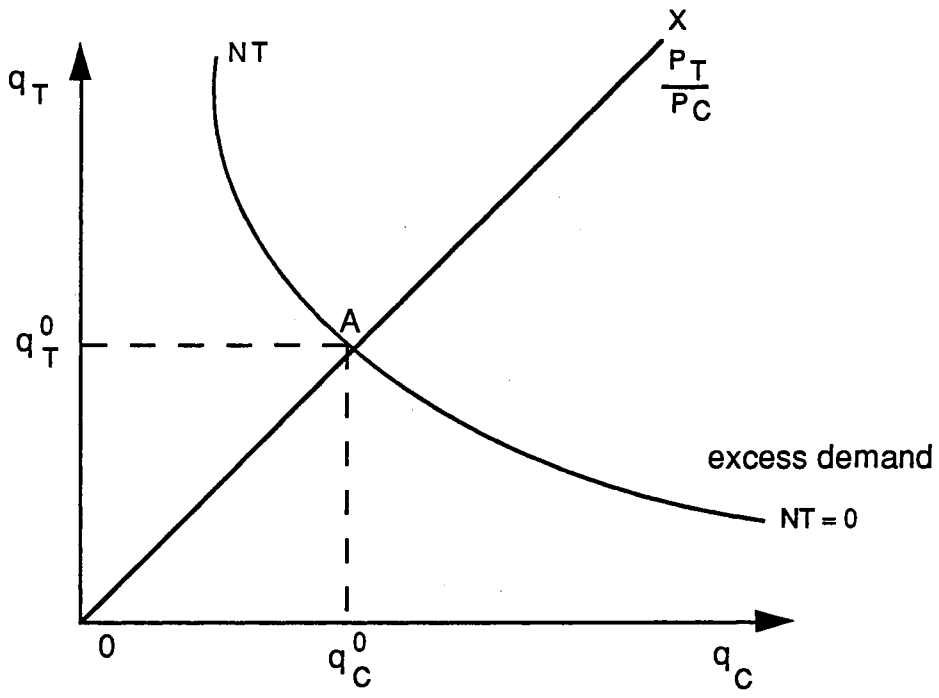

Figure 1: Equilibrium in the Non-traded Goods Sector

Source: Adapted from S. Edwards.

An exogenous increase in the price of copper P_C rotates OX to OX' as shown in Figure 2. This framework is used to analyze the effects of an export boom in the mining sector on the other tradable sector (agriculture and manufactures).

The increase in the price of copper relative to the price of non-tradables goods, assuming the price of non-tradables remains constant, creates an excess demand for non-tradables measured by AB. This excess demand will require an increase in the relative price of non-tradables to restore equilibrium.

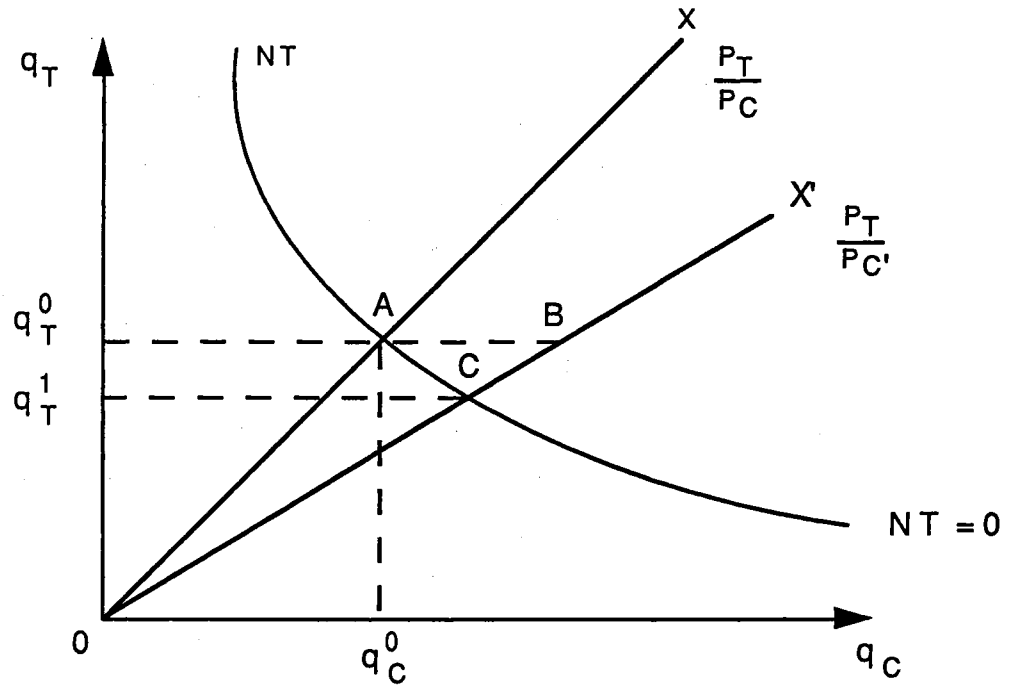

Figure 2: Effects of an Export Boom on Relative Prices

Source: Adapted from S. Edwards.

At B, the market for non-tradable goods does not clear and equilibrium is reached at C. The new equilibrium resulting from the increase in the price of copper drives down the price of other tradable goods relative to non-tradable goods, that is from q_T^0 to q_T^1 and also the price of other tradables relative to copper prices is lowered from $\frac{P_T}{P_C}$ to $\frac{P_T}{P_{C'}}$.

The increase in the price of copper has two direct effects, namely

- decrease in the relative price of tradable goods to non-tradable goods from q_T^o to q_T^1 and

- decrease in the price of other tradable goods relative to copper from $\frac{P_T}{P_C}$ to $\frac{P_T}{P_C'}$.

These two effects combined will result in resources moving out of the other tradable sector (agriculture, manufactures) into the non-tradable goods sector of the economy due to loss of competitiveness.

If the assumption that copper is not used locally is relaxed, the overall result is not affected provided copper and non-tradable goods are substitutes (Edwards, 1984). The excess demand function for non-tradables depends then on the relative prices of tradables, copper, and income:

$$(3.10) \quad NT = NT\ (q_T, q_C, Y) = 0$$

The above framework could be developed in terms of factor mobility between the different sectors of the economy. The assumption advanced earlier that the mining industry uses factors specific to the sector could be relaxed to exclude labor, which then becomes mobile between the different sectors. This analytical framework is developed by Corden and Neary (1982). They distinguish two distinct effects: the resource movement and the spending effect.

The boom in the copper industry resulting from an exogenous increase in export prices raises the marginal value product of labor in the mining industry and thus draws resources out of other sectors, giving rise to various adjustments in the rest of the economy, notably through the relative terms of exchange. The higher income resulting from higher copper prices in the mining sector leads to additional spending on non-tradable goods which raises their prices and induces further adjustments in the economy.

If only labor is mobile between sectors, the resource movement and spending effects lead to a reduction in the relative size of the non-copper tradable goods sector.

This effect is shown graphically in Figure 3. Before the increase in the price of copper, the production possibility curve is given by (T+C) NT with the assumption that the economy is at full employment. The equilibrium combination of output is given by NT_0 and $(T+C)_0$ and the relative price of traded to non-traded goods is given by the slope of the tangent at point a. I_0 represents the aggregate demand (indifference curve).

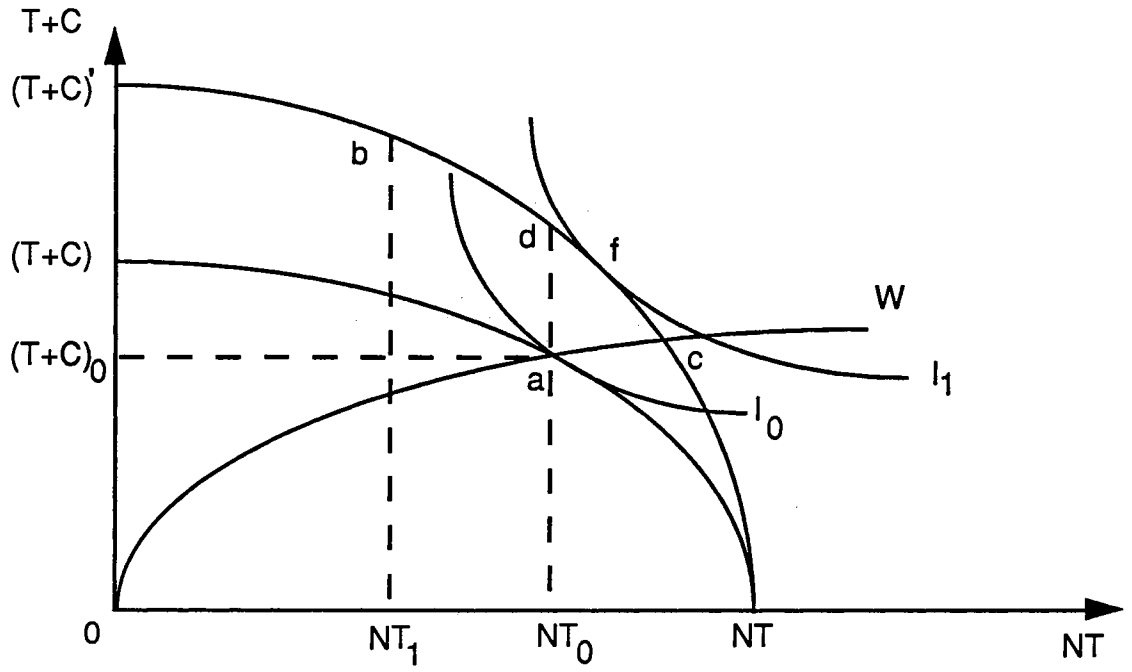

Figure 3. Resource Movement and Spending Effects on the Tradable and Non-tradable Goods Sectors.

Source: Adapted from Corden and Neary.

With an exogenous increase in the price of copper, the output of the copper industry increases and the economy's output of traded goods rises to (T+C)', while the output of non-traded goods remains the same. If the terms of exchange remains constant, the resource movement is represented by the movement from a to b which corresponds to a fall in the output of non-traded goods (NT_1) and to an increase in the output of traded goods, due to an increase in copper production. If we assume that the income elasticity of demand for non-traded goods is zero (abstracting from the spending effect), which implies that there is excess demand for non-traded goods at d and thus a rise in P_{NT}, e.i. real appreciation of the terms of exchange (exchange rate) is necessary to restore equilibrium. The new equilibrium is obtained at some point between d and b, but at lower output of non-traded goods (NT_1 less than NT_0).

The spending effect is obtained by keeping the resource movement effect constant by assuming that the mining industry does not use labor. The increase in copper prices raises the production possibility curve vertically upwards, point b now being vertically above a in Figure 3. If non-traded goods are normal goods, their consumption moves along the income consumption path OW which intersects (T+C)' NT at point c. At the old relative price ratio, there is now an excess demand for non-traded goods and their price must rise to restore equilibrium. The output of non-traded goods rises to between d and c compared to the initial equilibrium.

The resource movement and the spending effects combined contribute to a real appreciation of the terms of exchange, with the resource movement tending to lower output in the non-traded sector whereas the spending effect tends to raise it. Figure 3 shows a dominant spending effect so that f lies to the right of d. The increase in the output of the non-traded good sector raises the

demand for labor in that sector and wages rise, thus drawing labor away from the other sub-sectors of the traded goods, notably agriculture. This is an indirect reduction in the output of the agricultural sector caused by the spending effect.

In summary, the movement of the resources effect (out of the non-copper sector) draws labor away from agriculture and the non-traded sector (direct reduction) thus resulting in lower agricultural output and the spending effect compounds the reduction in output in the agricultural sector by drawing labor from agriculture towards the non-traded goods sector (indirect reduction).

In conclusion, the analytical framework described above has attempted to highlight the intersectoral relationships between the copper industry, the non-traded sector (services) and the agricultural sector. The Dornbusch and Edwards' approach concentrates on the effects the export boom has on the different relative prices in the economy. Corden and Neary's approach focuses on the real effects within the different sectors. Both, however, lead to the same conclusion that the relative prices of commodities determine the level of resource allocation between the different sectors and thus the level of output in the agricultural sector. The sectoral prices determine the real exchange rate which in turn determines the relative shares of the different sectors in the aggregate supply of goods and services within the economy. The present study follows the Dornbusch - cum - Edwards' approach.

3.4. Effects on the Monetary Sector of an Increase in the Price of Copper

The effects on the real sectors of an increase in the price of the primary export (copper) have been described as a loss of competitiveness of the other traded goods sector. These real effects have monetary consequences.

Equations (3.8) and (3.9) show clearly that an increase in the price of copper results in a higher income level with

$$\frac{\partial Y}{\partial P_C} > 0 \text{ and } \frac{\partial y}{\partial q_C} > 0.$$

From the traditional money demand function, an increase in income results in increase in the demand for money. The increase in the price of copper increases foreign exchange earnings and improves the balance of trade:

$$(3.11) \quad B = P_C\bar{C} + T^s - T^d$$

$$\text{with } \frac{\partial B}{\partial P_C} > 0, \quad \frac{\partial B}{\partial T^s} > 0 \text{ and } \frac{\partial B}{\partial T^d} < 0.$$

Under fixed exchange rate, such as applied in Zambia during most of the period under consideration, the export boom translated into an increase in foreign reserve (R) and an increase in the money supply (M^s):

$$(3.12) \quad M^s = D + R$$

with D = domestic credit

R = foreign exchange reserves.

The monetary theory of the balance of payments affirms that with ΔR positive, the domestic credit is not expanding rapidly relative to the demand for money. Noting that $\Delta M^S = \Delta D + \Delta R$ and $\Delta R > 0$, ΔM^S will be positive.

The money supply equation is thus given by

$$(3.13) \quad M^S = \Delta D + \Delta R + M^S_{t-1}$$

On the demand side, the higher level of income raises the demand for money (M^d).

$$(3.14) \quad \frac{M^d}{P} = L(r, y)$$

where

r = interest rate

y = income

P = general price level with the partial derivative with respect to y being positive.

In the money market, two outcomes are possible following the increase in the price of copper.

(i) If the increase in foreign reserves resulting from an increase in P_C is monetized, this will result in an increase in money supply. This increase creates a temporary disequilibrium in the money market which is translated into an excess demand for goods and services. The monetary effects thus reinforce the increase in P_{NT} caused by real effects and thus creates inflationary pressures which, in the short run, depresses further the relative prices of tradables (q_T). P_{NT} increases more than its long-run equilibrium level [Edwards (1984), Edwards and Aoki (1983), Harberger (1982)]. This overshooting of P_{NT} further improves profitability in the non-traded sector and thus leads to a deterioration of investment in the other tradable goods sector (agriculture) in the short run.

Edwards and Aoki (1983) provide a graphical analysis of this phenomenon which is reproduced in Figure 4.

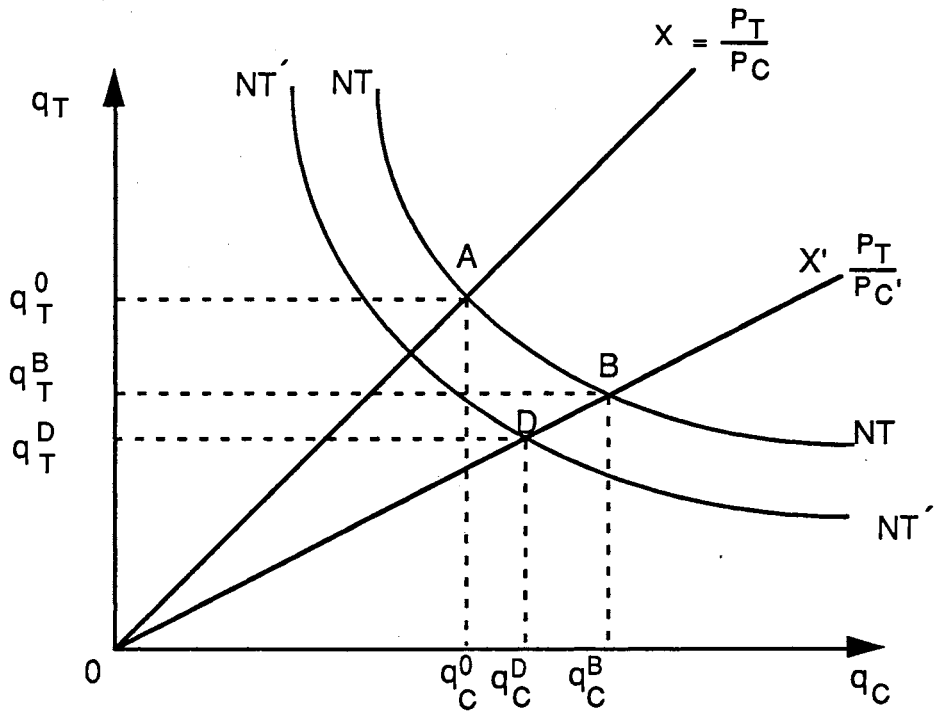

Figure 4: Effects of an Increase in Reserves on Relative Prices Following Monetization.

Source: Adapted from Edwards and Aoki (1983).

The increase in the price of copper rotates OX to OX'. The ensuing increase in money supply creates a disequilibrium in the non-traded goods sector and NT NT shifts down to NT' NT'. This shift occurs because there is an excess in supply of money which is translated into an excess demand for goods

at the old relative prices. The new short-run equilibrium is obtained at D, with relative prices q_T^D and q_C^D respectively. q_T^D is less than q_T^B, the long run relative price implying that in the short run, P_{NT} the nominal price of non-tradables is higher than its long run equilibrium level. This overshooting results in the appreciation of the real terms of exchange by an amount greater than would have been obtained without the monetary effects (Garcia and Llamas, 1988). Thus $q_T = \frac{P_T}{P_{NT}}$ decreases by a larger amount and thus competitiveness of the other traded goods (agriculture and manufacturing) is negatively affected. The exogenous increase in the price of copper results in an improvement in the terms of trade, and in a balance of trade surplus which depresses the price of tradables, i.e. increases the price of non-tradables.

The short run excess demand for money is thus affected by the sectoral price levels. If we define the excess demand for money as $M^E = M^S - M^D$, then

(3.15) $M^E = M^E (M^S, P_{NT}, P_T, y)$ and noting that y is a function of P_C,

$$\frac{\partial M^E}{\partial P_C} = \frac{\partial M^E}{\partial y} \frac{\partial y}{\partial P_C} > 0$$

(ii) The second possible outcome in the money market assumes that the increase in export earnings and the concomittant increase in foreign reserves is not translated into an excess supply for money, either through central bank sterilization or other mechanisms which prevent the spending of the foreign exchange in the domestic economy. This increase in the price of copper will generate an excess demand for money and the NT NT curve will shift to the right to NT″ NT″ together with OX to OX″ (Figure 5). In contrast to the first case, the change in

excess demand for money is negative. This creates an excess supply

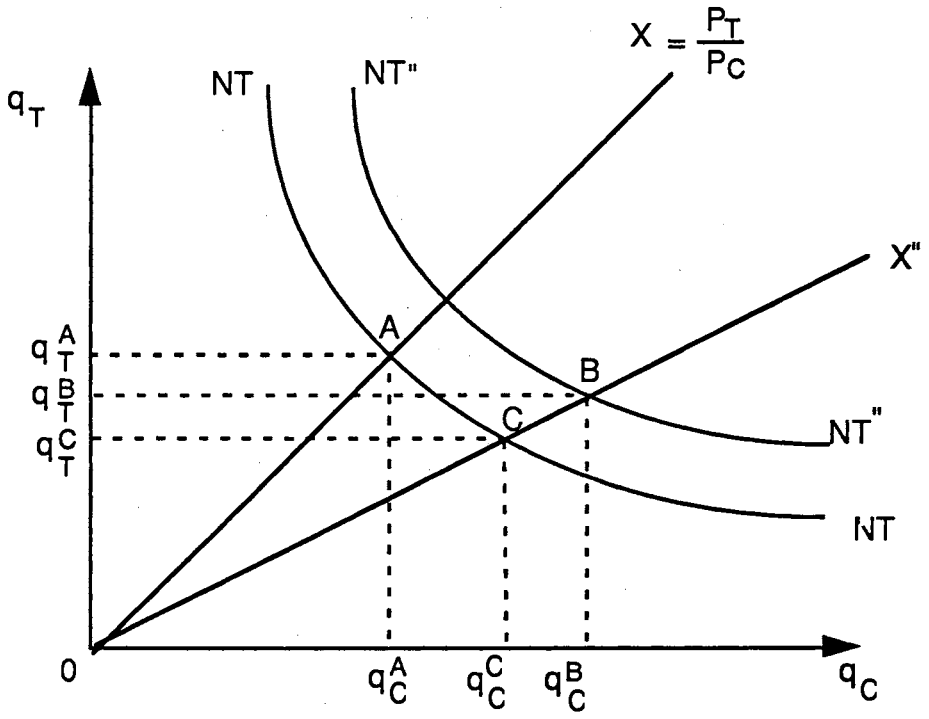

Figure 5: Effects of an Increase in Reserves on Relative Prices Which is not Monetized.

Source: Adapted from Edwards and Aoki (1983).

of goods and P_{NT} is reduced, $\frac{P_T}{P_{NT}}$ increases in the short-run. This undershooting improves profitability in the tradable sector by a smaller proportion in the short run. $q_T^B > q_T^C$ implying P_T increases. This situation is shown in Figure 5. At the initial equilibrium, the relative prices are q_T^A and q_C^A, respectively. An exogenous increase in

the price of copper rotates OX to OX″ and NT NT shifts to NT″ NT″. The shift is in response to an excess demand for money which is translated into an excess supply for non-tradables. The short run equilibrium prices are q_C^B and q_T^B, with the latter higher than its long run equilibrium level q_T^C, implying gains in profitability.

Experience in most countries with fixed exchange rates has shown that money supply has tended to increase following an export boom, resulting in higher short run incomes and higher prices for non-tradables, thus appreciating the real exchange rate (real terms of exchange) by an amount greater than would have been possible only with real effects. This results in loss of competitiveness in the tradable goods sector and a reduction in output. The demand for non-traded goods is affected, thus, by the excess supply of money. Equation 3.1 can then be expressed as

$$(3.16) \qquad NT = NT(q_T, M^E, Y)$$

$$\text{with } \frac{\partial NT}{\partial q_T} > 0, \ \frac{\partial N_T}{\partial M^E} > 0, \text{ and } \frac{\partial N_T}{\partial Y} > 0$$

3.5. Effects on the Fiscal Sector of an Increase in the Price of Copper

The increase in income resulting from an exogenous increase in the price of copper is easily translated into an increase in government revenues and expenditures, if progressive taxation is assumed. In Zambia, where taxation of the mining sector averaged 60 percent of government revenues before 1970, the boom in exports affected government expenditures. Does an

increase in government expenditures affect the level of relative prices within the economy?

Following Garcia and Llamas (1988), total expenditures (E) is divided between government expenditures (E_G) and private expenditures (E_P).

(3.17) $E = E_G + E_P$

(3.18) $E_P = E_P(Y_d, i) = E_P(Y - RT, i)$

where RT = revenue from taxes

i = the interest rate

Y_d = disposable income or total income less government revenues from taxes

(3.19) $E_G = NT_G + T_G$

(3.20) $E_P = NT_P + T_P$

Equation 3.19 says that the government revenue is spent on non-traded goods (NT_G) and on traded goods (T_G) other than copper. Likewise private expenditures are split between non-traded and traded goods (equation 3.20).

Equilibrium in the market for non-tradables implies that aggregate demand is equal to aggregate supply:

(3.21) $NT^S = NT_P + NT_G$

Equilibrium in the traded goods sector is obtained when the current account is in equilibrium (equal to zero), and by Walras Law this implies also that the non-traded sector is in equilibrium, assuming that all income is spent on tradables and non-tradables. This equilibrium could be summarized as

(3.22) $$q_T T^S - q_T (T_P + T_G) = q_C \bar{C}$$

where $q_C \bar{C}$ is the total foreign exchange inflow expressed in terms of P_{NT}

and

T_P = private demand for tradables

T_G = government demand for tradables

T^S = total output of tradables.

If the government finances all its expenditures from tax revenues then $E_G = NT_G + T_G = RT$. This is hardly the case since government expenditures were financed from a combination of foreign borrowing, money creation and taxes. The government budget equation is then given by equation (3.23).

(3.23) $$E_G = RT + MC_G + FB_G$$

where

MC_G = money creation or credit from the monetary authority

FB_G = foreign borrowing

The effects of government expenditures on the relative prices depends on its propensity to spend on non-tradable goods versus tradable goods. If the government propensity to spend on non-traded goods is higher than the private sector's propensity, an increase in E_G will result in an increase in the relative price of non-tradables and thus decrease the competitiveness of the traded goods sector. However, if a Ricardian equivalence assumption is adopted, this effect on P_{NT} is smaller.

An increase in interest rate reduces expenditures and thus reduces the demand for tradables and non-tradables. In the non-tradable goods market, there results an excess supply which drives the price of non-traded goods P_{NT} down. In the tradable goods market an increase in interest rate has the same effect of reducing demand and of creating an excess supply which results in the fall of P_T. Invoking Walras Law, the fall of P_T implies an increase in P_{NT}. By the Keynesian transmission mechanism, an increase in interest rate or equivalently a fall in money supply will reduce investment. Thus a rise in interest rate will affect more the tradable goods market rather than the non-traded goods market. An increase in interest rate will result in an increase in the relative price of non-traded goods, depending on the interest elasticity of the tradable goods market.

Relative prices are also influenced by the level of economic activity, that is the level of demand and supply in the different sectors of the economy. The relative price of tradables will increase if their demand exceeds their supply and thus result in the fall of the price of non-tradables. Likewise, a faster increase in demand than in supply in the non-traded sector will result in lower prices of traded goods and higher prices for the non-traded sector.

3.5 Conclusion

The above discussion has attempted to summarize the different elements that influence the price of non-traded goods. It is clear that this price is influenced by government expenditures, the price of copper, the interest rate and the overall level of economic activity. These results have the same implications for commodities in the agricultural sector.

CHAPTER IV

REVIEW OF EMPIRICAL PRICE DETERMINANTS

4.1 Introduction

The focus of this study is on prices and their relative distribution between the different sectors of the economy, especially agricultural prices and prices of non-tradable goods.

Producer price incentives are represented by changes in real agricultural prices. The assumption is that with positive supply elasticities, an increase in price will result in higher agricultural output and, conversely, a decrease in real price will result in lower output . An extensive literature has developed in an attempt to determine whether African farmers are responsive to price incentives and, generally, has concluded that supply price elasticities are relatively high in the short-run.

This study does not estimate supply elasticities for Zambian farmers, but provides a review of the literature pertaining to supply price responsiveness as it relates to farmers in low income countries. The main policy determinants of real prices remain, however, direct price controls, exchange rate policies, trade and tariff policies, and fiscal and monetary policies. The emphasis in the present review is on fiscal and monetary policies and exchange rate policies which constitute the core of the analysis in Chapter VI.

The literature review is divided in five sub-sections. Section 1 provides a succint review of the literature pertaining to supply-shocks and export booms.

Section 2 details agricultural supply responses in less developed countries. Section 3 reviews the impact of the exchange rate on agriculture and its determinants. Section 4 concentrates on the impact of inflation on agriculture and its causes. The last section reviews the literature pertaining to the interest rate and its importance for agriculture.

4.2 Supply Shocks and the Dutch Disease

We have hypothesized that higher copper prices lead to sectoral imbalances within the Zambian economy and thus to a need for agricultural policy adjustment. This dutch-disease type of effects has been extensively analyzed and has been ascertained to have real and monetary effects in small open economies.

Gregory (1976) has shown, in a partial equilibrium framework, that a growing export sector will affect the import competing sector in the same way as a tariff restriction (reduction in domestic prices) and will affect the traditional export sector in the same way as a tariff increase (increase in domestic prices). For the Australian economy, the rapid development of minerals amounted to a squeeze on import-competing sectors and the agriculture sector (earlier basis of exports) while the non-tradable goods sector flourished.

Corden and Neary (1980) have particularly addressed the effects of the oil boom and the consequent coexistence of a "booming and lagging" sub-sectors within the traded goods sectors.

Edwards and Aoki (1984) have shown that the dynamics of an export boom results in the equilibrium relative price of tradables declining and a resource movement out of the sector. With this line of reasoning, Bruno and Sacks (1982) have developed a model that allows for long-run capital mobility

between sectors within the domestic economy and between countries, using the assumption of perfect world capital markets. Their analysis shows that the oil boom reduces production of other tradables and that the size of this effect depends on government budget policies.

Harberger (1982) has attempted to quantify the change in the price of non-tradables relative to the price of tradables following the export boom and to assess the extent to which resources move out of the tradables sector to the non-tradable sector.

In a paper that includes both the real and monetary sector, Corden (1981) has shown that the fall in the price of tradables is brought about through monetary and fiscal policies management, or the lack thereof. Garcia and Llamas (1988) and Edwards (1984) have analyzed the effects of the coffee export booms on agriculture in Colombia and evidence suggests that higher coffee prices had a negative impact on other agricultural product prices and thus induced further adjustments not only between agriculture and other sectors of the economy but also within agriculture as well.

Most analyses of supply shocks such as those caused by sudden discovery and/or increase in price of natural resource based output, have identified macroeconomic variables, especially government expenditures, exchange rate, money supply, and inflation as policy variables through which the effects of higher export revenues are transmitted to other sectors of the economy. These will be discussed later in detail.

4.3 Agricultural Price Response

Direct distortion of prices is obtained either through price controls or by guaranteed prices. These policies generally favor consumption over production

and result in repression of domestic supplies, reduction in farm incomes, and increasing urban-rural migration (Norton, 1991). The latter, in turn, tends to perpetuate these types of policies due to increased political power of urban areas. Often times, price controls and guaranteed pricing schemes tend to offer farmers prices that are below their import or export equivalent and hence provide no protection for domestic production. Pricing policies applied differently to commodities also result in unequal protection among commodities and thus lead to resource misallocations with resources diverted to the commodities with the highest protection. Jansen (1988) shows how maize production has being relatively favored at the expense of other export crops within the agricultural economy of Zambia, mainly through loss of protection to the other crops despite the fact that maize production itself was left relatively unprotected. At the same time, pricing policies influence spatial production decisions. Pan-territorial pricing practiced in Zambia has led to increased production in the Eastern Province relative to other provinces despite higher marketing and distribution costs.

Overall, the price responsiveness of agricultural production in countries with a dualistic production system shows that :

(1) the estimated long-run elasticities tend to be less than one in value;

(2) non-food crops tend to be more price responsive than subsistence food crops; and

(3) commercialized food crop supply is more price elastic than the aggregated food crop category.

Despite the inelastic nature of the overall response, estimates of elasticities are always positive (Cook, 1980). These findings underscore the low price elasticity of supply in agriculture but nevertheless point to the fact that

commercialized agriculture in dualistic economies does respond to price incentives.

Falcon (1964), studying West Pakistan, found that farmers responded to increased relative prices by growing more acres of a given crop. The acreage elasticity of cotton was 0.4, much higher than estimates of elasticities for the U.S. during the same period. However, contrary to farmers in the U.S., relative prices did not have a significant impact on yield per acre. Reasons explaining the apparent inconsistent behavior included unavailability of inputs, lack of access to better cropping methods, lack of water, and institutional constraints such as land tenure arrangement. He concluded that there had been significant acreage shifts in response to changed relative prices and that it was possible to change the composition of total agricultural output through a price policy that took into account the relative importance of crops within the production system.

Cook (1980) estimated the responsiveness of non-coffee crops to prices in Colombia. His results showed positive response to agricultural prices and a negative elasticity with regard to manufacturing prices, implying that agricultural production depended not only on absolute prices in the sector but to prices of agricultural products relative to prices in other sectors. When terms of trade between agriculture and manufacturing was used as a variable, the acreage response was positive when terms of trade were favorable to agriculture. Holding the price of manufactured goods constant, the long-run elasticity with respect to price of non-coffee crops was estimated at 0.316 while the short-run elasticity was 0.262. Different specifications which included estimates of area adjustment models, the cobweb, and the price expectation models all showed positive responses to prices or to relative prices.

Individual crop response estimates were much higher than the aggregate elasticity for non-coffee crops. Own price short-run elasticitie were 0.329 for

corn, 0.707 for cotton, 0.117 for potatoes, and 0.148 for Yucca while long-run estimates were 0.687 for corn, 1.455 for cotton, 0.134 for potatoes, and 0.653 for Yucca. The estimates for individual crop area elasticities were much larger for most crops than the aggregate elasticity, implying greater allocative efficiency for growers in response to changing relative crop prices. The elasticity estimates were used to assess the impact of price distortion on the output of different crops. The analysis showed that had the terms of trade reflected world prices rather than domestic prices, the aggregate output of non-coffee crops would have been on average 29.8 percent higher than the actual level in 1962 and 15.9 percent above the 1969 level. Individual crops were most affected by the price distortions, with potential output of cotton being 120.7 percent, and 62.6 percent higher in 1962 and 1969, respectively.

In subsistence economies such as India, Bardham (1970) using cross-sectional data found that marketed surplus of grains may not necessarily respond positively during a year in which grain prices were up. Thus, "the short-run price elasticity of marketed surplus may be negative and since this forms a part of the long-run price elasticity, the value of the latter, even when positive, will be lower than otherwise" (p. 58). This phenomenon was because marketed surplus was affected directly through price and indirectly through the farmer's income. A rise in income due to higher prices lead to a larger withholding of grains for family nutritional improvement. This did not mean a reduction in total output, but rather the increased output was redirected towards better nutrition.

In another study using time series data, Bardham and Bardham (1971), found that the proportion of output marketed was responsive to the relative terms of trade between grains and manufactured products consumed by the agricultural population. Thus, the elasticity of marketed surplus of cereals with

respect to the price of cereals relative to manufactured consumables was positive and close to unity. This supported the hypothesis that in the long-run marketed grain surplus was very responsive to prices.

Using a Nerlovian partial adjustment model, Krishna (1963) estimated the price elasticity of acreage planted for the Punjab region. The results showed a high acreage elasticity with respect to price for cotton, maize, sugar-cane, rice, and barley.

With regard to Zambia, Fosu (1987) used the profit function to derive a system of net supply share functions, and thereby obtained own price elasticities for maize, sorghum, tobacco, groundnuts and other vegetable oil seeds for the period 1973 to 1982 (Table XIV). His estimates showed that agriculture was responsive to price incentives and the short-run elasticities obtained were equal to or higher than results obtained elsewhere in Africa for the same crops. These elasticities ranged from 0.36 to 0.55 for maize, 0.39 to 2.40 for sorghum, and 0.96 to 3.00 for tobacco. Substitution and complementarity relationships between different crops as indicated by their cross-price elasticity estimates, showed that higher prices for maize tended to discourage production of tobacco, cotton and groundnuts, while maize production was only marginally affected by the changes in the prices of other commodities.

Government interventions have tended to influence the level of prices prevailing within the economy. These interventions are both sectoral and macroeconomic. Though measures used to quantify these influences vary, they often include nominal protection coefficients, exchange rate distortions, and border equivalent prices. These are frequently combined to obtain a real domestic price which measures the real domestic purchasing power of

TABLE XIV

OWN-PRICE AND CROSS-PRICE ELASTICITY ESTIMATES FOR ZAMBIA, 1973-1982[a,b]

Output-input Response	Change in Price of:					
	Maize	Sorghum	Ground nuts	Other vegetable oil seed	Virginia tobacco	Ferti-lizer
maize	0.42	-0.04	-0.19	0.06[c]	-0.20	-0.05
sorghum	-1.37	1.22	-0.10	-0.39	2.12	-1.03
groundnuts	-2.71	-0.08	0.85	-1.84	3.18	-1.04[c]
other veg. oil seed	0.73	-0.15	-0.90	0.46	-0.62	0.60
tobacco	-2.25	0.89	2.33	-0.68	2.25	-1.29
fertilizer	0.34	0.14	0.16[c]	-0.19	0.33	-0.67

Source: Fosu, J. (1987).

[a] Elasticities estimated at the mean profit shares.

[b] The elasticities refer to 'quantity response' to price changes in contrast to the more traditional supply response elasticities obtained via acreage response analysis. It has been implicitly assumed, in deriving the elasticities above, that farmers adjust fully to changed conditions without any time lag. The traditional acreage response models explicitly distinguish between the short-run and long-run elasticities by allowing for adjustment in the length of time for which producers adjust to price changes.

[c] Estimated with statistically insignificant own or cross-price coefficients at the 5 percent significance level.

agricultural commodities relative to their real international purchasing power (FAO, 1987).[1]

Krueger et al. (1988), in the framework of the World Bank comparative study of agricultural pricing policies, subdivided the effects of intervention in agricultural prices into direct and indirect components. Direct intervention included sector-specific measures such as monopolization of purchases by marketing boards and sector specific taxation; and indirect intervention included trade policy instruments, credit subsidies, input subsidization, exchange rate overvaluation, and retail food price fixation. The effects of both direct and indirect interventions in all the countries covered, including Zambia, resulted in net taxation of agricultural production and in a reduction of incentives in the agricultural sector.

Von Braun's (1983) analysis of policies in Egypt showed that if domestic prices of agricultural products were allowed to move closer to their international levels, wheat and rice production would increase significantly, while removal of protection conferred to livestock and animal products would negatively affect livestock and wheat production. The latter result on wheat was because demand for fodder and feed constitutes an important element in the competitiveness of wheat. The Egyptian study illustrates the role played by prices in the composition and structure of the agricultural sector, especially the cross-price effects and the possible substitution and complementarity between commodities as in Fosu's (1987) analysis of Zambian agriculture.

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1 Real domestic price = Real international price (RIP) times
Nominal protection coefficient times Exchange rate bias (ERB)
where RIP = RIR = nominal international prices expressed usually in U.S. $ and deflated by U.S. CPI or any other deflator

where ERB = nominal exchange rate $\times \left(\frac{\text{CPI domestic}}{\text{CPI foreign}}\right)$

On the assumption that policy induced price changes tended to affect farm prices over a longer period than market induced year-to-year changes, Peterson (1979) used pooled cross-sectional data from 53 different countries to estimate a long-run aggregate supply elasticity for agriculture. His estimates were between 1.20 and 1.79, much higher than the short-run estimates previously found in the literature. The implications of such findings supported the hypothesis that the impact of policy induced price changes on production was much higher in the long-run than what had been given on the basis of year-to-year price variations. Using the lower bound of these estimates, Peterson estimated that the 1969 output level of the less developed countries (LDC's) comprising the sample would have been 63 percent higher if farmers in those countries had been paid the average prevailing price. His analysis showed that if farmers had been paid the average price in developed countries total food production would have improved to the point food shortages would have been eliminated.

To conclude, the above review has shown that prices are an important determinant of agricultural production in dualistic economies and that price distortions reduce supply. It has also shown that distortions in one price affected production of other crops through the cross-price effect and the overall structure and composition of total agricultural output.

4.4 Exchange Rate and Its Impact on Agriculture

The exchange rate stands as a powerful instrument of pricing policy not only as it relates to returns from exports of agricultural products but to the level of domestic prices as well.

Exchange rate misalignment distorts allocation of resources. There was a growing concern that Zambia's poor economic performance was linked to distortions in the exchange rate and the concomitant distortion in relative prices.

The trade and pricing effects of the exchange rate were first raised in a seminal paper by Schuh (1974), who advanced that the U.S. farm problem was inappropriately analyzed because the exchange rate was left out of the analysis. He hypothesized that the early 1970's devaluation had been an important structural change in the U.S. agricultural economy by lowering the value of the U.S. currency in foreign markets. Lower exchange rates cut the price of U.S. agricultural exports and thus increased the export demand, which would eventually lead to higher domestic prices of agricultural commodities.

This change in reasoning, especially the recognition that the exchange rate had important transmission effects on other countries' importation of U.S. commodities and on domestic price formation led to a large volume of empirical analysis on the role of the exchange rate in the agricultural sector of the U.S.

Greenshields (1974) evaluated the impact of changes in exchange rates on grain and soybean exports to Japan following the early 1970's devaluations of the U.S. dollar. His analysis used a three-stage approach. First, Japanese imports were estimated at actual exchange rates for the period 1971-1973. Second, he estimated imports at the fixed 1970 exchange rates, adjusting the yen prices to reflect what they would have been in the absence of currency realignment. The third stage considered the difference between stages one and two, and this difference represented the maximum change in quantity imported due to exchange rate changes. This approach showed that the more than 10 percent devaluation of the U.S. currency was followed by relatively small increases in Japan's import of wheat, amounting to 0.4 percent, 2.8 percent and 3.8 percent, respectively, for 1971, 1972 and 1973.

The study by Johnson et al. (1977) used an Armington type model to separate the effects of several variables, including the exchange rate on the U.S. exports of wheat and on the domestic price. They concluded that evidence failed to support the hypothesis that devaluation had a large effect on volume of trade.

Unlike the above two studies which had concluded that the exchange rate contributed little to the volume of imports, Longmire and Morey (1983) showed that the decline in the value of the U.S. dollar of about 30 percent in the early 1970's partly fueled the increased demand for U.S. farm products. The model used in the analysis assessed the direct impact of the U.S. dollar appreciation on export prices, export volume, and farm stocks. They concluded that following a 20 percent appreciation, the effects were about a 16 percent drop in the value of exports of grains and an increase in farm stocks.

In a theoretical paper assessing the impact of the exchange rate on exports, Kost (1976) determined that the impact of exchange rate changes on trade and prices was dependent on the size of the exchange rate adjustment and the elasticities of export supply (excess supply) and excess demand (import demand) functions. Taking into account that the elasticities of both supply and demand for U.S. agricultural commodities are very small in the short-run, a devaluation would generate larger domestic price increases relative to quantity exported and thus would be inflationary in the agricultural sector. Thus exports of agricultural products should not be counted on in an effort to improve the current account balance following a devaluation because imports will increase due to increased domestic prices and thereby offset the effect of higher export prices.

Exports of U.S. farm products increased substantially following the dollar realignment of 1971 and 1973. It has been advanced that this development

was more than random since it corresponded to important monetary decisions in the world. This has been reinforced by the subsequent drop in farm exports after 1983 following the nearly 40 percent appreciation of the U.S. currency during the 1982-85 period.

Velliantis - Fidas (1976) tested the validity of the hypothesis that the increase in farm exports were due, among other things, to the 1971 and 1973 monetary adjustments. Her conclusions seem to confirm Kost's (1976) theoretical conclusions that the devaluation was not an important factor in the domestic price rise of farm commodities nor did it significantly affect agricultural trade. She contended that the effect of the devaluation was to increase the price of tradable goods and thus was inflationary.

The above empirical and theoretical analyses approached the trade effect of exchange rate changes using different analytical tools and results varied widely in magnitude and impacts, ranging from no effect (Johnson et al., 1977; Velliantis - Fidas, 1976), to very little impact but disproportionate relative to the size of the currency realignment (Greenshields, 1974), and to significant impact (Longmire and Morey, 1983). The specifications in the above trade models were severely criticized. Chambers and Just (1979) showed that the elasticity of the exporter's price with respect to the exchange rate was confined to the (0,-1) interval in most of those models and thus limited the responsiveness of exports due to devaluation on a priori basis. They further showed that specifying a more general framework involving cross-price effects between traded goods and all other goods, freed that limitation while taking into account adjustments in other markets. Schuh (1975) also criticized Velliantis - Fidas approach as being ad-hoc and too simplistic because it did not specify a "complete model of the demand and supply of U.S. agricultural exports". He argued that to conclude that devaluation was not a significant factor was to

argue that price did not matter, and this failed to recognize the link between domestic and export prices and production.

On the basis of the above critiques, Chambers and Just (1981) in a subsequent paper assessed the effect of exchange rate on U.S. agriculture using dynamic multiplier analysis. The functional form of the trade model differed from earlier models by including the exchange rate as a separate regressor. The results indicated that the devaluations of the early 1970's had significant effects on agricultural exports. Likewise, their paper on the effect of monetary factors on U.S. agriculture (1982) showed that the exchange rate and other monetary variables affected the sector in a significant way.

Batten and Belongia (1984) using a structural model that included the demand for and supply of agricultural exports, derived a reduced form equation that included the trade weighted index of foreign real GNP, the price index of U.S. agricultural exports and the real trade-weighted index of the foreign exchange value of the U.S. dollar to assess the impact of an appreciation of the exchange rate on the export of agricultural commodities. Their analysis showed that an appreciation of the exchange rate had a negative effect on agricultural exports, but the exchange rate was not the most important determinant of exports but rather foreign real economic activity was the primary determinant of the movement of agricultural commodities across boundaries.

Lamb and Donovan (1992) used cross-sectional data of sub-Saharan African countries and a structural model that included both the demand for and supply of food and export crops to estimate the responsiveness of total agricultural output to changes in real exchange rates, prices of domestic food crops, and prices of export crops. They found that the exchange rate appreciation was negatively associated with overall agricultural production. The food and export crop equations showed highly negative coefficients for real

exchange rate, implying that food production declined with the exchange rate appreciation. The intuitive explanation is that an exchange rate appreciation lowers the cost of food imports which then compete in the domestic market and thus leads to lower food production.

Gardner (1981) focused on the effects of exchange rates on domestic prices and farm income. His analysis revealed that a fall of 1 percent in the trade-weighted value of the U.S. dollar lead to an increase in domestic farm prices of 0.4 percent, while an appreciation of 1 percent reduced net farm income by 4.3 percent.

For Colombia, Edwards (1985) found that the level of real world economic activity and the exchange rate were the most important determinants of the level of non-coffee exports. The long-run elasticity varied between 1.206 to 1.725 for the real exchange rate, between 5.093 to 9.409 for the world real economic level, and -4.36 to -2.79 for domestic economic activity. This implies that exports responded positively to lower exchange rates and higher economic activity abroad, while an increase in economic activity reduced the level of exports.

Several approaches have been used to explain the determination of the exchange rate. The monetary approach has received more attention, especially as it relates to adjustment programs and the leading role the IMF and the World Bank have played in their initiation and implementation.

Several measures have also been used to ascertain the magnitude of the real exchange rate. The most commonly used are

(i) (4.1) $$e = E * \frac{\text{price index domestic}}{\text{price index foreign}}$$

where E is the nominal exchange rate and

(ii) (4.2) $$e = \frac{P_T}{P_{NT}}$$

where P_T = price of tradable goods

P_{NT} = price of non-tradable goods

The real exchange rate in (ii) is viewed as the yardstick of the real terms of trade between the traded and non-traded goods. An increase in e will make the production of tradables relatively more profitable, inducing resources to move out of the non-tradable goods into the tradable goods sector. This measure relates more to real variables since factors that cause changes in relative prices such as productivity, technology, supply and demand factors determine the exchange rate.

Measure (i) relates to the purchasing power parity value of the domestic currency. And since the domestic price level is to a large extent determined by excess money supply, this measure implies that the exchange rate is largely a monetary variable rather than a function of real variables.

4.4.1 The Real Exchange Rate Approach

The real exchange rate approach to the movement of the exchange rate has emphasized the real targets approach view, i.e. the nominal exchange rate should be used together with other policy instruments to attain internal and external balance. Internal balance implies that the market for non-tradables clears whereas external balance is attained when the current account balances (current and futures) are compatible with long-run sustainable capital follows (Corden, 1990).

Edwards (1989), using an intertemporal framework which incorporated explicitly the non-tradable sector, a profit maximizing private sector, and a government budget constraint, developed a theoretical optimizing model of real exchange rate determination.

In the model, the equilibrium real exchange rate is determined by both international and domestic factors. These include international terms of trade, world real interest rate, international transfers, import tariffs and other trade restricting policies, exchange and capital controls, taxes and subsidies, government expenditures, and factors of production - - notably technological progress.

Fiscal expansion which increases demand in the economy will lead to an increase in P_{NT} or a real appreciation. This can be seen using Corden's (1990) formulation given by equation 4.3.

$$(4.3) \qquad RER = \frac{E}{P_{NT}}\left[\alpha\,(1+t)\,P_m^* + (1-\alpha)\,P_x^*\right]$$

where
- RER = real exchange rate
- E = nominal exchange rate
- P_{NT} = price of non-tradables
- t = tariff rate
- α = subsidy rate
- P_m^* = world price of importables
- P_x^* = world price of exportables

He distinguishes between a domestically financed deficit with excess capacity (internal imbalance) and a foreign - financed deficit with full employment. In the first case, the increase in fiscal expenditures results in higher income and a rise in interest rate. This raises the demand for non-traded goods and an appreciation of the real exchange rate. Equilibrium is restored by a depreciation. In the second case (deficit is externally financed and the economy is at full employment), an increase in expenditure results in higher income, above the full employment level in the short-run, a rise in price of non-

traded goods and in external imbalance (current account worsens). The rise in P_{NT} leads to a real appreciation. Equilibrium could be restored either by an increase in E (a devaluation), an appropriate rise in t, or a combination of both.

Penati (1983) has also shown that fiscal expansion results in an appreciation of the exchange rate because expansionary fiscal policy raises the domestic real absorption through an increase in real output and the demand for money. To restore equilibrium in the money market real output and aggregate demand must fall. The fall in output checks real domestic absorption which leads to balance in the current account.

Likewise, Edwards (1989b) in his model has shown that government deficits resulted in an appreciation of the equilibrium real exchange rate, which will reflect a disequilibrium if all the other variables in the model remain unchanged. On the other hand, the distribution of government expenditures between tradable and non-tradable goods will have repercussions on the equilibrium path of the real exchange rate. An increase in government expenditures concentrated on non-tradable goods and financed by borrowing in the current period will raise P_{NT} in the current period and result in a real appreciation. In future periods, the increase in borrowing in period one implies an increase in future taxes, which in turn reduces future disposable income and thus restricts the demand for non-tradable goods. The result of this substitution effect, induced by the Ricardo-Barro equivalence, is a depreciation in the current period. Both the income and substitution effects will tend to move the RER in opposite directions, the substitution effect tending to appreciate it, while the income effect tends to depreciate it. The most frequently encountered situation is that the substitution effect dominates and thus a real appreciation of the exchange rate follows.

Throop (1989) used a macroeconomic model developed by the Federal Reserve Bank of San Francisco to analyze the appreciation of the U.S. dollar between 1980 and 1986. The large increase in government deficit and the influx of foreign capital needed to finance the deficit appreciated the real value of the dollar with a concomitant large BOP deficit. The opposite argument has been that tight monetary policy followed by the Federal Reserve Bank in its anti-inflation fight led to higher interest rates and to the appreciation of the dollar. In the model, the long-run RER is endogenous and is influenced by expectations of future fiscal policy. Current fiscal policy affects the RER through its effects on the real interest rates and through expectations of future fiscal policy. Both these channels tend to appreciate the RER since an expectation of future deficits tend to reduce the value of the RER. Results of the simulation indicated that fiscal expansion caused the dollar to appreciate an additional 25 percent and constituted the single most important contributor to the dollar appreciation. Expectational effects were, however, more important than the rise in the interest rate differential between the domestic and foreign interest rates.

Similar results were obtained by Hutchison (1984) for Japan, using a variant of the Hooper-Morton monetary model which expresses the real exchange rate as a function of domestic and foreign real interest rate, domestic bonds in total wealth, proportion of domestic wealth in total wealth, and the cumulative sum of the current account. Results for the period 1973-1982 suggested that the relative supply of government bonds had influenced the yen-dollar real exchange rate towards an appreciation.

Bisignano and Hoover (1982) reached a similar conclusion using a portfolio - balance model.

Changes in terms of trade and trade barriers affect the real exchange rate. Deterioration of terms of trade result in importable goods being more

expensive relative to exportables and this will tend to appreciate the real exchange rate.

The earlier static approach of the effects of the terms of trade concluded that improvement in the terms of trade resulted in higher income, improved the current account balance and thus led to a real depreciation of the exchange rate. Likewise a deterioration of the terms of trade resulted in a real appreciation.

In the intertemporal model of real exchange rate of Edwards (1989), the equilibrium path of the real exchange rate is affected by both a substitution and an income effect. The income effect of a deterioration in the terms of trade will tend to a real appreciation while the substitution effect will tend to depreciate the real exchange rate. The resulting effect will depend on whether the income effect dominates (appreciation) or the substitution effect dominates (depreciation).

Ostry (1988) has also shown that the effects of a temporary current deterioration in the terms of trade depend on the temporal, intertemporal and welfare effects, with the temporal substitution effect tending to a real appreciation, whereas the intertemporal and wealth effects tending to a real depreciation. He has also shown that expected future terms of trade deteriorations will impact the RER depending on the magnitudes of the temporal elasticity and the intertemporal elasticity of substitution between importables and non-tradable goods. These magnitudes relative to a critical value determine whether the RER will depreciate or appreciate.[2]

Khan and Montiel (1987) use the labor market equilibrium, the sectoral labor demand functions, the production functions (for the three sectors of the

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2 See Ostry for further details.

economy, respectively, of exportables (X), importables (Z), and non-tradables (NT)), and the demand for tradable goods to derive the dynamic equations for the exchange rate and the accumulation of real financial wealth by the private sector.

They show that an improvement in the terms of trade causes output in the exportable (X) sectors to expand while contracting in the importable (Z) and non-tradable (NT) sectors. By contrast, a real exchange rate depreciation moves labor into and increases production in the tradable goods sector while contracting the non-tradable sector due to a relative decrease in P_{NT}. The improvement in the terms of trade, induced by an increase in export prices raises the level of real income and this leads to an excess demand for NT goods which in turn appreciates the RER. The real appreciation of the exchange rate is caused by P_{NT} rising and if the income effect is large enough the demand for NT could rise sufficiently to cause P_{NT} to increase more than P_X. On the contrary, the increase in P_{NT} will be smaller if the income effect is not large enough and lead to an appreciation of e when defined as $\frac{P_Z}{P_{NT}}$ and to a depreciation when defined as $\frac{P_X}{P_{NT}}$.

With regard to the effects of trade barriers on the exchange rate, Corden (1990) in the framework of equation 4.3 shows that t and E are the two policy instruments which could influence e (real exchange rate). If P_M , P_X and P_{NT} are held constant, a rise in t (the tariff rate) represents an increase in import restrictions often linked to revenue generation and/or to a current account objective and which leads, among other things, to overvaluation of the real exchange rate. Overvaluation is also the consequence of a rise in P_{NT} owing to domestic monetary and fiscal policies while t is held constant. The policy remedy often prescribed is to increase E (devaluation), which unfortunately

leads to a further rise in P_{NT} (at least in the short-run). To avoid this rise in P_{NT}, adjustment in the nominal exchange rate is delayed and more reliance is placed upon t (increased imports tariffs/restrictions) to attain external balance. The resulting consequences of such action is to reduce the profitability of the tradable sector, notably agriculture. This appears to have been the process that happened in Zambia between 1975 and 1985.

Khan and Montiel (1987) in assessing the effect of taxes on the RER distinguish between an export and an import tax. They assert that the imposition of an export tax is qualitatively equivalent to a reduction in the terms of trade that has the same effect on domestic producer prices. If the proceeds of the tax are redistributed as lump-sum transfers, the impact of the export tax is to depreciate the exchange rate on impact. The quantitative effect on the RER is much smaller with the export tax compared to deterioration in the terms of trade because the income effect is not operational in the later case. Similarly, an import tax raises the price of importable goods and is similar to a deterioration in the terms of trade, which in turn will result in a real depreciation of the real exchange rate. The effects of the imposition of an import tax will be quantitatively smaller relative to the effects of a deterioration in terms of trade brought about by the increase in world prices of importables due to the absence of the income effect. As a consequence, imposition of trade barriers through export and import taxes lead to a depreciation of the RER and measures designed to liberalize trade by way of removing all trade barriers will lead to a real appreciation.

The results of Khan and Montiel (1987) seem to contradict the traditional view that an increase in import tariffs will result in a real exchange rate appreciation. They seem to contradict also the views of the intertemporal model. In the general equilibrium model with foreign borrowings (Edwards,

1989a) temporary changes in tariffs affect the equilibrium real exchange rate in both directions depending on income and substitution effects. If the substitution effects dominate the income effects, a temporary tariff will generate an equilibrium real appreciation, which is generally the case.

In summary, the effects of the terms of trade have been shown to appreciate the RER following a deterioration and to depreciate following an improvement in the traditional view. In the intertemporal model, the deterioration in the terms of trade will result in real appreciation if the income effect dominates. If the substitution effect dominates, the RER depreciates. These results are contrary to Khan and Montiel's model where the deterioration in the TOT lead to a depreciation in the RER. One should, however, note the difference in the definition of the exchange rate used in both models.

An increase in tariffs and other trade barriers have been shown to lead to a real appreciation of the RER. In the intertemporal model, a temporary tariff will generally result in an appreciation of the RER, assuming the substitution effect dominates.

Exchange and capital market controls affect the RER. Domestic and foreign assets are often substitutes and the portfolio composition of savers change to take advantage of profit opportunities in either market. This is captured in most monetary approach models of the exchange rate where the interest rate differential between the domestic and world market is an important determining variable.

Edwards (1989a) equates capital controls with a tax on foreign borrowing which is shown by $S > S^*$ where $S^* = \frac{1}{1+r^*}$ the world discount rate. His analysis shows that an increase in S towards its world value S^*, implying a liberalization of the current account, results in an increase in P_{NT} or a real appreciation in

period 1. This is due to the intertemporal substitution effect which makes future consumption more expensive and hence leads to an increase in consumption in the current period (the increase in the discount rate S following liberalization). The income effect, on the other hand, increases borrowing from abroad (due to removal of the international transaction tax) and as a result there is an inflow of foreign capital. The increase in income exerts pressure on P_{NT} and thus reinforces the substitution effect.

Van Wijntergen (1989) uses a full intertemporal general equilibrium model and demonstrates that capital import taxes raise domestic interest rates, as in Edwards (1989b). Higher real rates domestically and lower international real rates induce a temporal shift of domestic expenditures from the current period to the future while foreign expenditures shift from consumption in the future to the present. His analysis complements Edwards', in that it takes into account expenditure patterns between the domestic and the world economies. When the pattern of expenditures is the same in the domestic economy and abroad, the change in composition does not affect the demand for any particular commodity leaving their prices unchanged, and hence capital controls do not affect the real exchange rate. When the consumers have a preference for domestically produced goods, the increase in domestic interest rate in period one implies a reduction in consumption of these goods and as such capital controls appreciate the real exchange rate, since P_{NT} is reduced.

4.4.2 Conclusion

The equilibrium real exchange rate approach has been shown to respond to fiscal policy, to terms of trade and trade barriers, and to capital movement controls. The extent to which they influence agricultural prices

depends on their influence on P_{NT}, prices of importables, and on whether or not importables and non-tradables are substitutes or complements in consumption. Expectations also play an important role in the intertemporal allocation of resources and thus on the exchange rate. If non-tradables and importables are substitutes, an anticipated increase in tariff in period two will increase the demand for non-tradables in period one. If non-tradables and importables are complements, however, an increase in tariffs will reduce the quantity of importables demanded together with the quantity of non-tradables. The level of aggregation that importables and non-tradable goods usually imply lead to non-tradable goods and importable goods being substitutes and the imposition of a tariff on importables leads to increase in NT demand and to increase in P_{NT} in both periods and to an appreciation of the RER. The equilibrium real exchange rate is also influenced by the level of technological progress in the economy to the extent that the price of tradable goods (manufactured and agricultural goods) will tend to decline due to technological progress at a faster rate than that of non-tradables, the terms of exchange $\frac{P_T}{P_{NT}}$ will be declining. Technological progress also affects the level of income and thus exerts a pressure on P_{NT}.

4.5 Inflation and Agricultural Prices

The rise in domestic inflation and the increasing deficits in the balance of payments constitute two signs of excess domestic absorption. It is often argued that in most LDC's, the inflationary pressures of the 1970's and 1980's resulted from increased fiscal deficits that often times were monetarized by borrowing directly from the central bank. How does inflation then affect agriculture?

The impact of inflation on a commodity depends whether it is tradable or non-tradable. In general, tradable good real prices will reflect movement in the real exchange rate. From the purchasing power parity definition of the exchange rate $E = \frac{P_T}{P_T^*}$ we can obtain the level of domestic prices as

(4.4) $P_T = E P_T^*$

which is a function of the nominal exchange rate (E) and the world price of tradables (P_T^*). The real exchange rate is given by

(4.5) $e = E\frac{P^*}{P}$ •

Assuming that the real price of tradables is a constant $K = \frac{P_T^*}{P^*}$, the world price level P^* could be obtained as $P^* = \frac{P_T^*}{K}$, which when substituted in (4.5) above gives equation 4.6:

(4.6) $e = E\frac{P_T^*}{PK}$ •

From (4.4) above, we obtain $P_T^* = \frac{P_T}{E}$ and after substitution in (4.6) and manipulation yields

(4.7) $\frac{P_T}{P} = eK$ •

Equation (4.7) states that in the absence of government intervention, the domestic real price of tradables would be determined by the real exchange (e) and the relative world price of tradables (K). But in most developing countries, the nominal exchange rate is a policy instrument and an overvalued E would tend to lower the real price of tradables and thus reduce their competitiveness.

The price of non-tradable goods which are not directly affected by exchange rate will move together with the general prices within the economy, so that their real level remains unaffected in the absence of movements in the supply and demand of non-tradable goods.

Most studies of the impact of inflation on agriculture have been carried out for developed countries and very little has been done for developing countries. It has been generally assumed that because inflation is bad for the economy as a whole agriculture, often the largest sector, will ultimately be negatively affected. The transmission mechanism goes from higher prices for inputs necessary in agricultural production and higher factor costs to a negative supply response from farmers.

Tweeten (1980, 1983) assessed the impact of inflation on food production by testing the hypothesis that (1) demand for farm output at the farm level was homogeneous of degree zero in prices and income and (2) that general inflation changed the ratio of prices received to prices paid by farmers because of its uneven impact on prices of inputs and prices of farm output, thus negatively affecting the terms of trade faced by farmers. His empirical analysis showed that retail demand for food was homogeneous of degree zero in prices and income, implying that real demand for food at the retail level was unaffected by inflation. At the farm level, there was no basis to reject the hypothesis that the increase in the national price level was fully passed on to nominal demand. Hence increases in the general price level were reflected proportionately by increases in farm price output. The elasticity of real farm prices (prices received by farmers) relative to price paid was negative (-0.3897 for the period 1963-77) implying that national inflation reduced the relative prices received by farmers by increasing the prices paid for inputs by a proportionately larger margin.

Bordo (1980) compared the relative price responsiveness of different sectors and different types of products to changes in the monetary factors using two different approaches: the traditional approach which relies on short-run supply elasticities and the contract approach.

Assuming that the general price level responds mainly to monetary factors, the contract approach asserts that the shorter the contract period negotiated by an industry for given transaction costs, the more responsive would that industry's prices be to changes in the general price level. The traditional approach predicts a faster price response by agricultural products than by industrial products. The contract approach predicts that agricultural products traded in well organized auction markets exhibit low transaction costs and thus will be inclined toward shorter contracts and thus will be more responsive to monetary changes. The conclusion of his study is that primary goods including farm products would respond more rapidly to monetary changes than industrial products, in which group most inputs used by farmers will be categorized. Thus farm prices will react more rapidly to increased demand induced by monetary changes than would input prices. His findings tend to contradict Tweeten's conclusions on the effect of inflation on agricultural prices..

Starleaf et al. (1985) using a different methodological approach reach the same conclusion as Bordo that non-farm price inflation tends to move slowly and smoothly in response to demand changes while farm price inflation is quick and sharp. Their evidence shows that farmers have been net beneficiaries of unanticipated increases in inflation and a decline in inflation has resulted in losses in terms of trade faced by farmers.

Inflation affects the level of exports by raising the domestic price and through its effects on the real exchange rate. Nainggolan (1987) found that an

increase in inflation in Indonesia slightly reduced the level of agricultural exports because it affected the real exchange rate only marginally.

In a general equilibrium model of the U.S. economy, Barclay (1986) found that by doubling the rate of money supply growth to 8 percent, non-agricultural prices rose 6 to 8 percent annually, while the real exchange rate and agricultural exports were only marginally affected, as in Naingollan's study.

Inflation affects the structure and organization of the farm sector by increasing instability through its impact on real wealth and cash flow. With rising costs and asset requirement, inflation limits entry of prospective family farmers, encourages land renting rather than capital accumulation through land purchase, and favors corporate farming with diversified sources of income (Tweeten, 1983).

Agriculture in developing countries is more fragmented and structurally the capacity of the economy prevents a high mobility of agricultural labor to other sectors of the economy. This type of agriculture with low capital requirement would be expected to be less sensitive to inflation. However, the export sector, through the effect of inflation on the exchange rate, would most likely be negatively affected. Another aspect of the impact of inflation deals with its differential impact on prices of agricultural tradables and prices of manufactured tradables. If market imperfections or other constraints lead to prices of manufactures increasing more than prices of agricultural tradables, inflation results in a tax on agriculture. In semi controlled economies such as Zambia, the rate of change of administered agricultural prices has lagged behind the rate of inflation in the general economy. It is therefore expected that inflation will have resulted in a tax on agriculture.

4.5.1 Determinants of Inflation

Inflation has been viewed essentially as a monetary phenomenon: increase in money supply that exceeds the rise in output will result in inflation. The question has centered on the mechanism through which money stocks operate to influence the general price level. The key of this monetarist view is the difference between nominal and real money stock.

This framework is reflected in Harberger's (1963) analysis of inflation in Chile during the period 1939 - 58 in which he attempts to ascertain the effects of monetary expansion on the level of prices and the importance of past accelerations of inflation upon the current rate of price changes. Harberger used the following equation:

$$(4.8) \quad P_t = a_0 + a_1 Y_t + a_2 M_t + a_3 M_{t-1} + a_4 A_t + A_5 W_t$$

where P_t = the percentage change in the price level at time t

M_t = money supply

A_t = percentage change in past inflation (acceleration of prices) defined as $\Delta P_{t-1} - \Delta P_{t-2}$

Y_t = income level

W_t = percentage change in minimum wage.

Empirical results showed that a one percent increase in income resulted in an equiproportionate decrease in P_t, while the sum of a_2 and a_3 was nearly one implying that a one percent rise in money supply resulted in increase in the general price level of the same magnitude in the next period. The adjustment of prices to money supply was completed in two periods.

A cross-country analysis of inflation undertaken by Glytsos (1977) included both monetary and what has come to be known as cost-push elements. The model was applied to a cross-section of 36 developing countries, first to the whole pooled group and then to smaller sub-divisions grouped alternatively by per capita income, annual rate of real rate of growth, inflation rate, and geographic region. Empirical results showed that real money supply decreased the level of prices, while nominal money increased the CPI equiproportionately. In the grouping by geographic region, the nominal money supply coefficient for African countries was less than that of other regions, implying the effects of nominal money was less for those countries for the three years covered by the study.

Rosser and Sheehan (1985) found, using a vector autoregressive methodology of Saudi Arabian inflation, that inflation was a function of both M_1 and import prices.

The success of the Harberger type model (and many of its monetary variants) in explaining inflation has led to extensive usage in policy formulation in LDC's where fiscal deficits tend to be, in large part, monetized. This has led to a high correlation between fiscal and monetary policies, deficits resulting essentially in increase in money supply. In Zambia, money stocks growth has generally been faster than the rate of growth of real output. Stabilization attempts have emphasized reduction in government deficits in an attempt to reduce money supply.

The monetary model of inflation has come recently under criticism following the break-down of the quantitative relationship between price movements and monetary aggregates. This is in part due to financial innovations which have created a discrepancy between the commonly used

measure of the stock of money (M_1) and the level of monetary activity in the economy.

Hall et al. (1989) have suggested that M_2 was a better anchor for the price level. Tatom (1990) has, however, shown that despite the increase in velocity of M_1, the linkage between M_1 and inflation is still strong. Moreover, Harberger's approach in evaluating the length of the adjustment process was to consider only those lags which added to the explanatory power of changes in prices and to reject those lags which were not significant. This was obtained with estimates of M_t and M_{t-1}, whose sum was nearly equal to one, with annual data. The adjustment to income was almost immediate (attained in the current year) with the coefficient being nearly minus one.

DiŻ (1970) contends that, according to the theory of demand for money, one should expect a lower level of real cash balances after the higher prices have worked their way through in the economy. This implies that some overshooting will occur in the path of the rate of change in prices during the adjustment period, in order for real cash balances to decline to their lowest desired level. Under these circumstances, it may be possible to observe some partial sums of the a coefficients in equation 4.8 to be greater than unity and some of them to be negative, while the total sum approaches unity as the whole adjustment process comes to an end (DiŻ , 1970). A coefficient not significantly different from zero could merely indicate a period in which the response changed signs. His application of the approach to quarterly prices for Argentina (wholesale and cost of living indices) confirmed not only the existence of lagged response in prices to changes in money but also initial overshooting and later significant deceleration of prices. The sum of the coefficients was less than

0.5[3], implying that the adjustment period may take longer than the six quarter lags used in the model. This pattern was also tested by Berhman (1973) using Chilean annual data and a process of overshooting and deceleration in response to changes in money supply was observed . The GDP deflator was used as the dependent variable. Sheehy (1980) found, however, that overshooting did not seem to be a strong empirical phenomenon in tests based on three chronic inflation Latin American countries (Brazil, Chile, and Argentina) and that Berhman's long lags in the adjustment process to money supply changes was a peculiarity of the data he had used.

Glytsos' main price and cost-push models point to another determinant of inflation notably wages. The dependence of prices on costs, especially wages, has led to the assumption that firms raise their prices only as their input costs are increased, thus forcing workers to bargain for higher wages, which in turn are passed through the pipeline of costs as higher inflation. The empirical application of Glytsos' model to 36 LDC's strongly support this view. The cost-push equation showed highly significant price response to wages, especially in the high-inflation countries and in the low-growth group of countries.

For the USA, however, this causality has become doubtful. Mehra (1989) using cointegrated time series techniques and Granger causality tests found that there was no causality between wage growth and the rate of inflation; but instead found a causality from inflation to wage growth.

Recent massive labor discontentment would tend to discount this source of inflation as not important for Zambia, first because of the weakness of unions and second because of the persistent decline in real wages since the early 1970's accompanied with high inflation. Though no empirical work could be

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3 0.5 expected for the sum of coefficients for M_{t-i} since semi-annual rates of money changes were used.

found on the role of wages in Zambian inflation, Harberger's (1963) empirical work for Chile did not provide significant estimates for both the annual and quarterly versions of the model.

Foreign trade, as a supplier of domestically consumed goods and service has also been singled out as an important determinant of inflation. The increase in the import bill with the resulting trade balance deficit has had effects on the domestic currency and prices. A simple comparison of Zambian export and import prices reveals that import prices have risen more than their export equivalents. Thus the combined effects of balance of payment deficits, higher foreign prices, and successive depreciations might have exacerbated domestic Zambian inflation. In his cost-push model of inflation, Glytsos (1977) included the price of imports as a variable, which turned out positive and significant for the high income sub-group, implying that an increase of one percent in the price of imports increased the general price level by 0.25 percent.

Bruno (1978) found that the level of inflation in OECD countries in the 1972-76 period was significantly influenced by import prices, but the impact effect of import cost changes was not homogeneous of degree one, implying that the full increase in import prices was not translated into increase in domestic prices.

Domestic prices of imports is not only a function of the price level abroad, but also of the domestic exchange rate and trade policies. Effective devaluation by changing either the nominal rate of exchange or by taxation or subsidization results in increases in the domestic prices of imports, which have inflationary effects.

The impact of exchange rates on the domestic price level has been tested in several empirical studies including those by Blejer and Halevi (1970), Behrman (1973), and Diz (1970).

Blejer and Halevi's model specification for their study of the quarterly rate of inflation in Israel is given by the following equation:

$$(4.9)\quad \pi = a_0 + a_1 E_d + a_2 P_m + a_3 \rho_t + a_4 \rho_{t-1} + - - - + \varepsilon$$

where E_d = excess domestic demand in the goods market (demand pull) proxied by the excess flow supply in the money market ($d\dot{M}$-$d\dot{Y}$)

P_m = the rate of change in the price of imports

ρ = the rate of effective devaluation

Their results showed that Pm was not significant, but ρ_{t-1} and ρ_{t-1} were important determinants of inflation in Israel. The sum $\sum_{i=1} \rho_{t-1}$ was highly significant, indicating that effective devaluation resulted in higher domestic prices.

Berhman's model differed from Blejer and Halevi. It included per capita annual rate of money supply change, per capita income, average annual exchange rate and average annual wage rate. Empirical estimation revealed that a one percent change in exchange rate increased domestic prices by 0.26 percent in the current period for Chile. For Argentina, Diz (1970) found that a one percent devaluation resulted in 0.1 percent increase in the wholesale price and about 0.09 percent increase in the cost-of-living in the current period.

Another important determinant of inflation singled out in LDC's is the government expenditures. The lack of markets for government securities and generally the limited tax base and weakness of government structures in collecting taxes have led to deficit-financing via money creation. A Rodriguez (1978) stylized model of devaluation-inflation spiral points to the role government deficits and their monetization play in the inflation - devaluation process under fixed exchange regimes. External balance and price stability

can not be achieved if the deficit is monetized assuming no inflow of foreign capital is forthcoming to finance the deficit. In his model, the price of non-traded goods experiences three distinct phases: (1) a stable period while foreign reserves are falling; (2) a jump at the moment of devaluation when reserves have reached their minimum acceptable level; and (3) a period of positive but decelerating inflation followed by accumulation of reserves.

The inflation - devaluation spiral is fueled by fiscal deficits, in that the change in money expansion is due not only to changes in reserves but also to changes in domestic credit due to central bank financing of the deficit. This cause of inflation has often been mistaken as induced by the devaluation, which is only a symptom. Aghelvi and Khan (1978) have shown that the causality often assumed in inflation models (from government deficits via money supply to prices) does not always hold true in LDC's. Government expenditures adjust faster than revenues to nominal income increases arising from inflation and thus attempts by the government to maintain the real level of expenditures at a given rate of inflation result in increases in the deficit hence in the money supply and thus aggravates inflation. This two-way causality leaves the price level dependent on money supply and the money supply in turn being a function of the level of inflation.

Thornton (1990) found no relation between deficit and inflation for the 16 OECD countries, contrary to what was found for LDC's. Hafer and Hern (1986) captured the effect of U.S. government indebtedness using a measure of the market value of privately held Federal government securities and a par-value measure (which allows direct testing of the effects of government debt on inflation) in a Granger causality framework. The results show that government debt has a positive influence on inflation and inversely inflation led the federal government debt, thus a bi-directional causality between government debt and

inflation. Further analysis, however, did not show that an increase in the growth of the federal deficit would lead to a permanent increase in inflation, the effects of changes in the debt on inflation being statistically non-significant.

4.5.2 Conclusion

Inflation, a symptom of excess demand in the economy, affects the price of agricultural commodities through increases in agricultural input prices. It also affects the real exchange rate and agricultural exports. Its main determinants are money supply, the level of income, the wage rates, price of imports, the exchange rate, and government expenditures.

4.6 Interest Rate and Agricultural Prices

Interest rates affect agriculture through borrowing and presumably the higher the interest rate, the larger the negative impact on agriculture. Higher interest rates will increase the cost of production and thereby reduce farm output.

The interest rate is responsive to demand for and supply of money. Increased money supply increases the availability of loanable funds and thus tends to reduce the interest rate. The monetary approach to exchange rate determination has also emphasized the role played by domestic interest rates in the price of foreign exchange. Higher domestic interest rates induce an inflow of foreign capital, which in turn increases the demand for domestic currency and leads to exchange rate overvaluation, unless other adjustments in the economy take place. This overvaluation has negative impact on agricultural production.

There is thus a strong linkage between interest rates, exchange rates, money, and agricultural prices. With regard to interest rates, the key element

remains, however, the real interest rate or $r = i - \pi$ where r is the real interest rate, i is the nominal interest rate, and π is the inflation rate.

The real interest rate (r) determines the level of borrowing and thus the level of production and as in Chambers (1984) the level of agricultural commodities carried in the future. Chambers shows that an increase in r causes a decrease in agricultural prices due to a greater cost of storing output. Reduction in storage creates excess supply and a reduction in prices, a loss of production and increase in exports due to movement from storage to world markets. In the above framework, increase in interest rate induced by contractionary monetary policy acts primarily on storage costs and agricultural prices.

Hughes and Penson (1985) used COMGEM, a commodity - specific general equilibrium model of the US economy with an agricultural sector, to project the effects of different macroeconomic policies during the 1984 - 1990 period. The analysis included the effects of expansionary fiscal policies and restrictive monetary policies (EFRM), expansionary fiscal and expansionary monetary policies (EFEM), and restrictive fiscal policy and a moderate monetary policy (RFMM). Their results showed that EFRM resulted in higher real interest rates, lower farm incomes and lower farm asset values. EFEM resulted in decline in real interest rates in the short-run but these climbed back to their pre-1984 level due to sizable government demands for funds. The short run effect on the farm economy was positive but harmful in the long-run. Scenario three (RFMM) reduces inflation and interest rates and leads to higher incomes in the farm sector and to rising asset values. Restrictive fiscal and restrictive monetary policies appear to have the largest positive impact on the agricultural sector.

Using a general equilibrium model to analyze the impacts of monetary policy on U.S. agriculture, Devados (1985) following Chambers (1984)

assumed that the interest rate in the agricultural sector feeds into the crop inventory equation. The impact of money supply changes on the interest rate in the farm sector is relayed through the interest rate in the general economy. His results showed that crop inventories are affected negatively by interest rates, among other variables, implying that higher interest rates reduce storage of commodities and thus production, reflecting the opportunity cost of higher interest rates.

Barclay's (1986) specification of the real interest rate included the real exchange rate, gross private investment, federal government budget deficit, supply of high powered money, and net capital outflow. The real interest rate increased by 3.5 percent in the short-run following a one percent deficit in the Federal budget, the long-run impact was 1.1 percent due to increased inflow of foreign capital. Net agricultural exports were affected negatively due to exchange rate appreciation caused by capital inflow. Estimates for net agricultural exports decrease were initially 2.1 billion dollars for a $100 billion deficit. Simulation analysis resulted in lower interest rates once government budget deficits were decreased, lower exchange rates and rising agricultural exports. Increase in domestic credit (increase in money supply) resulted in lower interest rates, increase in inflation and relatively minor changes in exchange rates and agricultural exports.

The above review has highlighted the role money supply and government deficits play in the determination of the real interest rate. The nominal interest rate, in the IS-LM framework, is determined by movements in either the IS curve, the LM curve or both. This implies that the forces that induce shifts in the IS-LM curves determine the nominal interest rate. The government expenditures, the level of investments, saving, and taxes underly the IS curve shifts, while real money supply and demand determine the LM curve.

Feldstein and Eckstein (1970), following the Fisherian tradition of the role of inflation in the determination of the nominal interest rate, includes the real per capita monetary base, the real per capita income, real per capita debt, inflation, interest rate, and a variable reflecting expectations about future rate changes. The above model explained nearly all the variations in the interest rate. An alternative conceptualization by Edwards (1985) links the interest rate to the exchange rate through the rate of devaluation and to the world interest rate.

There is nearly a general consensus that monetary policy plays a determining role in the interest rate formation because it determines to a large extent portfolio decisions. Fiscal variables tend to play important roles in countries where securities and financial markets are less developed and where government outlays constitute an important part of the economic activity. Where government securities are used to finance the deficit, interest rates tend to increase and private spending sensitive to interest rates may be crowded out.

Dewald (1983) found no strong historical association between real interest rates and real deficits in the U.S.A. He estimated that a one percent increase in the real deficit (relative to GNP) would increase real interest rate by one percentage point. He concluded that real rates of interest of 6 percent and higher experienced in 1981 and 1982 were more attributable to higher inflation expectations than normal, to uncertainty about future inflation, and to other credit market related factors. Walsh's (1987) analysis using time series techniques sheds more light to the process and shows that fiscal policy raised the realized real interest rate throughout the 1979-1984 period by nearly one percent. Between 1979 (fourth quarter) and 1982 (third quarter), the effect of fiscal policy was to raise the real interest rate by 1.2 percentage points and by 1.4 percentage points for the period 1981 - 1982 recession. The effect of monetary policy was however, estimated to add 2 percent to the real interest

rate between 1979 (fourth quarter) and 1984 (third quarter). These results were obtained using the purchases by the Federal government as a measure of fiscal policy. When the federal deficit was used as a measure of fiscal policy, neither fiscal nor monetary policy was estimated to have contributed much to the behavior of the real rate of interest during the period.

In summary, the catalytic role played by the interest rate in agricultural production seems to be through increasing production and marketing costs. Money supply and government fiscal policy both affect the real interest rate.

In a semi-open economy, real exchange rate movements will also determine the evolution of domestic real interest rates, since movements in the capital account will depend on the RIR. A decrease in real interest rate will accelerate the outflow of capital, which translates into decreased demand for local currency and in lower interest rates and in higher real exchange rates. The impact of such an increase in real exchange rates is to discourage agricultural production through reduced exports. Thus the real exchange rate (RER) is introduced as a separate regressor.

It is also assumed that the actual real interest rate (RIR) adjusts partially towards its equilibrium level:

$$(5.2) \quad RIR_t - RIR_{t-1} = \alpha (RIR_t^* - RIR_{t-1})$$

Substituting 5.1 into 5.2, the estimating equation is given by equation 5.3 where inflation (ΔP_t) is added to take into account that an increase in the general price level reduces the level of the real interest rate.

$$(5.3) \quad RIR_t = a_0 + a_1 Y_t + a_2 DEF_t + a_3 RER_t + a_4 \Delta P_t + a_5 RIR_{t-1} + \nu_t$$

where $a_1, a_2, a_3 > 0$ and $a_4 < 0$

Y_t = real level of gross domestic product;

DEF_t = deficit, used as a measure of excess government expenditures;

ΔP_t = change in the general price level or inflation, defined as $P_t - P_{t-1}$;

RIR_t = real interest rate defined as R minus inflation where R is the nominal interest rate; and

ν_t = error term.

An increase in the real level of income raises the demand for money and increases the nominal interest rate. At a given level of prices in the economy, this increase is translated into higher real interest rates. Excess government expenditures, if financed by borrowing from the domestic market, will also raise the nominal interest at a given level of money supply. Thus both a_1 and a_2 are expected to be positive. Likewise an inflow of foreign capital induced by an increase in real interest rates will result in increased demand for domestic currency and thus result in an appreciation of the real interest rate. Presumably the same effect could be obtained when the inflow of capital is caused by foreign borrowing to finance excess government expenditures. Thus a_3 is also expected to be positively related to the domestic real interest rate.

5.2 The Real Exchange Rate Equation

The main determinants of the long-run equilibrium real exchange rate have been shown to be the evolution of the terms of trade and trade policy, fiscal policy, and capital controls. Technology, to the extent that it increases domestic supply and income, is also a determinant of the long-run equilibrium exchange rate.

Long-run equilibrium exchange rates diverge from actual real rates due to both monetary and real factors. Thus monetary policy that results in excess money supply and excess government expenditures will affect the short-run real exchange rates. Assuming again that actual real exchange rates adjust to equate their long-run levels, the adjustment mechanism is expressed as in equation 5.4.

$$\ln RER_t - \ln RER_{t-1} = W(\ln RER_t^* - \ln RER_{t-1}) \tag{5.4}$$

where W = the speed of adjustment;

RER_t = the actual real exchange rate; and

RER_t^* = the long-run equilibrium real exchange rate.

Borrowing from Edwards (1989), RER is expressed as;

$$(5.5) \quad \ln RER_t^* = \alpha_1 + \alpha_1 \ln (TOT)_t + \alpha_2 \ln (NT_G)_t + \alpha_3 \ln (BOPCONT)_t + \alpha_4 \ln (EXCONT)_t + \alpha_5 \ln (KACCUM)_t + + \alpha_6 \ln (TECHN)_t + \varepsilon_t$$

where

TOT = terms of trade;

NT_G = government expenditures on non-tradable goods as defined in equation (3.19)

BOPCONT = capital account control;

EXCONT = exchange rate control;

KACCUM = capital accumulation; and

TECHN = technological progress.

In the short-run, however, macroeconomic policies affect the RER_t. An exogenous increase in domestic credit will increase the domestic supply of money and result in an excess demand for non-tradable goods, a rise in the price of non-tradable goods (P_{NT}) and thus an appreciation of the RER_t relative to its long-run equilibrium level. Likewise, excess government expenditures which are concentrated in the non-tradable goods sector will result in a real appreciation of RER_t. Specifically, equation 5.4 could be modified to take into account fiscal and monetary policies and rewritten as equation 5.6:

$$(5.6) \quad \ln RER_t - \ln RER_{t-1} = W(\ln RER_t^* - \ln RER_{t-1}) + \delta_1 (m_t - m_t^*) + \delta_2 (GEXP_t - GEXP_t^*) + h (E_t - E_{t-1})$$

where

$m_t - m_t^*$ = the excess real money supply;

$GEXP_t - GEXP_t^*$ = the level by which actual government expenditures exceed the equilibrium level compatible with the RER_t^*; and

$E_t - E_{t-1}$ = represents the change in the nominal exchange rate.

If $m_t < m_t^*$ and/or $GEXP < GEXP^*$, macroeconomic policies will tend to appreciate the RER_t. On the other hand, if $m_t < m_t^*$ and/or $GEXP < GEXP^*$, the RER_t will tend to depreciate due to a fall in P_{NT}.

Substituting equation 5.4 into 5.6 yields the estimating equation for RER_t:

$$(5.7) \quad \ln RER_t = \beta_0 + \beta_1 \ln(TOT)_t + \beta_2 \ln(NT_G)_t + \beta_3 \ln(BOPCONT)_t + \beta_4 \ln(EXCONT)_t + \beta_5 \ln(KACCUM)_t + \gamma_1 \ln RER_{t-1} + \delta_1 EXMS_t + \delta_2 EXGEXP_t + h_1 DEV_t + \varepsilon_1$$

where $\beta_1, \beta_2, \beta_3, \beta_4, \delta_1, \delta_2, < 0$; $\beta_5, h_1 > 0$ and

EXMS = excess money supply;

EXGEXP = excess government expenditures;

DEV = devaluation defined as changes in nominal official exchange rate $E_t - E_{t-1}$.

Equation 5.7 implies that an export boom that improves the terms of trade will tend to appreciate the RER_t. Exchange rate controls, trade barriers, and capital account controls that insulate the domestic economy from the rest of the world will result in an appreciation of the domestic currency (reduction in the RER). On the other hand, nominal devaluation will move the RER towards its long-run equilibrium and affect the RER positively (increase the RER). An increase in government expenditures concentrated in the non-tradable sector will exert appreciating pressure on the RER, and as a result reduce the profitability of the tradable sector. With regard to agriculture, the reduction in relative prices which will initiate movement away from the sector and lead to low levels of agricultural output and exports caused by the overvaluation.

5.3 The Inflation Model

The monetary effects of an increase in the price of copper have been shown to reinforce the real effects by creating an excess demand for goods and services and thus resulting in inflationary pressures in the economy. This is possible not only through an increase in real income but also through an increase in nominal money supply resulting from increased receipts of foreign exchange. To the extent that copper is not consumed in the domestic economy, the general price level could be thought of as being only a function of non-tradable and other tradable goods. Because the level of tradable prices is a function of the world price and the nominal exchange rate (purchasing power parity equation), movements in the price of non-tradables (P_{NT}) would tend to determine a large proportion of the aggregate price level in the domestic economy.

The inflation equation is obtained from a Harberger type model to which is appended the change in the price of imported goods. This formulation has the advantage of taking into account changes in nominal exchange rate (devaluation) implicitly since it is included in the price of imported goods (expressed in local currency). Inflation is thus specified as a function of changes in the nominal money supply, in the level of real output, and in the price of imports. The price of domestic output will increase if the content of domestic output is made up of a large proportion of imported intermediate inputs such as the case in Zambia. The same holds true for final consumption goods. The price level is thus specified as:

(5.8a) $$P_t = \alpha_0 + \alpha_1 y_t + \alpha_2 NOMS_t + \alpha_3 Pmt + k_t$$

Linearity permits recasting 5.8a in incremental form:

(5.8b) $$\Delta P_t = \alpha_0 + \alpha_1 \Delta y_t + \alpha_2 \Delta NOMS_t + \alpha_3 \Delta Pm_t + k_t$$

where $\alpha_1 < 0$; $\alpha_2, \alpha_3 > 0$; ΔP_t is defined as $P_t - P_{t-1}$; NOMS is nominal money supply; y_t is real income; Pm_t is price of imports; and Δ is the first difference operator.

To the extent that prices of agricultural commodities were set administratively and their average rate of change maintained below the level of inflation, the rise in the general price level could be viewed as an inflation tax on agriculture and thus has negatively affected agriculture relative to other sectors in the economy.

5.4 The Agricultural Price Equation

Equations 3.3 and 3.4 can be expanded to include both the relative prices of tradable goods and copper as expressed in equations 5.9a and 5.9b.

(5.9a) $$NT^d = NT^d \left(\frac{P_T}{P_{NT}}, \frac{Pc}{P_{NT}}, Y\right), \text{ or } NT^d = NT^d (q_T, q_c, Y)$$

(5.9b) $$NT^s = NT^s \left(\frac{P_T}{P_{NT}}, \frac{P_c}{P_{NT}}, W\right), \text{ or } NT^s = NT^s (q_T, q_c, W)$$

where

NT^d = demand for non-tradable goods;

NT^s = supply for non-tradable goods;

$q_T = \frac{P_T}{P_{NT}}$ (price of tradables relative to price of non-tradables);

$q_C = \frac{P_C}{P_{NT}}$ (price of copper relative to price of non-tradables);

Y = income level; and

W = vector of other variables.

At equilibrium, the demand for non-tradable goods is equal to the supply and the excess demand function is equal to zero.

$NT^d = NT^s$ or as expressed in equation 5.10

(5.10) $$NT = NT (q_T, q_C, y) = 0$$

Total differentiation of equation 5.9a and 5.9b while holding Y and W constant yields equations 5.11 and 5.12.

(5.11) $$\frac{dNT^d}{NT^d} = n_T \frac{dq_T}{q_T} + n_c \frac{dq_c}{q_c}$$

$$(5.12) \qquad \frac{dNT^s}{NT^s} = \varepsilon_T \frac{dq_T}{q_T} + \varepsilon_c \frac{dq_c}{q_c}$$

which at equilibrium imply

$$(5.13) \qquad n_T \frac{dq_T}{q_T} + n_c \frac{dq_c}{q_c} = \varepsilon_T \frac{dq_T}{q_T} + \varepsilon_c \frac{dq_c}{q_c}$$

Rearranging, we obtain

$$(5.14) \qquad (n_T - \varepsilon_T) \frac{dq_T}{q_T} + (n_c - \varepsilon_c) \frac{dq_c}{q_c} = 0$$

$$(5.15) \qquad \zeta_T \frac{dq_T}{q_T} + \zeta_c \frac{dq_c}{q_c} = 0$$

where $\zeta_T = n_T - \varepsilon_T$

and $\zeta_c = n_c - \varepsilon_c$

Noting that $q_T = \frac{P_T}{P_{NT}}$ and $q_c = \frac{P_c}{P_{NT}}$ yields

$$\zeta_T \left(\frac{dP_T}{P_T} - \frac{dP_{NT}}{P_{NT}} \right) + \zeta_c \left(\frac{dP_c}{P_c} - \frac{dP_{NT}}{P_{NT}} \right) = 0$$ which reduces to

$$(5.16) \qquad \left(\frac{dP_T}{P_T} - \frac{dP_{NT}}{P_{NT}} \right) = \frac{-\zeta_c}{\zeta_T} \left(\frac{dP_c}{P_c} - \frac{dP_{NT}}{P_{NT}} \right)$$

Equation 5.16 can be converted into the logarithmic expression as in equation 5.17:

$$(5.17) \qquad d \ln \frac{P_T}{P_{NT}} = \gamma \, d \ln \frac{P_c}{P_{NT}}$$

where $\gamma = \frac{-\zeta_c}{\zeta_T}$

Assuming γ is constant and after integrating 5.17 we obtain

$$(5.18) \qquad \ln \frac{P_T}{P_{NT}} = \beta_0 + \beta_1 \ln \frac{P_c}{P_{NT}} + u_t \text{ where } \beta_1 = \gamma$$

and n_T = demand elasticity for non-traded goods with respect to the price of tradables (q_T)

n_c = demand elasticity for non-traded goods with respect to the price of copper (q_C)

ε_t = supply elasticity of non-traded goods with respect to the price of tradables (q_T)

ε_c = supply elasticity of non-traded goods with respect to the price of copper (q_C)

$\zeta_T = n_T - \varepsilon_T$ = elasticity of excess demand of non-traded goods with respect to q_T

$\zeta_c = n_c - \varepsilon_c$ = elasticity of excess demand of non-traded goods with respect to q_c

Equation 5.18 is the basic equation used in the assessment of the impact of copper prices on the price of tradable goods. In the derivation, Y was held constant, which it is not. The distribution and size of government outlays between the different sectors play an equally important role in the formation of domestic relative prices in the various sectors. It was shown in equation 3.21 that an increase in government consumption of non-traded goods will result in an increase in P_{NT}, and in the loss of competitiveness in the tradable sector, including agriculture, and in low growth of agricultural output relative to the non-tradables and copper sectors of the economy.

The estimating equation for the agricultural sector price is thus given by 5.19.

(5.19) $$\ln Pag = d_0 + d_1 \ln Y_t + d_2 \ln q_{ct} + d_3 RIR_t + d_4 GEXPE_t + U_t$$

where $d_1 > 0$; d_2 , d_3 , $d_4 < 0$

and Pag = Price of agriculture relative to price of non-tradable, assuming that all of agriculture is tradable and the other variables are as defined earlier.

The above framework could be used to analyze the effect of copper prices and government expenditures on the different subsectors of agriculture. This, however, will not be undertaken here due to data limitations. The RIRt variable is introduced here to capture the effect of production costs, subsumed in W in equation 5.9b and storage costs as in Chambers (1984).

The price of other tradable goods is, likewise, given by equation 5.20

(5.20) $$\ln q_T = \Omega_0 + \Omega_1 \ln Y_t + \Omega_2 \ln q_{ct} + \Omega_3 RIR_t + \Omega_4 GEXPE_t + Z_t$$

where $\Omega_1 > 0$; $\Omega_2 \gtrless 0$; Ω_3 , $\Omega_4 < 0$

and q_T and q_c remain as defined earlier.

5.5 The Equation for the Price of Non-tradable Goods

From 5.16 we can derive the equation for the price of non-tradable goods as follows:

(5.21) $$\frac{dP_T}{P_T} - \frac{dP_{NT}}{P_{NT}} = \gamma \left(\frac{dP_c}{P_c} - \frac{d\, P\, N\, T}{PNT} \right) \quad \text{or}$$

$$\frac{d\, P_T}{P_T} - \gamma \frac{d\, P_c}{P_c} = \frac{dP_{NT}}{P_{NT}} - \gamma \frac{d\, P_{NT}}{P_{NT}}$$

$$\frac{dP_T}{P_T} - \gamma \frac{d\, P_c}{P_c} = (1 - \gamma) \frac{d\, P_{NT}}{P_{NT}}$$

$$\frac{dP_{NT}}{P_{NT}} = \left(\frac{1}{1 - \gamma}\right)\frac{d\,P_T}{P_T} - \left(\frac{\gamma}{1 - \gamma}\right)\frac{d\,P_c}{P_c}$$

(5.22) $$\frac{d\,P_{NT}}{P_{NT}} = \omega\frac{d\,P_T}{P_T} + \psi\frac{d\,P_c}{P_c}$$

where $\omega = \frac{1}{1-\gamma}$ and $\psi = -\left(\frac{\gamma}{1-\gamma}\right)$

Equation 5.22 yields the differential equation 5.23

(5.23) $$d \ln P_{NT} = \omega\, d \ln P_T + \psi\, d \ln P_c \bullet$$

After integration of 5.23, we obtain

(5.24) $$\ln P_{NT} = \omega \ln P_T + \psi \ln P_c \bullet$$

Adding the income (Y) and government expenditures ($GVEXPE_t$), we obtain the estimating equation 5.25

(5.25) $$\ln P_{NT} = W_0 + W_1 \ln P_{Tt} + W_2 \ln P_{ct} + W_3 \ln Y_t + W_4\, GVEXPE_t + \gamma_t$$

where W_1, W_2, W_3, W_4 are all expected to be positive.

5.6 Summary of the Model

The model described above is consistent with the analytical framework of Chapter III. It includes the following equations:

1. $$RIR_t = a_0 + a_1 Y_t + a_2\, DEF_t + a_3\, RER_t + a_4 \Delta P_t + a_5\, RIR_{t-1} + v_t$$

2. $$\text{Ln } RER_t = \beta_0 + \beta_1 \ln(TOT_t) + \beta_2 \ln(BOPCONT)_t +$$

$$\beta_3 \ln(EXCONT)_t + \beta_4 DEF_t + \beta_5 DEVAL_t + \beta_6 \ln\left(RER_{t-1}\right) + \varepsilon_t$$

3. $\Delta P_t = \alpha_0 + \alpha_1 \Delta y_t + \alpha_2 \Delta NOMS_t + \alpha_3 \Delta Pm_t + k_t$

4. $\text{Ln } PAG = c_0 + c_1 \ln\left(Y_t\right) + c_2 \ln q_{ct} + c_3 RIR_t + c_4 GVEXPE_t + \mu_t$

5. $\text{Ln } P_{NT} = h_0 + h_1 \ln\left(Y_t\right) + h_2 \ln\left(Pc_t\right) + h_3 \text{Ln } PT_t + h_4 GVEXPE_t + \gamma_t$

other definitional equations include

6. $NOMS = D + R$

7. $GVEXP = GR + DEF$

8. $Y = GVEXPE + E_p + (P_cC - M)$

where ν_t, ε_t, k_t, γ_t, and μ_t are error terms

GVEXPE = government expenditures;

E_p = expenditures by the private sector as per equations 3.19 and 3.20;

R = total foreign exchange receipts defined as P_cC (export revenues);

M = imports; and

GR = government revenues.

Other variables are as defined in the text. NT_G and KACCUM were not included in the estimation of equation 2.

The hypothesized linkages are as follows: An increase in the price of copper increases nominal income and government revenues, which results in increased government expenditures. If the increase in government

expenditures leads to a deficit, this deficit is subsequently monetized or covered by borrowing, which in turn leads to increased money supply in the economy (equation 7), to higher real interest rates, to inflation, and to an appreciation of the real exchange rate. The rise in the price of copper combined with increased government expentitures lead to an increase in the price of non-tradable goods, which in turn depress the relative prices of agricultural commodities. The resulting effect is a loss of competitiveness in the agricultural sector and to resources moving out of the sector. Agriculture is negatively affected by increased real interest rate because of the cost of production increase and reduction in storage which further depresses current prices. The real exchange rate appreciation discourages agricultural exports because export receipts converted into local currency do not provide an incentive to continue exports.

In the model, money supply income level is endogenous, nominal money supply is endogenous, and domestic credit and deficit are exogenous.

CHAPTER VI

MODEL ESTIMATION AND RESULTS

6.1 Data Used in the Analysis

Data was collected from various issues of the Monthly Digest of Statistics and the National Account Statistical Bulletin issued by the Government of Zambia. Other national aggregates were obtained from various issues of the IMF Yearbook of Financial Statistics. The price series used are all implicit prices obtained by dividing current values by their real values expressed in 1985 Kwacha. All the real variables are 1985 base year.

Information on parallel exchange rates were obtained from Pick's Currency Yearbooks and for most recent information from the World Bank's "African Economic Indicators."

The real exchange rate (RER) is computed as the bilateral real exchange rate (E) between the Kwacha and the U.S. dollar deflated according to the formula $RER_t = E \cdot \frac{WPI^{US}}{CPI^{Z}}$ where WPI is the U.S. producer price index and CPI^{Z} is the Zambian consumer price index. This formulation has been extensively used in recent years. An index was derived with 1985 as the base. An increase in the index is indicative of a depreciation of the Zambian currency relative to the U.S. dollar, while a decrease constitutes a relative appreciation. With this index, the Zambian Kwacha has been overvalued throughout the 1970's and 1980's.

The price of tradables is the implicit price of manufacturing, while the price of non-tradables was obtained by excluding the mining, the agricultural and the manufacturing sectors from the National Accounts in the computation of the GDP deflator. The price of copper is proxied by the implicit price of mining. Copper represents more than 90 percent of value added in the mining sector. The analysis was carried out with annual data from 1965 to 1989.

6.2 Empirical Results

The model presented in Chapter V above contains some non-linear variables, but it is linear in all the parameters. The model is recursive and each equation was estimated separately using ordinary least squares (OLS). The use of OLS is contingent upon the asumption that

$$\text{cov}(v_t, k_t) = \text{cov}(v_t, \varepsilon_t) = \text{cov}(v_t, u_t) = \text{cov}(v_t, \gamma_t) =$$
$$\text{cov}(k_t, \varepsilon_t) = \text{cov}(k_t, u_t) = \text{cov}(k_t, \gamma_t) = \text{cov}(\varepsilon_t, u_t) =$$
$$\text{cov}(u_t, \gamma_t) = 0$$

The results of the estimation are given below.

6.2.1 The Real Interest Rate

Table (XV) summarizes the results for the real interest rate. The results show that the RIR is significantly related to the deficit level, to the real exchange rate, to inflation, and to its own lagged value (equation 1.2). An increase in the deficit will increase the demand for money and thus raise the real interest rate. An increase of one million Kwacha government deficit will result in an increase of nearly 0.002 percent in the real interest rate. The real exchange rate also contributes in the rise of the RIR. A 10 percent increase in RER will increase the

TABLE XV

PARAMETER ESTIMATES FOR THE REAL INTEREST RATE EQUATION (RIR)

Variable/ Statistic	Brief Description	Equation 1.1	Equation 1.2 (CO)
constant		-12.9460 (-2.382)	5.2620* (5.016)
Y_t	real income	0.20380 (2.502)	-0.06323 (-0.7766)
DEF_t	deficit	0.00474 (3.850)	0.00239* (3.413)
RER_t	real exchange rate	0.07582 (3.198)	0.08365* (5.032)
ΔP_t	inflation	-0.9565 (-35.30)	-0.9525* (-69.58)
RIR_{t-1}	real interest rate lagged	0.2067 (1.658)	-0.17891* (2.802)
$\bar{R}^2$		0.997	0.998
D.H.		2.344	-0.5626
F		13900	

NOTE: Numbers in parentheses are t-statistics, CO is Cochrane Orcutt procedure for autocorrelation. DH is the Durban H statistic; $\bar{R}^2$ is the adjusted coefficient of determination, F is the F statistic. The * stands for significance at the $\alpha = 0.05$ probability level.

real interest rate by 0.8 percent. This effect is through increased deficit in the capital account. Inflation reduces the real interest rate almost proportionately to the rise in the general price level. The real income variable is not significant at the conventional levels.

The significant Durban H suggests that equation 1.1 of Table (XV) has a problem of autocorrelation. It was reestimated after transformation of variables by the Cochran-Orcutt method. The results are those reported above and are given by equation 1.2 in the table.

The implications for agriculture are twofold:

(1) higher deficits will increase the real interest rate and increase the cost of production while at the same time contribute to depressed prices by discouraging storage (see Chambers, 1984).

(2) over-appreciation of the real exchange rate will reduce capital inflow, create a deficit in the capital account and result in higher real interest rates, which not only discourages production of agricultural commodities but also decreases their competitiveness in international markets, resulting in lower agricultural exports.

6.2.2 The Real Exchange Rate

Table (XVI) summarizes the estimated parameters for the real exchange rate of the Zambian Currency vis-a-vis the U.S. Dollar.

TABLE XVI

PARAMETER ESTIMATES FOR THE REAL EXCHANGE RATE EQUATION (LnRER)

Variable Statistic	Brief Description	Parameter Estimate	t Statistics
Intercept		0.6713	2.051*
Ln TOT	terms of trade	-0.0289	-1.243
Ln BOPCONT	balance of payments control	-0.02932	-2.333*
Ln EXCONT	exchange rate control	-0.15705	-4.846*
DEF	deficit	-0.00032	-1.087
DEVAL	devaluation	0.00429	11.73*
Ln RERt-1	real exchange rate lagged	0.89506	10.51*
$\bar{R}^2$		0.9725	
DH		0.8633	
F		136.47	

The results show that an improvement in the terms of trade (TOT) will tend to appreciate the Zambian currency with regard to the dollar. The parameter estimate is negative but it is not significant at the conventional levels.

Increases in balance of payment restrictions such an restrictions on imports and exports and free movement of capital will also appreciate the local currency. As a measure of balance of payments control (BOPCONT), the differential between the London real interest rate and the domestic real interest rate was used as a proxy. An increase in the domestic real interest will attract

an inflow of capital from abroad and contribute to the alleviation of capital account imbalance. A decrease of one percent in the interest rate differential will appreciate the real exchange rate by 0.029 percent. The implications of such an appreciation for agriculture are that it increased the cost of exporting agricultural goods and could explain their virtual elimination in the last 15 years.

Exchange rate control (EXCONT) increased the relative value of the domestic currency vis-a-vis other currencies. An increase of one percent in the exchange rate control variable will appreciate the exchange rate by 0.157 percent. In measuring the exchange rate control, the ratio of the parallel to the official exchange rate was used as a proxy. An increase in exchange rate control through several administrative schemes has often resulted in a increase in the parallel exchange rate. This measure is significant at the five percent probability level.

Deficit is used here as a measure of excess government expenditures. An increase in government expenditures increases the price of non-tradables in the domestic economy and results in an overvaluation of the exchange rate. An increase in the real exchange rate discourages production of tradable goods including agricultural goods and increases imports. The estimated parameter implies that government excess expenditures of one million Kwacha appreciates the real exchange rate by 0.00032 percent. The estimate is, however, not significant at the conventional level of 5 percent probability.

Devaluation (DEVAL) is highly significant and positive, implying that nominal devaluation has attempted to restore the real exchange rate towards its long-run equilibrium level. A one percent devaluation depreciates the real exchange rate by 0.0043 percent, and not by the full magnitude of the devaluation. This suggests that a devaluation alone will not restore the equilibrium value of the real exchange unless other measures are taken

simulaneously with the devaluation such as easing capital account barriers, alleviating government control of the exchange rate, and/or reducing government expenditures. The consequences are a reduction in domestic relative prices and loss of agricultural exports due to zero or low profitability.

6.2.3 Inflation

As discussed in Chapter III, the effects of an increase in the price of copper are translated into increased demand for goods and services through the increased supply of money generated by the boom.

Due to the lag between the time the export takes place and the financial transactions that follow, the lagged change in money supply variable was introduced in the model in equation 3.2 to capture this effect. The fit of the equation was improved (the residual variance was reduced). Table (XVII) summarizes the results for both equations.

Inflation seems to be primarily a function of changes in nominal money supply and import prices. This is consistent with economic theory. Changes in real variables (income) are not significant. This would tend to suggest that increases in export prices (copper prices) to the extent that these increases are translated into money creation will tend to be inflationary. Thus, increases in prices of copper affect not only the real variables in the economy but monetary variables as well, consistant with the theory of Chapter III. The coefficients of ΔNOMS together (equation 3.2) suggest that an increase of 1 percent in the nominal money supply will increase the rate of inflation by approximately 0.7 percent, much less than the equiproportional increase suggested by Harberger (1963) in his study of Argentina. This would tend to support the contention that increase in money supply would affect other variables such as the real

TABLE XVII

PARAMETER ESTIMATES FOR THE
INFLATION EQUATION (ΔP)

Variable/ Statistic	Brief Description	Equation 3.1	Equation 3.2
Constant		-2.6924 (-0.3047)	-11.241 (-1.345)
Δ $NOMS_t$	change in nominal money supply	0.25025 (0.8835)	0.04698 (0.1814)
Δ $NOMS_{t-1}$	change in nominal money supply lagged	---	0.6823* (2.677)
Δ Y_t	change in real income	1.5239 (0.9737)	1.1337 (0.8239)
Δ Pm_t	change in import prices	0.9052* (12.81)	0.8640* (13.56)
$\bar{R}^2$		0.911	0.932
DW		1.715	1.909
F		79.86	80.15

t-values are in parentheses.

exchange rate and the real interest rate and result in balance of payment difficulties.

Prices of imports constitute another important element in the inflationary process. To the extent that these prices are affected by the nominal exchange

rate, devaluation will contribute to increased pressures on the general price level. Thus, though devaluation seems to be a good prescription in the movement of real exchange rates towards their equilibrium level, devaluation should be only a part of an overall program of adjustment tending towards restoring imbalance brought about by the increased export prices and increased government expenditures. The latter tend to aggravate inflation, which in turn might lead to increased government expenditures, to monetization of the deficit, and to further inflation.

The estimated coefficient for the change in price of imports is 0.8640, implying that a 10 percent rise in import prices will be reflected by 8.6 percent rise in inflation. Thus, though the increase is borne by final consumption, nearly 15 percent of the increase goes toward reduction in profits.

In Zambia, particularly, the rise in the general price level has negatively affected agriculture. Prices of imports, a large intermediate input in production, have been shielded by government subsidies, and combined with administratively fixed prices of output, this has distorted real prices received by agricultural producers.

6.2.4 Relative Agricultural Prices

The relative price of agricultural commodities was shown to be a function of real income, of the price of copper relative to non-tradable prices, cost of production, and government expenditures. Table (XVIII) summarizes the estimated parameters.

Equation (4.1) includes all variables in the current and lagged format. Only current government expenditures and lagged q_c were significant (equation 4.1). Equation (4.2) reveals that RIR_t, q_{ct} and current government expenditures

TABLE XVIII

PARAMETER ESTIMATES FOR THE AGRICULTURE PRICES EQUATION (LnPAG)

Variable/ Statistic	Brief Description	Equation 4.1	Equation 4.2	Equation 4.3
Constant		4.4291*	6.1164*	3.8777
		(2.49)	(5.759)	(1.06)
LnY_t	real income	-0.47637	-0.3321	----
		(-0.9081)	(-1.314)	
LnY_{t-1}	real income lagged	0.5602	----	0.21708
		(1.117)		(0.8442)
Ln q_{ct}	price of copper relative to non-tradable prices	-0.00235	-0.14098*	----
		(-0.0349)	(-2.639)	
Ln q_{ct-1}	price of copper relative to non-tradable prices lagged	-0.12427*	----	-0.12849*
		(-2.418)		(-2.852)
RIR_t	real interest rate	-0.00063	-0.00090*	----
		(-.00009)	(-2.233)	
RIR_{t-1}	real interest rate lagged	-0.00518	----	-0.00725*
		(-0.3406)		(-2.966)
$GVEXPE_t$	government expenditures	0.000069**	-0.00027*	-0.000063*
		(1.987)	(-2.254)	(-3.184)
$GVEXPE_{t-1}$	government expenditures lagged	0.000012	- - -	- - -
		(0.1337)		
$\bar{R}^2$		0.4153	0.2231	0.4716
DW		1.78	2.063	1.99
F		3.042	2.651	6.131

t - values in parentheses.

* significant at $\alpha = 0.01$

** significant at $\alpha = 0.05$

are the most significant variables. The best fit however, was obtained with lagged real interest rate, lagged price of copper, and current government expenditures (equation 4.3).

Equation 4.3 of Table (XVIII) shows that all the coefficients are highly significant except for the real income variable. An increase in the relative price of copper will negatively affect the relative price of agricultural commodities. An increase in the relative price of copper (q_c) of 10 percent in the current period will reduce prices in agriculture (PAG) by nearly 1.3 percent in the next period.

Likewise an increase in real interest rate of 10 percent will increase the cost of producing agricultural goods and result in a decrease in PAG by 0.07 percent. A government expenditure increase of 100 million Kwacha results in a decrease of 0.06 percent in the relative price of agriculture. These results conform strongly with theoretical expectations and complement results obtained with the real interest rate equation and the real exchange rate model.

It is thus apparent that excessive government expenditures result not only in increased demand for cash balances, which raises the real interest rate and appreciates the domestic currency, but also directly affect agricultural relative prices negatively. These two effects, direct and indirect, on the price level of agricultural commodities create a disincentive to produce agricultural goods by improving the real terms of trade (real exchange) in favor of the non-tradable sector.

The improvement in the terms of trade brought about by the rise in the price of copper is felt in the agricultural sector not during the current period but with a one year lag. The implications of such a result is that increased export receipts must be managed efficiently in order to prevent the dutch disease effect on the tradable sector. This would, among other things, imply sterlizing copper receipts, reduction in government expenditures in times of increased export

revenues, maintaining an equilibrium real exchange rate, and holding money supply at a level compatible with the real level of economic activity. The findings underscore the apparent decline of agriculture, especially in the 1970's and mid 1980's and the concommitant rise in food imports, not withstanding the damaging effect that climatic conditions had, in some years, on food production. They also highlight the rise of the non-tradable sector in the economy at the expense of manufacturing and agriculture. In the 1980's, the service sector contributed on average 35 percent to GNP, as compared to its smaller share in national income in the mid 1960's.

6.2.5 The Price of Non-Tradable Goods

The purpose of this equation is to show the opposite effect that a stimuli has on the price of non-tradable goods relative to the price of agriculture and other tradables. Table (XIX) summarizes the results of the estimation.

Several versions of the equations yielded consistant results for the estimates of the parameters for the price of copper, the price of other tradables and of government expenditures. Four equations are presented in Table (XIX). The estimated parameters have the correct signs and are highly significant except for the real income variable. Equation 5.4 was, however, preferred because the fit ($\bar{R}^2$) was identical to all other equations but it contained fewer parameters and a smaller residual variance (higher F statistic).

The price of non-tradable goods is thus a function of price of copper, price of other tradable goods, and government expenditures, increasing linearly with an increase in any variable. An increase in the price of copper by 10 percent results in an increase of 0.75 percent in the price of non-tradable goods. An increase of 10 percent in the price of other tradable goods

TABLE XIX

PARAMETER ESTIMATES FOR THE PRICE OF NON-TRADABLE GOODS EQUATION (P_{NT})

Variable/ Statistic	Brief Description	Equation 5.1	Equation 5.2	Equation 5.3	Equation 5.4
Constant		1.0294	0.9399**	0.4254	0.4705
		(1.827)	(13.90)	(1.165)	(1.288)
Ln Y_t	real income	0.17982	----	0.11637	0.11728
		(1.809)***	----	(1.313)	(1.315)
Ln Y_{t-1}	real income lagged	-0.2332	----	----	----
		(-1.705)			
Ln Pc_t	price of Copper	0.06295**	0.06976**	0.06817**	0.07532**
		(2.721)	(3.637)	(3.428)	(3.978)
Ln Pc_{t-1}	price of copper lagged	0.03168	----	0.02262	----
		(1.470)		(1.110)	
Ln PT_t	price of other tradables	0.7235**	0.68633**	0.69922**	0.6996**
		(10.06)	(8.975)	(41.92)	(41.70)
Ln PT_{t-1}	price of other tradables lagged	0.0089	0.02803	----	----
		(0.1112)	(0.3568)		
$GVEXPE_t$	government expenditures	----	0.00026**	0.00025**	0.00028**
			(3.371)	(3.149)	(3.830)
$GVEXPE_{t-1}$	government expenditures lagged	(0.00002)	----	----	----
		(1.53)			
$\bar{R}2$		0.9992	0.9992	0.9992	0.9992
DW		2.03	1.86	1.66	1.71
F		4055.8	6778.13	5949.4	7346.6

t - values in parentheses.

** significant at $\alpha = 0.01$

*** significant at $\alpha = 0.1$

(manufacturing) results in an increase of 7 percent in the price of non-tradables. A government expenditure increase of 10 billion Kwacha increases the log of the price of non-tradable goods by 0.28 percent, and in view of recent levels of government deficits, such an impact could easily reach more than 2 percent of the price level in the non-tradable sector.

It would be enlightening to elicit the impact different types of government expenditures have on the level of prices. Government expenditures include capital investment, expenditures destined towards final consumption, and expenditures in the tradable and non-tradable sector. But such a division of expenditures is not available. Such a classification would show the differential effects government expenditures have on relative prices in the economy. Nonetheless, a large proportion of government expenditures is concentrated in the non-tradable sector and increases prices in that sector. This differential impact of government expenditures can be ascertained by comparing the price of agricultural commodities equation to its non-tradable counterpart.

The coefficient of Government expenditures in equation 4.3 of Table (XVIII) is negative and much greater in absolute size than the coefficient in equation 5.4 of Table (XIX), implying that government expenditures reduce the relative price of agricultural commodities by a larger proportion than it increases the price of non-tradables. Thus, the impact on agriculture is much greater. Moreover, the impact of an increase in copper prices raises the price of non-tradables in the current year, but reduces agricultural prices in the coming year. The implication is that agricultural relative prices are affected twice, in the current year by relative increases in the price of non-tradables, and in the following year by the delayed effect. Thus, in a period of two successive export booms, agricultural relative prices will be affected in the year of the boom due to the immediate increase in P_{NT}, in the following year due to further increases in

P_{NT} and to lagged effect of Pc on PAG, and in the third year due to lagged effect from the second year boom.

6.3 Conclusion

There has been a negative impact of copper prices on the relative prices of agricultural commodities in Zambia. An increase in the price of copper has resulted in a decrease in the prices of agriculture while at the same time increasing the prices of non-tradable goods. This together with government macroeconomic and agricultural policies have contributed to the loss of competitiveness in the agricultural sector, and presumably to the decline of agriculture's contribution of GDP. There has also been an important inflationary result brought about by increases in money supply either caused by domestic credit expansion or by increases in foreign receipts.

The estimated model compares well with the estimates of Mugerwa (1990) who found that copper prices (lagged) reduced the log of the price of tradable goods by 0.22, while current prices reduced them by 0.09. His analysis also showed that increases in prices of tradable goods tended to increase prices of non-tradable goods. His model specification was, however, different from the model used in the present analysis and included monetary policy variables in the price equation.

Garcia and Montes Llamas (1988) also found that government deficit reduced the relative price of agricultural commodities by 0.7585 in Columbia. The resource boom originated in this case from increased receipts of an agricultural export (coffee). Coffee price increases resulted in an increase of 0.1952 in the price of non-tradable goods (log).

The above two studies used different model specifications and the estimates cannot be compared. What is clear, however, is that export booms have had negative effects on the tradable sector, while the non-tradable sector has flourished along side with the booming sector. Such has also been the case of oil price increases in Nigeria, with a boom in the construction and service sector and a shrinkage in the agricultural sector (Oyejide, 1986).

7.3 Policy Experiments

Simulation 1. Impact of a Reduction in Government Expenditures on the Real Interest Rate.

Starting with 1985, the nominal interest rate has lagged behind the rate of inflation by a widening margin each year. For 1990 and 1991, the rates of inflation relative to the preceding year were respectively 880.9 and 1550.4 percent while the average rates of interest on loans were 35.1 and 43.0 percent, resulting in real interest rates of -845.2 and -1495.8 percent, respectively.

The experiment involved reducing government expenditures (deficit) by 25 percent in 1992, 50 percent in 1993, and 75 percent in 1994 until a balanced budget is obtained in 1995. Table (XX) gives the results of the baseline projections and of the simulation. The deficit is obtained as a residual between projected government revenues and government expenditures. Between 1985 - 1990, the deficit increased 65.4 percent on average every year and projected deficit for 1995 was K 56,447.9 million, assuming that the conditions of 1985 - 1990 continued to persist. This would seem to be unacceptable to society, in view of the economic disruption it would entail. Moreover, nominal interest rates are government administered and this might explain the domineering role government has taken in financial market operations and the virtual lack of credit by banks to the private sector.

Table (XX) shows that reduction in government expenditures would decrease real interest rates by 0.12 percent in 1992 and on average 0.14 percent every year subsequently. The change in real interest is very small, but it however brings to light that fiscal policy alone is inadequate in correcting the problem of interest rates, insofar as monetary policy affects both the level of the

TABLE XX

IMPACT OF A REDUCTION IN GOVERNMENT EXPENDITURES ON THE REAL INTEREST RATE

Year	Projected Government Deficit (million K)	Real Interest Rate Projection		
		Baseline (Percent)	Simulation (Percent)	Difference (Percent)
1991	7542.3	-2548.57	--	--
1992	12475.0	-6165.58	-6173.04	0.12
1993	20633.7	-15860.11	-15884.76	0.15
1994	34128.1	-41924.21	-41984.54	0.14
1995	56447.9	-105201.27	-105336.18	0.13

real exchange rate, and the level of inflation in the economy. Inflation overwhelms the level of interest rate. In 1995, the government has a balanced budget, but the results of the simulation shows very little impact on the real interest rate. This underscores the partial conclusion of Chapter VI in that economic management should be aimed at coordinating all policy instruments and affect changes simultaneously to arrive at a satisfying solution.

It also brings to light the inefficiency of government controlled financial markets, and the inability of interest rates to adjust to changing opportunities. A cursive analysis of domestic credit in recent years shows that the share of government in domestic credit has increased and a lack of investment by the private sector.

Simulation 2. Impact of Reduction in Government Expenditures on the Relative Price of Agricultural Commodities.

In the projections, World Bank price projections for copper were used. The foreign exchange price was converted into local currency by multiplying by the forecasted exchange rate. Prices of non-tradable goods were assumed to increase by 254.7 percent annually, the rate corresponding to the period 1985 - 1990. Table XXI gives the results of the simulation experiment.

TABLE (XXI)

IMPACT OF A REDUCTION IN GOVERNMENT EXPENDITURES ON THE RELATIVE PRICE OF AGRICULTURAL COMMODITIES

Year	Projected Government Expenditures (million K)	Relative Prices of Agriculture Projections		
		Baseline (Ln PAG)	Simulation (Ln PAG)	Difference (Percent)
1991	20,018.9	10.7190	--	--
1992	28,560.9	14.9860	15.1249	0.93
1993	40,747.9	25.1729	25.8227	2.58
1994	58,135.0	46.1654	47.7778	3.49
1995	82,941.2	89.1075	92.6451	3.97

Reduction in government deficit of 25 percent in 1992, 50 percent in 1993, 75 percent in 1994, and 100 percent in 1995 result in an increase in the

relative price of agricultural commodities, but the impact is much smaller than the reduction in government expenditures. A reduction of 25 percent in government deficit in 1992 induces a 1 percent increase in agricultural prices. In 1995, when the fiscal gap is nil the impact is 4 percent.

The implications of such a policy are an improvement in agricultural prices relative to the non-tradable sector prices. This suggests that prices of agricultural goods have been held down by excessive government deficits.

Simulation 3. Impact of a Reduction in Government Expenditures on the Price of Non-Tradables.

Prices of non-tradable goods decrease following a decrease in government expenditures. A 25 percent reduction in government deficit results in a fall of the price of non-tradables by 1.6 percent in 1992 while a balanced budget in 1995 yields a fall of 12 percent. The lower government deficit decreases demand for non-tradable goods and reduces profitability in the sector. The decrease in prices are much larger than those of agricultural commodities, implying a relative improvement in agricultural sector profitability. The implications of such fiscal readjustment is that resources currently in the non-tradable sector would be drawn towards the tradable sector, and agriculture specifically. Such a policy could be used, along with other incentives, to encourage investment in agriculture. Table (XXII) gives the impact of reduced fiscal deficit on the price of non-tradable goods.

TABLE (XXII)

IMPACT OF REDUCTION IN GOVERNMENT EXPENDITURES ON THE PRICE OF NON-TRADABLE GOODS

Year	Policy Reduced Government Expenditures (million K)	Projection of Non-Tradable Goods Price		
		Baseline (Ln PNT)	Simulation (Ln PNT)	Difference (Percent)
1991	--	--	--	--
1992	25442.15	9.6558	9.5055	-1.56
1993	30431.05	11.0520	10.6992	-3.19
1994	32538.48	12.5423	11.7626	-6.22
1995	26593.30	14.2450	12.6012	-11.54

Simulation 4. Impact of Reduction in Money Supply on the General Price Level.

Money supply is here defined as the sum of domestic credit and foreign assets. Between 1985 and 1990, money supply grew at an average rate of 33 percent per annum while domestic credit growth was 57.25 percent on average. Using the rate of growth of money supply, the level of prices was estimated to grow by 267.2 percent annually (on average) between 1992 and 1995. This result is given in Table (XXIII) as the base prediction.

The policy simulation consisted of reducing the rate of growth of domestic credit by the same proportion as the rate of growth in government deficit, with

the implicit assumption that reduction in government deficits would result in reduction in the demand for cash balances of the same proportions.

For 1995, when the deficit is assumed to be nil, the projected value of domestic credit was reduced by the amount of the projected deficit utilized in the base projection. This allowed us to obtain the value of domestic credit used in the experiment. This equiproportional relationship between government deficit and demand for domestic credit might not hold in the real world, but it was a convenience used here.

TABLE (XXIII)

IMPACT OF A REDUCTION IN MONEY SUPPLY
ON THE GENERAL PRICE LEVEL

Year	Projected NOMS (million K)	Projection of the General Price Level		
		Baseline (Percent)	Simulation (Percent)	Difference (Percent)
1992	60,310	267.22	265.19	-0.76
1993	94,837	267.22	251.40	-5.92
1994	149,132	267.22	254.55	-4.74
1995	234,510	267.22	258.94	-3.10

Reduction in the rate of growth of money supply results in a reduction in inflation ranging from -0.76 to 6 percent. Reduction in the rate of growth in money supply will also affect the nominal and real exchange rates, and the real interest rate. This readjustment will eventually result in lower import prices and

thus reduce the level of inflation further than what is implied by the simulation forecasts. The simulation is made holding other variables constant and thus assesses the direct impact of a reduction in the rate of growth of money supply alone.

For 1992, a reduction in domestic credit of 25 percent results in a decrease of 0.76 percent in inflation. The equation for the inflation model shows that the coefficient of $\Delta NOMS_{t-1}$ is much larger than the contemporaneous coefficient, implying that the effect of such a reduction will be much larger the following time period. This is obtained in 1993 with a 5.92 percent reduction in the general price level. For 1994 and 1995, money supply grows much more than in 1993 due to increases in foreign assets resulting from increased exports receipts and inflation is subsequently reduced by a smaller margin following reduction in domestic credit.

The implications of such a result are the following:

(1) an increase in money supply resulting from an increase in domestic credit creation originating from an increase in government expenditures will result in inflationary pressures and affect economic activity; and

(2) similarly, an increase in money supply resulting from an increase in foreign exchange receipts will result in inflationary pressures. This tends to confirm that export receipts translated into domestic money supply will have monetary and real effects insofar as they affect the general price level and the relative prices of agricultural and other tradables goods.

7.4. Conclusion

Results of the simulation show that both fiscal and monetary policies have had strong negative impacts on the real interest rate, the level of agricultural prices, and strong positive effects on the level of inflation. A reduction in fiscal deficits will tend to improve the relative price of agricultural commodities by reducing the demand for non-tradable goods, while a reduction in money supply with reduce inflation. The magnitude of the results obtained should however be viewed in a "ceteris paribus" framework realizing that other variables were held constant in their projection.

CHAPTER VIII

CONCLUSIONS AND LIMITATIONS

Zambia is in the process of redefining its economic strategy in the framework of the Structural Adjustment Program currently underway. The sectoral policy approach that has been used until recently isolated the agricultural sector from the rest of the economy, oblivious of the intersectoral flows and the effects of final demand of goods in other sectors on agricultural output and prices.

The study's main objective was to find linkages between agricultural relative prices, macroeconomic policies, and copper prices, and to implicitly show that the development of copper mining had indirectly undermined agricultural development. To this effect an econometric model was estimated that included equations for the real interest rate, the real exchange rate, inflation, prices of agricultural commodities, and prices of non-tradable goods.

The second objective was to simulate the impact of alternative fiscal and monetary policies, respectively, on the real interest rate, the price of agricultural goods, the price of non-tradables, and inflation.

The first hypothesis proposed that high copper prices of the late 1960's and early 1970's with the resulting increase in government revenues and expenditures contributed to the decrease of relative prices of agricultural commodities. The estimated equation for the relative price of agricultural commodities upholds this hypothesis and the parameter estimate for the relative

price of copper and the government fiscal variable was negative. This indicates that an increase in government budget deficit and in copper prices affected the price of agricultural commodities negatively. The simulation experiment reduced the fiscal deficit by 25 percent, 50 percent, 75 percent, and a balanced budget, respectively, in 1992, 1993, 1994 and 1995. The results showed that relative prices of agricultural commodities increased with a decrease in government budget deficit.

The second hypothesis advanced that fiscal expansion would result in an increase in relative price of non-tradable goods and further depress the price of agriculture. This price compression reduced incentives to produce agricultural goods. This hypothesis is also maintained in that increased government expenditures resulted in higher non-tradable goods prices. With regard to agriculture, the increase in the price of non-tradables constituted a loss of competitiveness. This effect can be seen in official statistics. The increase in the non-tradable sector has been obtained at the expense of the agricultural sector, where there has been less direct government investment. The other tradables sector (manufacturing) has managed relatively well with direct government intervention and investments.

The results of the simulation experiments show that a reduction in government expenditures will reduce prices of non-tradable goods, due to decreased demand.

The third hypothesis stated that high copper prices resulted in increased demand for non-tradable goods and hence bid their price up. This is obtained in the non-tradable price equation with a positive parameter estimate for the price of copper. The implications of such a positive relationship are that increases in income and government receipts exert an appreciating effect on the prices of non-tradable goods. A policy implication would be to devise a

mechanism that would lead to copper receipts being invested in sectors such as agriculture to increase production instead of increasing demand for non-tradable goods.

The fourth hypothesis proposed that an increase in the price of copper and increased fiscal deficit resulted in an appreciation of the real exchange rate, and thus negatively affected agriculture and exports of other tradable goods. The estimated exchange rate equation has a negative parameter estimate for the terms of trade variable. The improvement in terms of trade are brought about by an improvement in the price of copper because Zambia is essentially a one commodity export country with copper revenues representing more than 90 percent of export receipts. Likewise, the fiscal variable has a negative sign implying that an increase in the fiscal gap will result in an overvaluation of the Zambian Kwacha relative to the U.S. dollar. The overvalued exchange rate reduces exports and renders domestic prices of agricultural and other tradable goods more expensive relative to world prices.

With regard to the impact of fiscal policy on the real interest rate, hypothesis five stated that the increased deficit resulted in higher real interest rates. Higher real interests increase the cost of production and discourage storage of goods. Indeed, the increased demand of cash balances induced by government deficits resulted in an increase in the real interest rate. But in view of already negative interest rates, and the larger share of domestic credit used to finance the fiscal imbalance, the problem becomes more than that of availability of credit to farmers rather than that of real interest rates. If the financial market oppression theory is followed, one would conclude that control of nominal interest rates has limited farmers access to credit and the negative interest rates have increased the reluctance of private financial institutions to make loans available.

Simulation of reduced government deficits resulted in an increase in the level of real interest rates relative to the baseline projections.

The sixth hypothesis advanced that increases in money supply had resulted in inflation. This hypothesis is confirmed. The effect of money supply is felt with a lag of one year. The assumed linkage was that an increase in the price of copper increased foreign exchange receipts. If the latter were translated into domestic money supply, increases in price of copper could thus lead to inflationary pressures in the economy. Similar to the effect of the price of copper on agricultural goods, money supply impacts inflation with a lag. The conclusion drawn from the inflation equation is that foreign assets resulting from an export boom should be managed in a manner that does not exasperate the money supply substantially. Likewise, domestic money creation should attempt to balance the need for growth and the government need for cash balances.

The policy experiments reduced money supply from 1992 to 1995 and resulted in lower levels of inflation.

It is evident that copper prices have exerted a significant influence in the macroeconomy of Zambia. The economic boom of the late 1960's and early 1970's corresponded with the rise in the price of copper. The decline of the mid 1970's was also associated with the fall in the price of copper in 1975. These two events bring to light the interlinkage between the copper sector and the macroeconomy. There has been an effort to address the imbalances between the different sectors of the economy since the late 1980's. These efforts have yet to bear fruit. Macroeconomic problems have been the target of the structural adjustment program Zambia has embarked upon and policies that led to lower agricultural prices have been partially corrected in the last few years.

The main objective should remain that of getting the fiscal and monetary policies right. Zambia's agricultural sector has seen some recent fundamental

changes as attested to by the remarkable increase in its contribution to GDP in 1989 and 1990. Has it been a question of prices? One is inclined to respond affirmatively. A look at implicit prices shows that agricultural prices have increased by very large margins relative to prices of non-tradables and of other tradable goods both in 1989 and 1990. This probably explains the sudden change in output in those years. It is too early, however, to gauge the impacts of such recent policy changes.

Methodological Refinements and Limitations

The study has been undertaken at broad agricultural levels due to lack of disaggregated data. Such level of aggregation masks the differential impact of macroeconomic policies and of the price of copper on the different subsectors of agriculture. It would be instructive to assess the impact of such policies on the price of agricultural exports, on agricultural domestic consumption commodities, on agricultural non-tradables, and agricultural importables.

Moreover, annual data was used. With such large price variations in recent years, intra-year variations were lost in the averaging necessary to obtain annual data. It was, however, difficult to find quarterly price information and macroeconomic data.

The study does not explicitly take into account policy decisions implemented in recent years in forecasting the future and assumes that conditions prevailing during the 1985 - 1990 would continue to prevail in the 1990-1995 period. This is rather a strong presumption in view of the size of the economic malaise in Zambia and efforts made during the last two years to redress the situation.

The partial equilibrium approach used in the study concentrates exclusively on price effects and ignores the resource movement effects that an increase in the price of copper entails. This could be analyzed in an open economy general equilibrium model that has the advantage of taking into account not only the commodity market but the labor and capital markets as well. The differential impact of exogenous copper prices on the different sectors of the economy could then be analyzed and the different equilibrium prices determined endogenously.

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APPENDICES

APPENDIX A-1

GROSS DOMESTIC PRODUCT, DEFICIT, MONEY SUPPLY, DOMESTIC CREDIT AND GDP DEFLATOR

	GDP (K Million)	Deficit (K Million)	Money Supply (K Million)	Domestic Credit (K Million)	GDP Deflator (1985=100)
1965	711.10	24.00	108.00	-46.00	12.70
1966	848.20	30.00	145.00	-19.00	15.80
1967	957.10	-39.00	169.00	28.00	17.00
1968	1062.00	-105.00	219.00	53.00	18.40
1969	1313.50	35.00	282.00	-6.00	22.10
1970	1279.00	23.00	356.00	-27.00	19.80
1971	1204.00	-194.00	319.00	192.00	19.20
1972	1348.20	-176.00	341.00	287.00	20.10
1973	1591.30	-266.00	411.00	348.00	23.90
1974	1892.60	64.00	441.00	386.00	26.60
1975	1583.70	-341.00	494.00	697.00	22.90
1976	1896.80	-270.00	623.00	919.00	26.30
1977	1986.40	-261.00	699.00	1204.00	28.90
1978	2250.00	-325.00	639.00	1440.00	32.60
1979	2660.40	-241.00	832.00	1589.00	39.70
1980	3063.60	-567.00	907.00	1863.00	44.40
1981	3485.40	-450.00	979.00	2261.00	47.60
1982	3595.30	-669.00	1309.00	2910.00	50.50
1983	4181.20	-327.00	1454.00	3180.00	59.90
1984	4931.00	-414.00	1704.00	3554.00	70.90
1985	7072.00	-1073.00	2102.00	4223.00	100.00
1986	12963.00	-2805.00	4062.00	5834.00	182.30
1987	19632.00	-2549.00	6266.00	7047.00	276.60
1988	22608.00	-3466.00	10126.00	9619.00	386.20
1989	60025.00	-2757.00	16728.00	15328.00	779.23
1990	113340.90		24390.00	19059.00	1479.74

APPENDIX A-2

IMPLICIT PRICES OF NON-TRADABLES, AGRICULTURAL GOODS, TRADABLES AND TERMS OF TRADE

Year	TOT (1985=100)	Price of Non-Tradables (1985=100)	Price of Agricultural Goods (1985=100)	Price of Tradables (1985=100)
1965	201.89	14.63	16.32	7.71
1966	281.04	15.18	17.49	9.25
1967	279.61	17.33	18.00	9.94
1968	283.56	18.43	18.69	11.22
1969	366.77	19.42	19.03	11.83
1970	287.16	19.32	19.19	11.95
1971	212.31	20.42	21.20	12.39
1972	207.25	21.27	22.64	13.32
1973	266.29	22.26	23.96	14.13
1974	137.20	24.19	25.43	15.92
1975	124.44	25.45	25.24	18.76
1976	118.40	27.79	31.43	21.34
1977	111.91	31.90	37.16	26.02
1978	89.19	35.41	41.10	30.20
1979	134.48	40.12	47.66	32.22
1980	114.47	45.12	53.23	38.40
1981	84.15	49.00	62.61	41.37
1982	61.75	55.08	63.00	46.40
1983	73.46	61.48	701.13	56.14
1984	90.24	73.84	80.02	67.61
1985	100.00	100..00	100.00	100.00
1986	92.27	172.47	156.85	179.60
1987	132.77	271.08	221.61	311.74
1988	161.63	355.98	430.65	451.60
1989	85.56	813.11	924.83	1048.66
1990	88.29	1373.36	1982.49	1600.98

APPENDIX A-3

IMPLICIT PRICES OF COPPER, MINING, IMPORTS, EXPORTS AND FOREIGN RESERVES

Year	GDP (K Million)	Deficit (1985=100)	Money Supply (1985=100)	Domestic Credit (1985=100)	GDP Deflator (1985=100)
1965	143	17.53	16.86	5.81	11.73
1966	150	27.38	26.29	5.96	16.75
1967	129	29.01	27.89	6.18	17.28
1968	142	32.55	31.33	6.51	18.46
1969	263	43.98	42.27	6.35	23.29
1970	367	35.21	33.89	6.93	19.90
1971	197	23.10	22.42	7.31	15.52
1972	115	23.67	23.00	7.72	16.00
1973	124	39.21	37.69	8.75	23.30
1974	132	45.94	44.00	10.86	25.76
1975	96	17.17	17.04	13.46	16.75
1976	79	23.51	23.02	16.85	19.95
1977	56	16.98	16.86	17.21	19.26
1978	47	19.64	19.72	22.29	19.88
1979	71	41.75	40.56	26.51	35.65
1980	71	42.00	41.22	33.72	38.60
1981	53	38.92	38.34	41.38	34.82
1982	130	31.45	31.07	48.50	29.95
1983	174	48.73	48.80	58.24	42.78
1984	123	56.60	56.81	72.77	65.67
1985	1146	100.00	100.00	100.00	100.00
1986	906	226.67	224.97	214.28	197.71
1987	675	245.65	246.42	244.61	324.10
1988	1394	331.46	331.68	256.87	415.17
1989	2602	753.98	741.28	709.60	607.09
1990	9217	1056.69	1058.82	1694.89	1496.44

APPENDIX A-4

EURO-DOLLAR RATE, ZAMBIA CPI, ZAMBIA NOMINAL INTEREST, EXCHANGE RATE BILATERAL REAL EXCHANGE RATE, AND DEVALUATION

Year	Euro-Dollar Rate in London (%)	CPI Zambia (1985=100)	Interest Rate (%)	Exchange Rate (K/$US1)	Parallel Market Exchange Rate (K/US$)	Bilateral Real Exchange Rate (K/US$)	Deval-uation (%)
1965	4.81	10.24	4.50	0.71	2.27	0.97	0.00
1966	6.12	11.91	4.50	0.71	2.13	0.97	0.00
1967	5.46	11.86	5.00	0.71	2.05	0.97	0.00
1968	6.36	13.13	5.00	0.71	1.90	0.97	0.00
1969	9.76	13.45	5.00	0.71	1.93	0.97	0.00
1970	8.51	13.82	5.00	0.71	1.94	0.97	0.00
1971	6.08	14.65	7.00	0.71	1.89	1.06	0.00
1972	4.97	15.39	7.25	0.71	1.85	1.48	0.00
1973	9.16	16.39	7.50	0.65	1.73	1.24	-8.84
1974	11.01	17.71	7.50	0.64	1.82	1.15	-1.23
1975	6.99	19.51	7.50	0.64	1.83	1.19	0.00
1976	5.58	23.17	8.13	0.71	1.79	1.87	10.90
1977	6.05	27.76	8.25	0.79	1.76	2.26	10.80
1978	8.78	32.29	8.25	0.80	1.65	2.13	1.26
1979	12.01	35.43	9.08	0.79	1.66	1.44	-0.87
1980	14.06	39.55	9.50	0.79	1.68	1.30	-0.50
1981	16.82	44.69	9.50	0.87	1.78	1.40	10.01
1982	13.16	50.76	9.50	0.93	1.75	1.40	6.91
1983	9.60	60.71	13.00	1.25	2.00	1.64	34.77
1984	10.78	72.86	14.54	1.79	2.44	2.29	43.40
1985	8.34	100.00	18.60	2.71	2.71	4.79	51.28
1986	6.77	154.00	27.40	7.30	4.67	9.76	169.16
1987	7.11	224.30	21.20	8.89	3.99	15.00	21.70
1988	7.91	346.90	18.39	8.22	2.45	30.30	-7.49
1989	9.10	793.50	18.39	12.90	1.76	107.80	56.86
1990	8.21	1674.40	35.10	28.98	1.97	121.20	

APPENDIX A-5

ZAMBIA GOVERNMENT REVENUE, UK CONSUMER PRICE INDEX, AND U.S. WHOLESALE PRICE INDEX

Year	Government Revenue	UK CPI (1985=100)	USWPI (1985=100)
1965	209.00	15.70	32.57
1966	212.00	16.30	33.62
1967	275.00	16.70	34.00
1968	306.11	17.50	34.96
1969	401.19	18.40	36.29
1970	432.42	19.60	37.54
1971	360.71	21.50	38.68
1972	315.23	23.00	39.92
1973	385.18	25.10	43.55
1974	680.47	29.10	50.24
1975	448.24	36.10	55.58
1976	443.02	42.10	58.07
1977	499.02	48.80	61.80
1978	549.90	42.80	66.67
1979	592.68	59.90	74.12
1980	767.63	70.70	84.05
1981	820.40	79.10	91.79
1982	840.45	85.90	95.51
1983	1016.18	89.80	97.04
1984	1092.07	94.30	99.05
1985	1546.72	100.00	100.00
1986	3035.54	103.40	98.57
1987	2801.11	107.70	100.67
1988	5176.49	113.00	103.15
1989	7244.18	121.80	108.50
1990	5535.01	133.40	113.85

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