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The short-term stagflationary impact of stabilization policy in Sudan: a test of the new structuralist hypothesis

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by

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INTRODUCTION

Since the early 1950s, economists and policy makers have been increasingly preoccupied with the problems of inflation and balance of payments disequilibria. Their preoccupation has led to the emergence of the so-called monetary approach to the balance of payments. The adherents to this approach typically assume that--in short-run models of an open economy--supply behavior is fixed exogenously and thus so is real income. Inflation is, therefore, viewed as the effect of a continuing upward pressure in aggregate demand. Their solution, therefore, is to restrict money and credit growth with its accompanying fiscal cutbacks. This is the analytic framework behind IMF stabilization policies (Polak, 1957).

There is increasing evidence, however, that these models fail to capture elements that are necessary to understand and predict the consequences of credit policy in LDCs (VanWijnbergen, 1983, and the references mentioned therein). Stabilization attempts have persistently recorded a poor score on both real growth and inflation, overpredicting the first and underestimating the second. The problem is that the supply side effect is not included in these models.

In LDCs, a significant production lag requires huge advances of money for working capital needs. Since equity and commodity markets are weak, these working capital needs to pay for labor and intermediate input costs are often financed by credit, thus raising costs, reducing output and raising prices. When monetary and credit supplies are cut, credit

rationing forces many firms to turn to an underground curb market--higher than legal interest rate--for loans. The higher interest cost results in a lower level of aggregate supply and, therefore, exerts an upward pressure on prices.

Research Objectives

The purpose of this study is to model the interaction between the monetary sector and the real sector in the Sudan by focusing on the prominent role played by the rate of return in the parallel--unofficial--sector of the Sudanese economy. This will make it possible to predict the short-run impact of a tight monetary policy and test the hypothesis of an immediate stagflationary impact coming from the supply side of the economy.

Organization of the Study

Chapter I starts with a description of the sectoral distribution of the GDP over time. Following that is a brief overall review of the economic crisis in Sudan. The problem of stagflation is then traced throughout the period from 1981 to 1988. The last part of this chapter provides information about the size of the parallel sector and some further evidence from the agricultural sector. This is particularly important because monetary contraction causes stagflation through the parallel sector.

Chapter II reviews the new structuralist critique of the monetarist theory of inflation. It starts with a typical IMF stabilization program and its theoretical basis. Previous studies about stabilization in Sudan

are then reviewed. Monetary contraction is then described. A survey across the new structuralist models besides a detailed description of the supply response mechanism concludes this chapter.

Chapter III is about the model setup, it starts with citation of similar studies from the literature, the basic assumptions of the model are then stated. Following is the model setup and a description of how in the model context monetary contraction affects supply and demand. The last part of this chapter deals with the data base. Chapter IV deals with the econometric estimation issues and Chapter V is the summary and conclusions.

CHAPTER I. EVOLUTION OF THE SUDANESE ECONOMY

Economic Structure of Sudan (1970-1988)

This part contains information about the relative importance of the different sectors of the Sudanese economy. This is intended to show the sectors that dominate the economy and, therefore, the policy effect on them determines the policy effect on the whole economy.

The Sudanese economy is dominated by its agricultural sector. The sector provides for more than 90% of total foreign exchange earnings out of exports, over 30% of GDP, and about 45% of total employment (see Table 1.1). Most productive capacity that lies outside agriculture is dependent on it as a source of raw materials or as a consumer of goods and services. The sector contains three main subsectors, namely the traditional rain-fed subsector, the mechanized rain-fed subsector and the irrigated subsector. The sector clearly occupies a dominant position in the economy of Sudan.

The industrial sector, on the other hand, produces only about 6% of the GDP. One-third of manufacturing value added comes from traditional small-scale industry, the sector is also a valuable source of employment and income for many Sudanese. The sector is characterized by excessive undercapacity utilization. Capacity utilization in manufacturing plants is estimated at only 20-30% with rates in private companies averaging about twice those of the public sector enterprises (World Bank, 1985). The domestic industry and a significant portion of the agricultural sector depends heavily on imported capital and intermediate goods.

Table 1.1. Sectoral distribution of GDP, export, and labor force in the Sudan

Indicator	Year	Agriculture	Manufacturing	Services
Percent share in GDP	1970	43	15	42
	1980	34	14	52
	1988	36	15	49
Contribution to value of exports (%)	1970/71	89	11	--
	1977/78	95	5	--
	1982/83	90	10	--
Distribution of labor force (%)	1970/71	70	3	27
	1077/78	69	4	27
	1982/83	70	5	31

Source: Elbadawi (1991).

The service sector, including both social and economic services, is relatively large, constituting roughly 50% of GDP compared to an average of about 30% of all low income countries. Within this sector transport and trade dominate.

The declining share in the GDP of the primary producing sectors, and the increasing share of the service sector (a supposedly unproductive sector) is believed to be associated with the expansion of the parallel economy. The ratio of the GDP generated in the parallel economy to the regular GDP grew from 2.9% in 1972 to 90.3% in 1986 (Elbadawi, 1988).

The Economic Crisis in Sudan

Since the 70s, the economy of Sudan has been passing through a period of unsatisfactory macroeconomic performance. The international

monetary fund (IMF), for example, diagnosed the problem as a result of a number of domestic and external developments affecting the budgetary operations, credit expansion and cost price relationships have resulted in structural disequilibria in Sudanese economy. These are clearly indicated by the severe imbalances in the budget and the balance of payments (see Table 1.2). In addition to taking steps to eliminate the causes of the imbalance, the Fund has persistently urged the government to take corrective action through depreciation of the Sudanese pound (Ali, 1985). As a result, the Sudanese pound was devalued four times between 1978-1984. The issue of devaluation is one of the most unpopular issues usually recommended for LDCs by the Fund. Sudan, of course, is no exception. Sudanese scholars have always emphasized that the supply elasticity of Sudanese exports and the demand elasticity for imports are extremely low for the devaluation to have its effect (Ali, 1985). They also stressed that Sudan suffered from economic mismanagement crisis, not structural imbalance and admitted to the need for fiscal and monetary improvements rather than a devaluation for a remedy (Hassan, 1989).

This research, however, deals with different aspects of the IMF stabilization program in Sudan, namely the stagflationary impact of credit control on private sector lending.

Stagflation in Sudan: The GDP Growth Rates (1981-1988)

The gross domestic product (GDP) series which is based on the national income accounts has some well-known problems associated with it. Nevertheless, it is the best income data available for Sudan. The GDP

Table 1.2. Sudan: Summary of macro indicators

Item	1982	1983	1984	1985	1986	1987
LS millions						
GDP (86/87) current prices	8330.8	3278.0	28158.0	29409.0	30676.0	31362.0
Current account balance	-210	-257.2	-80.2	298.5	-53.7	-701.9
Percent of current price GDP						
Imports	14	15	10	10	8	6
Exports	5	7	5	4	3	4
Current account balance	-2	-2	-1	1	-.1	-2
Central government						
Current revenues	15	12	15	13	16	14
Current expenditures	9	9	9	13	14	13
Development expenditures	4	13	13	15	18	16
	1982/83	1983/84	1984/85	1985/86	1986/87	
Growth rates						
GDP (constant price)	0.4	-2.9	-12.8	12.9	3.4	
Money supply	26	31	32	45.4	29	
	70/71	72/73	77/78	80/81	81/82	82/83
US$ millions						
External public debt (MIR-disbursed only)	300	370	1800	3100	5000	5100
Debt service ratio (%)	14	12	14	27	41	41
Cotton exports	1500	1200	749	460	260	630

Source. Ministry of Planning Economic Surveys, various issues.
Bank of Sudan Annual Reports, various issues (World Bank, 1985).

average growth rate over the period 1981/82 - 1987/88 is about -.24% per year. A closer look at the series Table 1.3 shows that output growth rates have been fluctuating over time. Specifically, there is a positive growth period (81/82 - 82/83) of .8%, a negative growth period (83/84-84/85) of -7.85%, a remarkable turnover to a positive average rate of growth of 8.15% during 85/86 - 86/87) and finally a moderate negative growth rate of -3.4% in 1987/88.

Table 1.3. Percent Δ in prices and real GDP (1981/82 prices)

Year	Real %Δ in GDP	Year	Low salaries index %Δ	High salaries index %Δ	Average
80/81	4.6	1981	24.6	23.9	24.3
81/82	1.2	1982	25.6	26.7	26.2
82/83	0.4	1983	30.6	31.7	31.2
83/84	-2.9	1984	34.2	30.7	32.5
84/85	-12.8	1985	45.3	47.2	46.3
85/86	12.9	1986	29.8	28.4	29.1
86/87	3.4	1987	25.9	24.0	25.0
87/88	-3.9	1988	48.7	46.9	47.8

Source: Bank of Sudan Annual Report, various issues.

A considerable number of events could be put forward to explain this instability. These events for example include the IMF liberalization experiment with Sudan (1970-84) and the post-1984 period. Taylor (1988, and the reference mentioned therein) sees the problem as associated with the investment boom around 1978. The idea was to transform Sudan into

the breadbasket of the Middle East. The transformation failed for reasons that involved both technical difficulties and bad economic management of existing agricultural products. Traditional exports of cotton and other crops declined while cereals never made it into the picture. He also argued that capital flight, mainly by Sudanese working abroad, traders with their presumably high earning flows (enhanced by inflationary income redistribution in their favor) and the military is another story behind stagflation. Meanwhile, both the "official" and productive sectors of the economy are starved of foreign exchange, provoking austere IMF policies which among other politically visible effects led to food riots in 1985 when consumer subsidies were cut (Taylor, 1988).

Devaluation, which is the core of the IMF stabilization program, is believed to have caused disproportionate supply responses of major exportable goods in Sudan (e.g., cotton, gum arabic) (Umbadda, 1985). The decline in the world prices for key export goods together with rising import prices during 1980-82 is another factor contributing to the problem (World Bank, 1983).

Given the aforementioned events, variation in the GDP can also be explained by variation in agricultural output and the problems associated with it. In 1984-85 the effect of drought and shortages of rainfall, rain-fed crop production declined substantially. The agricultural sector share in GDP dropped to 28.2% compared to 29.6% in 1983-84. During 1985-86 while the real GDP in absolute amount increased by LS-165 million, the contribution of agriculture was LS 377 million, which is 35% of the GDP.

Again, a lower share of agricultural output can explain the lower rates of growth of the GDP during 1986-87 and 1987-88. Heavy rains and floods created irrigation problems in 1987-88. The rigidities or the problems associated with the agricultural sector include foreign exchange availability, lack of seasonal labor and lack of credit (The World Bank, 1985).

Inflation Rates (1981-88)

Despite the continued restrictive monetary and credit policy measures which have been implemented in recent years, inflation, as measured by cost of living indices, continued its upward trend during the period under review (81-88) (see Table 1.3, which shows the cost of living indices for low and high income groups for the same period). On average, the general level of prices rose by 35.9 percent per annum during the 1981-85 period.

A combination of factors is believed to have contributed to the continuation of the price rise during the period under consideration. These include the frequent appreciation of the dollar in the free market leading to higher prices of imports, rising internal cost of production and the increase in prices of imported consumer goods due to the frequent valuation of import duties according to adjustment in exchange rates. A further element in the price rise during the period under review was the negative growth rate in GDP, which was adversely reflected upon production in the various sectors of the economy. Moreover, continuous increases in salaries and wages in recent years and the inflationary tendencies generated thereon were also among the factors affecting the

rise in the general level of prices.

According to data in Table 1.3 the upward trend in the general level of domestic prices continued through 1985. During 1986, inflation decelerated to 29.1%. The slower rate of inflation could be explained by the import of meat and further drop in the prices of sorghum and vegetables due to good harvest. During 1987, the increase in the cost of living indices recorded a further decline to 24.1% and 22.4% for lower and higher salaried persons. However, it is worth noting that in 1986-87 the cost of living indices included a number of official prices which made the cost of living indices published data unrepresentative to the fully consumer price increases. In 1988, there was a sharp increase in the rate of change in prices in the first three quarters. The rate of inflation increased sharply in mid-1988 due to shortages of basic commodities.

Other explanations are also offered by Sudanese scholars for inflation. For example, M. N. Hussain (1985) believes that imported inflation played the major role not only in initiating domestic inflation, but also in forcing the government to rely on deficit financing, thereby leading to excessive money balances. It has, therefore, been argued that the excessive money balances were the result of domestic inflation initiated by inflated import prices, rather than the cause. Elbadawi (1988, and the references mentioned therein) believes that deficit financing is the heart of the problem. Domestic money supply rose from LS 1825 million at the end of 1981-82 to LS 9011 million at the end of 1986-87, with an annual average rate of expansion totalling 40%

over the period. Also, private sector borrowing increased from 936.59 million in 1981-82 to 3460.0 million in 1986-87, an increase of 270%. Due to the high rates of return to black market dealings most of these funds are believed to have been used to finance black market operations.

In the following, I will trace the history of credit policy in Sudan for the period 1980-88. This is particularly important because it is one of the main instruments through which the IMF stabilization program tried to improve the position of the balance of payments and to lower inflation.

The Bank of Sudan Credit Policy (1980-88)

The basic objective of the Bank of Sudan Credit Policy is to outline the role of the bank in influencing the volume and the direction of credit extended by commercial banks to the private sector according to the stated economic policy objectives.

During 1980 the credit policy based on the Fund program aimed at curtailing credit to imports, private and professional loans, and medium- and long-term capital investment. On the other hand, facilities to exports, local industries and other productive sectors of the economy were to be promoted. In line with the policy of restricting credit, an advisory committee headed by the Governor of the Central Bank was established in March 1980. The main task of the committee was to scrutinize applications submitted to commercial banks for credit exceeding a certain amount. It is worth noting that by the end of December 1980 actual credit to the private sector was below the newly set target

by LS 90 million. During 1981, interest rates on advances and savings were raised by 2% in accordance with the declared credit policy objectives. Bank of Sudan placed a ceiling on the volume of credit to be extended to the private sector by each commercial bank. Subsectoral ceilings, however, were left to commercial banks to decide. By the end of December 1981 actual credit to the private sector was below target by 35.7 million. Interest rates were also raised by 3% during 1982. In 1983, a new credit policy was issued with the same major objectives and some minor changes in the subceilings, and as a result, the rate of growth of credit to the private sector went down from 46.9% in 1982 to 20.5% in 1983. In 1984, a new policy was issued in line with the previously stated objective of restricting credit and as a result, the rate of growth of credit to the private sector slowed to 17%. In 1985, the growth rate continued to be 17%. The main objectives of the policy issued in 1986 were again the containing of the growth of money supply in line with the growth of the economy and to ensure adequate flow of credit to priority sectors such as agriculture, industry and export. The rate of growth of credit extended to the private sector was 40%. In 1987, the subceiling had been unified and commercial banks were given greater freedom in allocation of their credit, customer-wise the growth rate of credit was 44%. In 1988, the growth was 19%; the objectives of the policy were monetary stability and the combat of inflation without stifling economic development. There were no new major changes from the 1987 policy. As mentioned before, despite those efforts to cutback inflation and to increase output, inflation continued to register high

rates of growth throughout the period and output continued to fluctuate over time.

We should also note that at this stage, as it is clear from Table 1.4, that for example if for analytical purposes we divide the period under consideration into three subperiods, namely 1981-82, 1983-85 and 1986-87, the rates of growth in private sector domestic credit, inflation and output seems to have a certain pattern. The first subperiod witnessed an average rate of growth in domestic credit of 39%, average inflation rate of 25.25% and average rate of GDP, though, measured in terms of fiscal years of 2.9%. A high rate of growth in credit is associated with a relatively low inflation and a positive rate of growth in GDP though not high. For the second period, the rates were 18%, 37%, and -5.1, respectively. The trend in this subperiod is clearer--low credit, high inflation, negative GDP. For the third subperiod, the rates were 42%, 27% and 8.15, once more high credit, relatively lower inflation and high positive growth of GDP. This could raise a question about credit planning in Sudan and whether credit needs of the different productive activities of the private sector are met from the regular banking system or whether the rate of growth of credit extended to the private sector is adequate to finance their productive activities. This, of course, is not a claim that--as it is clear from the previous discussion--monetary contraction is solely responsible for stagflation in Sudan rather it is a question of the degree to which it can contribute to its explanation.

The effect of monetary contraction on prices and output is usually

Table 1.4.

Year	%Δ in Domestic Credit to the Private Sector	Average %Δ in Prices	Fiscal Year	%Δ in Real GDP
1980	--	--	79/80	--
1981	31	24.3	80/81	4.6
1982	47	26.2	81/82	1.2
1983	20	31.2	82/83	0.4
1984	17	32.5	83/84	-2.9
1985	17	46.3	84/85	-12.8
1986	40	29.1	85/86	12.9
1987	44	25.0	86/87	3.4
1988	19	47.8	87/88	-3.9

Source: Bank of Sudan Annual Report, various issues.

transferred through the unofficial money market (Bruno, 1979; VanWijnbergen, 1982; Taylor, 1983; Buffie, 1984). To complete the specification for the Sudanese economy let us have an insight into the Sudanese parallel economy. Informal credit is believed to be one of the main blocks forming the parallel economy in Sudan.

The Size of the Parallel Economy in the Sudan

In this part, I will review the work of Elbadawi (1988) and will provide further evidence on the parallel economy in the agricultural sector, the mainstay of the Sudanese economy.

The Sudan is believed to have a sizable parallel economy. The spill over effects from an underground economy such as the one in Sudan can be

Table 1.5. Deposits and advances of commercial banks

	1982	1983	1984	1985	1986
Advances of commercial banks	1142537	1376923	1609191	1776704	263759
Deposits of commercial banks	1339560	1781357	2603602	362257	5136929
Advances/Deposits	85.3%	77.3%	77.97%	49%	59.3%

Source: Ministry of Planning Economic Surveys, various issues.

quite frustrating to the conduct of macroeconomic policy. Using a simple model of demand for money balances in addition to the definition of velocity and the equilibrium condition in the money market Elbadawi (1988) estimated the size of the income generated in the parallel economy or what he termed "missing" income. He argued that there are two opposing factors that have been working on the velocity of money in Sudan. One is the increased urbanization of the economy during the last two decades besides the successive monetization of the agricultural sector, the mainstay of the Sudanese economy. This is also the period which witnessed the expansion of the highly monetized activities of the service sector. The combined effect of these factors, he argued, is supposed to slow down the velocity of money. On the other hand, the increased number of banking and financial institutions in the country during the last decade is supposed to increase the efficiency in the use of money where a lesser amount of money is needed to support a given

level of transaction, thus causing a rise in velocity. The accelerated rate of domestic inflation and the expectations of future exchange rate devaluation in Sudan are supposed to reduce the demand for money, but since the stock of money is given the level of transaction must rise so that this stock is willingly held, hence, velocity should rise.

According to Table 1.6, he argued the velocity of money has experienced both considerable and consistent slow down over three periods. Between 1960 and 1987 this is obviously inconsistent with the behavior of other variables in Table 1.6, namely rates of growth in money supply (M1) prices and GDP. He went on arguing that this slow down can only be explained by the existence of a large and expanding parallel economy in Sudan since, perhaps, the last decade and one half. The parallel economy, however, is believed to have started expanding rapidly only after the post-1979 liberalization era (Umbada and SheaelDin, 1985). The conditions of high inflation, expectations of future devaluations besides the tendency of the economy towards developing excess demand are the main factors behind the expansion of the parallel economy. The black market for foreign exchange is another chain that constitutes the parallel economy. The ratio of currency in circulation to total money supply is another measure of the size of the parallel economy. Transactions are done in cash in order to cover these activities and for the purpose of tax evasion. Despite the expansion of the banking system during the post-1979 period, the CURR/M1 ratio increased to an annual average of 44% during this period as compared to 43% during the 1975-1978 period. Furthermore, it is widely believed that funds acquired from the banking

Table 1.6. M1 velocity and other macroeconomic indicators means and (standard deviations)

Period	Velocity	% ΔV	Curr/M1 %	π %	Rate of Growth in M1%	Rate of Growth in GDP%
1961-74	6.7	-3.95	54	6	13.3	3
	(1.23)	(8.01)	(3)	(8)	(9.6)	(8)
1975-78	5.0	-3.59	43	14	24.6	6
	(0.41)	(5.72)	(2.3)	(8)	(7.6)	(9)
1979-87	3.3	-4.79	44	25	26.7	-3
	(0.44)	(14.04)	(2.8)	(7)	(10.0)	(12)
1961-87	5.3	-4.18	49	14	19.4	2
	(1.8)	(9.86)	(5.8)	(11)	(11.2)	(10)

Source: Elbadawi (1988).

system as loans to the private sector have been routinely used to finance transactions in the parallel economy. Based on the findings of Domowitz and Elbadawi (1987) regarding stable demand for money function in the Sudan, Elbadawi (1988) estimated the "missing" income of the parallel economy. He obtained a revised figure for the GDP, and he obtained the missing income as a difference between the $\hat{Y}R$ and the reported GDP Y. He also estimated a revised velocity based on $\hat{Y}R$ (see Table 1.7). The figures he obtained are fairly consistent with the evidence from the Sudanese economy. The missing income was shown to exhibit a sustained and considerable rate of growth with the first jump in it taking place in 1979, the beginning of liberalization. The estimated missing income of the parallel economy is then shown to pursue a rising trend before declining sharply in 1983-84. The year 1983 witnessed a major effort by the state to quell the expansion of the black market while the end of

Table 1.7. Incomes in regular and parallel economies and the velocity of money in the Sudan (millions of Sudanese pounds)

Year	% of unreported to regular GDP	Revised V	V
72	2.9	5.35873	5.20844
73	4.1	5.27843	5.07289
74	3.4	5.43349	5.25379
75	3.1	5.53732	5.37078
76	5.8	5.58373	5.27698
77	10.4	5.19585	4.70765
78	13.1	5.14613	4.55043
79	26.9	4.93789	3.88978
80	37.0	5.08466	3.71064
81	63.8	5.12856	3.13064
82	71.9	5.12802	2.98231
83	40.8	5.02021	3.56620
84	31.9	4.96872	3.76818
85	70.8	4.85323	2.84153
86	90.3	5.24505	2.75652
87	85.6	5.48364	2.95474

Source: Elbadawi (1988).

1984 is the year of a severe drought and a consequent decline in economic activity. The rising trend in this income, however, was firmly rees-tablished during the subsequent years. The ratio of the missing income to reported GDP averaged 35% during the 1970-1987 period and the figure for the 1979-1987 period is almost 58%.

The implication of these findings for macroeconomic policies in

Sudan are great. Maredo (1985) argued that the link between the elements of the parallel economy--smuggling, informal credit, and black market for foreign exchange--have severely constrained commercial, monetary and exchange rate policy in the Sudan. In fact, even the regular banking system which is 60% owned by the state is believed to have provided credit to finance transactions in the parallel economy. Elbadawi (1988) with such a sizeable parallel economy competing with the regular economy for working capital in order to finance desired transactions, the role of monetary policy as a major stimulus to real economic growth and equity will be greatly undermined. To be sure the role of monetary expansion is already intolerably high and the system is fairly monetized. Due to the high rate of return in the parallel economy, a tight monetary policy, however, may lead to disproportionate financial repression and severe deflation of the regular economy with the significant portion of credit being drawn to the parallel economy. Some signs that this development might have already taken place is evidenced from the declining share in GDP of the primary practicing sectors, and the increasing share of the service sector which is closely associated with the parallel economy.

Some Evidence from the Agricultural Sectors

The agricultural sector, as has repeatedly been said here, is the mainstay of the Sudanese economy. The sector provides for more than 90% of the total foreign exchange earnings out of exports, over 30% of gross domestic product (GDP), and about 45% of total employment in Sudan (see Table 1.8).

Table 1.8.Key indicators of the agricultural sector role in the Sudan economy

Indicator	Year	Percent
Share of agriculture in GDP	1988/89	36
Contribution to foreign exchagne earnings	1986/87	93
Share to GDP of government investment in agriculture	1984/85	8
Share of total investment in GDP	1984/85	17
Share of total employment	1982/83	44

Source: Elbadawi (1991).

In this part, I will provide some evidence for the existence and the size of the unorganized or the (curb) money market in the sector. The Agricultural Bank of Sudan (ABS) is the main source of agricultural credit for the sector, other commercial banks allocate a small portion of their portfolio for agricultural credit. Despite the fact that the agricultural sector dominates the economy, the total local portfolio of the ABS was 20, 26, 76, 85 LS million in 1981, 1984, 1986, and 1987, respectively. As a percentage of total credit extended to the private sector, it was 3%, 2%, 3%, and 2%, respectively.

Most of the ABS loans go to the cotton sector or the rain-fed mechanized sector, and most of course for the purchase of machinery (World Bank, 1985).

Until recently, traditional farmers in Sudan knew only of the informal sources of agricultural credit. They still largely depend on the informal suppliers of agricultural credit. These include the village

merchant, the pure money lender, large farmers, friends and relatives. Credit from these informal sources came to be known in the Sudan as the "sheil system." Medium traditional farmers obtain the highest amount of the informal credit. Borrowing is mainly for consumption and farming activities. A high proportion of traditional farmers use the sheil system. In a study by the Agricultural Bank of Sudan (Oct. 1987), it was found that 57% of small farmers, 33% of medium and 9% of large farmers used the sheil system. The most commonly used methods of the sheil are cash against agricultural output and advance payment for labor work. The cost of credit of the sheil system has been estimated differently by different researchers (e.g., the ABS study mentioned the cost was found to be 110%). Another study by Technoserve, Inc. (1987) about credit in Elobeid came out with the average rate for reported sheil credit was 20% but ranged from 10% to 110%. Evidence for the existence of sheil in the irrigated agricultural subsector--which produces more than 50% of the agricultural output--can be found for example in S. T. Saleem (1987), who used a sample Gazira and Rahed irrigated schemes and stated that 55% out of 98 tenants traded in sheil during the relevant season. The observed rates of interest presented in this study ranged between 172% and 201%.

Elbadawi (1987) talked about the inadequacy of credit among other things for agricultural production. The rural agricultural markets are quite segmented. In the absence, government, small merchants or surrogate traders enjoy a virtual monopsony. The majority of small holders in the traditional sector deal with this market. He then argued that in some cases, these farmers may depend on the "shail" credit system.

"Sheil" credits sometimes make profits as high as 200%. In the case of gum arabic--the contribution of gum arabic to total foreign exchange earnings is about 17%. It is the second largest after cotton--it is estimated that about 30% of total production is sold in this market, 40% through the "sheil" credit system and only 30% sold in the auction markets. The World Bank (1985) on the other hand argued that although part of the cost to borrowers under "sheil" system reflect the cost of providing valuable services in remote areas where ordinary lenders find it difficult to function, the real interest charges are very high (and often explosive) varying anywhere between 100%-300% per annum.

Evidence of the size and the interest rate of the unorganized money market in developing countries including Sudan is also found in U. Tumwai (1977). He talked about the phenomena as being defined through and associated with rural credit markets. He also provided data for the different noninstitutional rates of interest for the period 1968-1971 for the Sudan as 60%, 30%, and 200%. He also named them as: usual, occasional, and exceptional, respectively.

To sum up, what we said so far is that during the period between 1979-1984 and the post-1984 period the Sudan was engaged in a series of Fund-supported programs. The IMF program among other things slowed down the rate of growth of credit to the private sector. The period also witnessed on average, low rates of growth and sometimes negative ones of the Sudanese GDP coupled with high rates of inflation. A number of events domestically and internationally are believed to have an input on stagflation in Sudan. The question that I am raising here, to repeat, is

to what extent contraction of credit extended to the private sector forced private firms and/or small farmers to borrow from the unorganized money markets at higher rates of interest and thus contributed to stagflation in Sudan.

CHAPTER II. MONETARIST STABILIZATION AND THE NEW STRUCTURALIST CRITIQUE

This chapter contains a description of a typical IMF stabilization program, its theoretical basis, and a review of some of the studies on the Sudanese stabilization programs. The chapter contains a detailed description of the policy of monetary contraction and a survey across the new-structuralist anti-monetarist models besides a detailed description of the supply response mechanism to monetary contraction.

Orthodox Stabilization Policies

The standard economic policies usually included in the orthodox packages for countries facing balance of payment difficulties accelerating inflation and blatant mismanagement in key sectors of its economy are:

1. Monetary contraction, usually due to the imposition of separate ceilings on credit from the banking system to the private sector and the central government.
2. Devaluation, either explicit or in disguised fashion through cuts in quotas, higher prior deposits for imports and subsidies for exports, and general tightening of trade restrictions. In country, economists may prefer the latter package of indirect measures, while the IMF typically presses for a devaluation up front.
3. Abolition or reduction of government intervention in the price system, for example, consumer food subsidies.

4. Internal financial reform and liberalization, in particular, attempts to raise interest rates.
5. External liberalization in the form of reduction of barriers in trade and capital flows.
6. With or without discrete devaluation, there may be a device to slow the rate at which the local currency is devalued over time in a crawling peg. The slower crawl is supposed to dampen expectations and be an anti-inflationary force.
7. Freezing of wage demands is often recommended to cut inflationary pressure and perhaps shift the income distribution toward high-saving profit recipients and the upper middle class.

Theoretically, the IMF programs are based on the so-called monetary approach to the balance of payments (Polak, 1957; Frenkel & Johnson, 1976). The approach was developed in the 1960s and early 1970s primarily by Mundel (1968) and Johnson (1976); more recent contributions are numerous, among them Dornbusch (1973), Mussa (1974), Blejer (1979), and Johannes (1981) (On the quantitative fund macro projections see Mohsinskhan, Peter Montiel and Nadeem, J. Haque, 1990). The basic assumptions of the monetary approach are a fixed exchange rate, stable demand for money and stable process through which the money supply is generated. The IMF policies have targeted inflation as one of its prime enemies, however, many of these monetarist policies have yielded disappointing results at least in the area of controlling inflation.

Previous Studies about IMF Policy in Sudan

In the context of the Sudanese economy, the devaluation issue has received a lot of attention. For example, M. N. Hussain (1985) believes that the IMF diagnosis of domestic inflation in the Sudan as a result of excessive money supply to finance government deficits and the expansion of bank credit is not appropriate. Inflation, he argued, is mainly imported and the excessive money balances are the result of domestic inflation rather than the cause. It was not only IMF diagnosis of domestic inflation that was inappropriate, but also its claim of an overvalued Sudanese exchange rate. He argued that Sudan's exchange rate was undervalued at least the four years before the 1978 balance of payment crisis. He went on and argued that the IMF justified devaluation on Sudan on the basis of supply sided argument, but did not consider the response of import costs, domestic costs, and export supply to the reduction in foreign price of domestic currency.

Umbadda and Shaaeldin (1985) concluded that devaluation, trade liberalization, breaking of government monopolies, and dissolution of government enterprises were not effective in terms of the major factor constraining the economy, i.e., productive capacity. They believe in long-term planning and a leading efficient public sector. Again, M. N. Hussain (1985) conducted a more general and dynamic analysis of the determinants of the relationship between "competitiveness" and "productivity." He concluded that the program resulted in less supply of exports, higher import bill, worsened balance of payment, high inflation and negative growth. M. H. Diab (1985) used Taylor's model to investi-

gate the price and income effects of devaluation and concluded that the effects are adverse on the balance of trade. He further argued that devaluation will reduce the supply of home goods and redistribute income unequally.

Nashashibis' (1980) study of the cost structure and competitiveness of Sudan's major export crops suggested a depreciation of the Sudanese pound to restore profitability of exports supporting the IMF program. Ali (1985), using Nashashibi's common supply framework showed that the actual 1978-1983 devaluations were either in the wrong direction or at the wrong magnitudes. He also argued that the exchange rate should have been revalued effective in 1981 according to the competitiveness criteria rather than devalued. Elbadawi (1988) conducted a study on Sudan's collapsing exchange rates and the speculative attacks on official reserve to the case when currency inconvertibility gives rise to a black market for foreign exchange. He concluded that the fiscal deficits in most of the LDCs are the root causes of the problem. Therefore, in order for incentive policies to succeed, the issues of government finance and resources mobilization should be top priority in LDCs economic reform package.

The issue of monetary contraction to the best of my knowledge has not received attention from Sudanese scholars, or there is no written work about it. Except that commercial banks used to complain about credit ceilings and that they could lend to the productive sectors above the ceiling which they claim would increase output and reduce prices.

Monetary Contraction

There are two justifications for monetary expansion, which get muddled in the minds of practitioners of applied orthodoxy. The first is based on the equation of exchange from the quantity theory of money, which states that the value (price times quantity) of transactions in the economy is proportional to money supply. If the quantity of transactions or output stays constant, then smaller money stock ought to be associated with a lower price level. On this rationale, cutting money supply or at least its growth is a key anti-inflationary move.

Open economy monetarism retains the hypothesis of the equation of exchange and stable output (or, effectively, full employment) but adds the notion that the price level is determined in the short to medium-run either from competition of imported goods or from labor and intermediate import costs, that is, the level of wage and exchange rate. The IMF couples these assumptions with the balance sheet identity for the banking system--any rise in the money supply (the bank's main liability item) must be balanced by increases in loans to the government or private firms or else by higher foreign exchange reserves (bank's loans and foreign exchange holdings are their principal assets). Monetary restriction takes the form of ceiling on credit to the government and private sector; the main benefits are supposed to come in the form of higher reserves <u>not</u> lower prices. Because Polak's (1957) model, which is the base of the stabilization programs focuses on the relationship between credit expansion and change in foreign assets (NFA), (NFA) is assumed in the model to depend on exports, capital movements and change in domestic

credit (NDC). The latter is the policy variable that can be used to control (NFA).

To apply the open economy monetarist model in detail, first, make projections of output and the price level, then you have money demand. Put limits on government and private borrowing from the banking system. From the bank's balance sheets, the change in foreign reserves "must" be determined as a residual item. Or, in other words, if domestic borrowing from the banking system is restricted, the balance of payments will improve.

The new structuralists argued that monetary and credit contraction, espoused by monetarists as a key policy for controlling inflation and improving the balance of payment, will increase the cost of financing working capital needs. This has an immediate short-run stagflationary impact coming from the supply side of the economy causing a heavy and costly recession before price inflation can be brought down.

Theoretical case for the new structuralists

New structuralist models specify Keynesian adjustment mechanisms. The market-determined nominal interest rate is the curb or noninstitutional credit market adjusts to equate demand for and supply of money and credit. Income adjusts to equilibrate demand and supply in the goods market. Structuralist models incorporate the effect for the curb markets in developing countries. They view these markets as competitive and agile (Taylor, 1983). Reserve requirements constitute a leakage in the process of financial intermediation through commercial banks. For this

reason new structuralists claim that banks cannot intermediate as efficiently as curb markets between savers and investors. All new structuralist models use Tobin's portfolio framework for household sector asset allocation. Households face three categories of assets--gold or currency, bank deposits, and curb market loans. Taylor (1983) and VanWijnbergen (1982) point out that whether higher deposit rates do increase the total supply of credit depends on the required reserve ratio and on whether the increased holding of real money balances come mainly at the expense of inflation hedges or mainly from direct lending in the curb market (Fry, 1982). Edward Buffie (1984), Akira Kohsaka (1984), Taylor and VanWijnbergen conclude that, in practice, financial liberalization is likely to reduce the rate of economic growth by reducing the total real supply of credit available to business firms. The new structuralists assume that funds flow freely between the banking system and the curb market savers and investors can generally use either or both markets, at least to some extent. Hence, the relevant interest rate in structuralist models is the curb market rate because it represents the marginal cost of borrowing on one hand, since curb market loans constitute an alternative to holding money balances.

Any increase in the curb market rate raises the price level because a rise in the curb market rate increases the cost of making capital; prices are determined by fixed markups over costs in all new structuralist models. A rise in the curb market rate also reduces output by deterring investment. An increase in the deposit rate of interest may raise the curb market rate and so depress growth if it reduces the total

supply of working capital--working capital supplied by both the banking system and the curb market.

Commercial banks are subject to a fixed required reserve ratio 1-q, and the central bank does not extend credit to the private sector. The cash base (reserve money or high-powered money) is, therefore, entirely outside money. The household sector holds three assets: currency or gold, bank deposits, and curb market loans. An increase in the deposit rate of interest raises demand for deposit and reduces demand for currency and curb market loans. If substitution of deposit for curb market loans is more important than substitution of deposits for currency holdings, the total supply of working capital can fall and the curb market interest rate can rise (VanWijnbergen, 1983). The same conclusion is reached by Buffie (1984), "Once we allow for repercussions in the curb market, financial liberalization becomes a perilous undertaking."

The Supply Response Mechanism

The complete description, the supply response mechanism to monetary contraction goes in the following manner.

In a relatively underdeveloped system of financial intermediation, the stock market plays a limited role, if any at all. Accordingly, banks play a much more predominant role than they do in Europe or the United Stated as a source of funds for firms, both for short-term working capital purposes and for long-term fixed capital formation. The fact that working capital is nearly entirely financed via credit makes the business sector in LDCs very vulnerable to adverse credit conditions.

Bank credit is often severely rationed, with bank lending rates unresponsive to excess demand for credit. This is, of course, one of the main reasons why "curb markets," play such a large role in many countries. Via these markets the public can lend directly to firms bypassing the banking system.

Much more important here in the short-run, however, is the transmission channel between monetary instruments and the supply side of the economy via credit financing of working capital needs. Working capital is needed to finance stocks of raw materials, semi-finished goods, intermediate imports, advanced payments to workers, etc. Typically, working capital needs are financed by banks or curb market credit. This implies that the cost of credit (the real interest rate) is a component of input costs. Markup pricing rules will, therefore, lead to an immediate cost push effect of high interest rates (the curb market rate is usually the relevant rate to look at) on prices. Also, under monopolistic market structures, a high cost of credit will not only lead to a short-run cost push effect on prices, but lead to a reduction in real output as real input costs have gone up.

This transmission channel, from tight limits on bank credit via the curb market and high costs of financing working capital into the supply side of the economy gives a stagflationary bias to tight monetary policies. Basically, what is going on is that this transmission channel adds an adverse supply shock aspect to policies of monetary restraint on top of more traditional demand reducing effects. Tight money policies lead to expensive credit which leads to increase the component of input

costs. This in turn leads to more inflation and less output then would obtain without this transmission mechanism present. Tight money policies pushes firms into the curb market, drives up interest rates there, and so initiates the stagflationary effects mentioned above.

Nearly all bank credit and certainly all curb market credit, has a very short maturity. This implies that the stagflationary impact of a credit crunch via the credit-working capital link will work itself through the system quickly, say within one or two quarters. The demand restraining impact, however, typically works only gradually: first aggregate demand (investment) will fall, which over time will increase unemployment. This in turn will, after further lags,ease real wage pressure and, thus, inflation. A typical response to a one-shot tightening up of monetary policy would, therefore, be an initial acceleration of inflation rate, after which demand effects take over, effecting a slow down of the rate. Both effects have a negative impact on output.

CHAPTER III. THE MODEL

In this section, the basic model used to test the new structuralist hypothesis in Sudan will be described. This model is the same (with few modifications) as the one used by Joseph Lim (1987), a number of other models seem to have input in Lim's model. These include, for example, Bruno (1979), VanWijnbergen (1982), Buffie (1983, 1984), and Taylor (1983) to mention some of them.

The Assumptions of the Model

The model is based on four assumptions, these assumptions actually hold for all new structuralist models (M. J. Fry, 1988). These assumptions are:

1. Wages are determined institutionally or exogenously through class conflict.
2. Savings takes place out of profits, not wages.
3. The price level is determined by fixed markups over cost of labor, imports, and working capital finance (the interest rate).
4. There is a critical need for imports of raw materials, capital equipment, and intermediate goods. Assumptions (3) and (4) imply that the restrictive monetary policy that raises interest rates can produce stagflation--an acceleration in the inflation rate and a reduction in the rate of economic growth at the same time.

The Sudanese Conditions

The first assumption is rationalized based on that for example the agricultural sector which employs about 70% of the labor force suffers from labor shortage. The main reason behind this is believed to be wage incentive (World Bank, 1985). It is also true that the general wage level is not fully indexed to price increases in Sudan.

The second assumption is justified in that, in Sudan, savings appear to come mainly from firms and farmers who are engaged in production rather than from wage earners. There is, however, no empirical support for this observation (The World Bank, 1985).

Mark-up pricing is justified based on the findings that (i) Sudan's commercial and foreign exchange policies are biased against exportables in favor of nontradeables and import competing industries (Elbadawi, 1987), (ii) real prices of home goods and nonagricultural tradeables stayed constant over time (Hassan, 1989), and (iii) the coexistence of price control and black market (World Bank, 1985). Given these results mark-up pricing is assumed to hold for nonagricultural tradeables and home goods.

Finally, the existence of critical needs for imports of raw materials, capital equipment, and intermediate goods for both agriculture and domestic industry has already been mentioned in Chapter I.

The Model

This model will include both monetarist and new-structuralist hypotheses. We test this on Sudan with annual data from 1970-1986. We assume a one-sector economy. The production function is neo-classical and output is assumed to have three inputs (1) labor, (2) capital stock, and (3) imported raw materials and imported intermediate inputs. The capital stock is assumed to be fixed in the short-run.

Aggregate supply--the output function

The supply function of domestically produced goods is dependent on capital stock as well as the real costs of the variable factor inputs (wages and domestic price of imported raw materials and intermediate inputs) inclusive of the real cost of borrowings at the interest rate for marginal funds (i.e., the curb or parallel market rate r_c). This function is the result of profit maximization and yields.

$$Q^s = Q^s(\tilde{w}(1+r_c-\pi^e),\ \tilde{e}\overset{*}{P}_m(1+r_c-\pi^e),\ k) \qquad (3.1)$$

where:

Q^s = level of output

$\tilde{w}$ = real wage rate

r_c = parallel or curb market rate

π^e = expected price inflation

$\tilde{e}$ = real exchange rate

$\overset{*}{P}_m$ = world price of imported inputs

k = level of capital stock

To obtain (3.1) in the profit-maximization process, we should recall that labor supply (L) and intermediate input requirements (R) are functions of the same right-hand variables in (3.1), i.e.,

$$L = L(\tilde{w}(1+r_c-\pi^e),\ \tilde{e}\tilde{P}^*_m(1+r_c-\pi^e),\ k) \tag{3.2}$$

$$R = R(\tilde{w}(1+r_c-\pi^e),\ \tilde{e}\tilde{P}^*_m(1+r_c-\pi^e),\ k) \tag{3.3}$$

Q^s in (3.1) is the gross output inclusive of the value of imported inputs. Our usual value added or real GNP, $\tilde{y}$ (a tilde denotes that the value is in real terms), which nets out the value of imported inputs, should have the same form of equation (3.1) or

$$\tilde{y} = \tilde{y}(\tilde{w}(1+r_c-\pi^e),\ \tilde{e}\tilde{P}^*_m(1+r_c-\pi^e),\ k) \tag{3.4}$$

Output, $\tilde{y}$, is assumed to depend on the size of the existing real capital stock, k, (fixed in the short run) and the amounts employed of the variable factor ($\tilde{w}$, $\tilde{e}\tilde{P}^*_m$) while the stock of real capital is given at any moment in time, employment of the variable factor will depend on its price (including the real cost of borrowings at the interest rate for marginal funds, i.e., curb market rate, r_c) relative to the price of the final product and the financial possibilities open to the firm. It is assumed that, at the prevailing prices of inputs and outputs, firms would be willing to expand production but are effectively constrained in their utilization of the variable factor by the availability and the cost of financial working capital. This is believed to be true even where current production is financed through the accumulation of past profits or original capital endowments of the firm. High real interest rates or in our case quantitative limitations on the availability of credit for working capital could lead to reduced levels of inventories, which then

limit the ability of the firm to produce and supply final goods and, of course, lead to higher costs of production. Shortages in working capital may also be reflected in a cutback in hiring. Availability and cost of financial working capital is also assumed to be crucial for small-scale farming (Keller, 1980). Farmers producing cash crops as mentioned before depend on credit from money lenders (for hiring of labor in case of publicly owned irrigation schemes), where available, on bank credit for their working capital needs for the rest of the sector to cover the necessities of life and the cost of seeds and the other inputs during the time preceding the harvest and sale of agricultural produce. The same assumptions are applied to the whole economy where the final output is the total use of the final goods and the total imports of goods and service from abroad.

Estimation of the curb market rate

Curb market rate is unobservable, however, we assume that it can be predicted using observable variables. Asset holders are assumed to divide their assets among demand deposits, time-savings deposits, curb market loans, foreign assets, commodity stock, housing, and currency.

The level of curb market loans, therefore, would depend on the rate of return of these assets, i.e., curb market, expected depreciation in the black market rate, expected inflation rate (π^e) as well as real income $\tilde{y}$--interest rates on time and savings deposits will be ignored here because of its empirical irrelevance (Domawitz and Elbadawi, 1987) and because it does not reflect the true opportunity cost of holding

money due to the redundancy of the assets market in Sudan (R.M. Hassan, 1989).

Because of the financial regulation on the banking sector credit market does not clear, it is the curb market rate that freely fluctuates to equate the supply of curb-market lenders and the curb market demand of the credit rationed firms. Firms working capital needs are financed by bank loans and, since there is credit-rationing, curb market loans. Thus, the curb market rate would be determined by the following:

$\tilde{LO}^{b}$ = real bank loans available. The more bank loans are made available, the less the demand for curb market loans, leading curb market interest to fall.

π^{e} = expected inflation rate. A higher expected inflation rate reduces the real return and curb market loans and so diverts funds out of curb market loans into other assets where values do not deteriorate with price inflation (such as commodity stock and housing or foreign assets). This has an upward push on the curb market rate.

E^{b} = The rate of depreciation in the black market exchange rate is positively related to the curb market rate or people will make sure that their curb lending rate or transactions account for the loss of value of the local currency. E^{b} is defined here as: $E^{b} = \log EB_{t} - \log EB_{t-1}$, where EB = black market exchange rate.

$\tilde{w}L+\tilde{e}\tilde{P}^{*}_{m}R$ = working capital needs. The higher the working capital needs, the greater the demand for curb market loans, so the higher the curb market rate.

$\tilde{y}$ = real income. The higher the income, the higher will be both the

demand and supply of curb loans. Also how an increase in income (and, therefore, savings) will affect the asset portfolio choice will depend on the parameters relating the various assets to income.

r_c, therefore, can be written as a function of observable variables, as in (3.5).

$$r_c = f(\underset{-}{\tilde{LO}^b}, \underset{+}{\pi^e}, \underset{+}{\tilde{w}}, \underset{+}{\tilde{e}\overset{*}{P}_m}, \underset{+}{R}, \underset{?}{\tilde{y}}, \underset{+}{E^b}) \tag{3.5}$$

But using equations (3.2), (3.3), and (3.4) reduces equation (3.5) to

$$r_c = f(\underset{-}{\tilde{LO}^b}, \underset{+}{\pi^e}, \underset{+}{\tilde{w}}, \underset{+}{\tilde{e}\overset{*}{P}_m}, \underset{?}{\tilde{y}}, \underset{+}{E^b}, \underset{+}{k}) \tag{3.6}$$

The supply function

Substituting (3.6) into (3.1) and (3.4) yields

$$Q^s = Q^s(\underset{-}{\tilde{w}}, \underset{-}{\tilde{e}\overset{*}{P}_m}, \underset{+}{\tilde{LO}^b}, \underset{+}{\pi^e}, \underset{-}{E^b}, \underset{+}{k}) \tag{3.7}$$

$$\tilde{y} = \tilde{y}(\underset{-}{\tilde{w}}, \underset{-}{\tilde{e}\overset{*}{P}_m}, \underset{+}{\tilde{LO}^b}, \underset{+}{\pi^e}, \underset{-}{E^b}, \underset{+}{k}) \tag{3.8}$$

We, therefore, have a semi-reduced form for our supply function. Now aggregate supply should equal aggregate demand and price fluctuates to achieve this. Thus, we have

$$Q^s(\underset{-}{\tilde{w}}, \underset{-}{\tilde{e}\overset{*}{P}_m}, \underset{+}{\tilde{LO}^b}, \underset{+}{\pi^e}, \underset{-}{E^b}, \underset{+}{k}) = Q^D \tag{3.9}$$

Aggregate demand

Aggregate demand is composed of consumption demand for domestically produced goods, investment demand for domestically produced goods,

government expenditure and export demand. Government expenditure is assumed to be determined exogenously. Export demand is also assumed to be determined outside this model.

Consumption demand for domestically produced goods is assumed to be dependent on total resources mobilized in the economy net of capital flight. This is based on the following accounting identities:

$$\text{Resource Mobilization} = M = Y + B + R \tag{3.10}$$

$$\text{Resource use} = E = C + I + F + K \tag{3.11}$$

where Y, B, and R are GDP, current account balance or net borrowing, and net current transfers or remittances including official and black market, respectively. C, I, F, and K are consumption, investment, net factor service payments, and capital flight, respectively. The basic principle behind the use of (3.10) is the identity between mobilized resources and their use. Thus, we have (The World Bank, 1985; Ali, 1987)

$$M = E \tag{3.12}$$

Due to the unavailability of accurate data on remittances and capital flight and since testing the new structuralist hypothesis does not require a direct estimation of the marginal propensity to consume, I will use the marginal propensity to consume estimated by Ali (1987) for seven years as

$$C = \underset{(214)}{84} + .8396\,(M - k) \tag{3.13}$$

(Figure between brackets is t ratio.) to generate $M \hat{-} k$, which will be used later in the investment and price inflation equations.

Public sector investment demand is assumed to be exogenous, private

sector investment demand is endogenous and assumed to be affected by resources mobilized, the flow of real credit forthcoming from the banking system. The idea behind this is that firms will try to get whatever bank financing they can get, as it is offered at below-market clearing rates. This in turn makes rationing necessary, which explains why the quantity and not the price variable (real bank lending rate) is of relevance (VanWijnbergen, 1982; Blejer & Khan, 1984; Fry, 1988). For the parts of planned investment not covered by bank loans firms will have to decide whether to go to the curb market or not to undertake the project involved. For this the real curb-market rate is of relevance, not hampered by regulations, clears the credit market. Private investment is also assumed to be affected by public investment (Blejer and Khan, 1984; and the references mentioned therein) although there is a considerable uncertainty about whether, on balance, public sector investment raises or lowers private investment. In broad terms, public sector investment can cause corwding out if it utilizes scarce physical and financial resources that would otherwise be available to the private sector, or if it produces marketable output that competes with private output. Yet, public investment that is related to infrastructure and provision of public goods can also clearly be complementary to private investment. This type of investment can enhance the possibilities for private investment and raise the productivity of capital increase the demand for private output through increased demand for inputs and services, and augment overall resources availability by expanding aggregate output and savings. The overall effect then depends on the relative strength of

these factors and there is no reason to believe that they are necessarily substitutes or complements. The investment demand function for the private sector will be written as

$$\tilde{I} = I(\hat{M\tilde{-}k},\ \hat{\tilde{LO}}^{b},\ r^{c},\ \tilde{IG}) \qquad (3.14)$$
$$\qquad\quad ?\quad +\quad -\quad ?$$

where

M-k = real resources mobilized as defined in (3.10, 3.11).

LO^{b} = real bank loans available

r^{c} = curb market rate as defined in (3.6)

GI = real public investment

Knowing that r^{c} is assumed to be influenced by LO^{b} then equation (3.14) can be written as

$$\tilde{I} = I(\hat{M\tilde{-}k},\ r^{c},\ \tilde{IG}) \qquad (3.15)$$
$$\qquad\quad ?\quad -\quad ?$$

or

$$\tilde{I} = I(\hat{M\tilde{-}k},\ \tilde{w},\ \overset{*}{\tilde{eP}}_{m},\ \hat{\tilde{LO}}^{b},\ \pi^{e},\ E^{b},\ k,\ \tilde{IG}) \qquad (3.16)$$
$$\qquad\quad ?\quad -\quad -\quad +\quad +\quad -\quad +\quad ?$$

<u>The price inflation function</u>

Equation (3.9) can, therefore, be rewritten as

$$Q^{s}(\tilde{w},\ \overset{*}{\tilde{eP}}_{m},\ \hat{\tilde{LO}}^{b},\ \pi^{e},\ E^{b},\ k) =$$

$$\tilde{C}(\hat{M\tilde{-}k}) + \Psi I(\hat{M\tilde{-}k},\ \tilde{w},\ \overset{*}{\tilde{eP}}_{m},\ \hat{\tilde{LO}}^{b},\ \pi^{e},\ E^{b},\ k,\ \tilde{IG}) + \tilde{G} + \tilde{E} \qquad (3.17)$$

where $\tilde{C}$, $\tilde{I}$, $\tilde{G}$ and $\tilde{E}$ denote real consumption demand for domestically produced goods, real investment demand real government expenditure and

real export demand, respectively. Ψ refers to the proportion of total investments that is spent on domestically produced goods. It is assumed to be fairly constant and stable. A further assumption is that government consumption expenditure has very little imported content.

The price level is assumed to fluctuate to achieve the equilibrium described in (3.12). (The equilibrium is assumed to hold when savings equal investment and the aggregate excess demand in the economy is equal to zero. The basic assumptions here are that any increase in investment will create excess demand for output that can only be reduced by rising price level and mark-up rate. Given that nominal wage is assumed to be fixed, real wage will fall. Since savings are assumed to come from producers and profit earners as opposed to labor, the marginal propensity to consume is higher for the latter. The reduction in real wage, then, will reduce consumption, increase savings, and drive the excess demand back to zero. The investment-saving balance is equivalent to Walras's Law.) (For further details see Taylor, 1983). If we further assume that it takes one year for prices to adjust to supply and demand changes, this results in a semi-reduced form for the price inflation, which is

$$\dot{P} = f(\underset{+}{\hat{\bar{w}}}, \underset{+}{\hat{\bar{e}}\hat{P}^{*}_{m}}, \underset{-}{\hat{\bar{LO}}^{b}}, \underset{+}{d\pi^{e}}, \underset{-}{dE^{b}}, \underset{-}{\bar{I}_{t-1}/k_{t-1}}, \underset{-}{\hat{M}\bar{k}}, \underset{+}{\hat{\bar{G}}}, \underset{-}{\hat{\bar{E}}}) \qquad (3.18)$$

A hat denotes a growth rate while d denotes first differences. We use the first difference for the expected inflation, foreign interest rate and the rate of depreciation in the black market exchange rate instead of growth rates. I_{t-1}/k_{t-1} is the variable used to measure the growth rate in capital stock.

Monetary Contraction Effect on Supply and Demand

The changes in $\tilde{w}$, $\tilde{e}\overset{*}{P}_m$, and E^b have positive effects on price inflation since a rise in these variables would lead to expected contractions in aggregate supply. However, they have negative effects on inflation since they reduce aggregate demand mainly via investment demand. Similarly bank loans ($\hat{LO}^b$) and expected inflation may affect prices negatively since they are expected to increase aggregate supply; but at the same time, they would have a positive effect since they will give an upward push to aggregate demand via investments. Herein lies the problem of this study. Monetary and credit contraction (lower LO^b and higher E^b) will have a positive effect on prices via the working capital cost push on aggregate supply, while at the same time exerting a negative one via the standard monetarist effect on aggregate demand. Simple regression will be used here to determine which effect is stronger in the short run.

The Data Base

The sample period covered for this study is 1970 to 1986, for lagged variables it is extended back to 1961. The variables required for this study are: (1) income, (2) wage rate, (3) real effective exchange rate, (4) banking claims on the private sector, (5) price level, (6) investment, (7) black market exchange rate, (8) consumption, (9) demand deposits, (10) time deposits, (11) exports, (12) government expenditure.

D.1 Income

The income variable used in this study is the Sudanese gross domestic product series, GDP, which is based on the national income accounts. There are some well-known problems with such series. These are due to changes in methodology used to assemble the accounting data, and to potentially large errors in the survey data. Nevertheless, these are the best income data available at this time and are obtained from the IMF International Financial Statistics. (Note that reported GDP and unreported GDP move together which means the former captures all variations in latter and that excluding the latter in this study does not change the results.)

D.2 Wage

The wage data is obtained per man days for the labor in the public irrigated schemes and the traditional rain-fed subsector as a proxy for the wage rate per man day in the agricultural sector, wage per man day is also obtained for the nonagricultural, tradable, and the home good sectors. A weighted average wage rate by area cultivated is constructed for the agricultural sector. A weighted overall average wage rate is constructed according to the percentage of labor force in each sector. Basic data is obtained from R. M. Hassan (1989). Weights are obtained from the World Bank (1985).

D.3 Real effective exchange rate

It was computed as a weighted sum of the exchange rate multiplied by wholesale price indexes (WPIs) for Sudan's major trading partners,

divided by the Sudan's consumer price index (CPI). J. Lim (1987) used the domestic cost of all imports to measure the domestic cost of inputs. The CPI is used as a proxy for the price of nontradables. The partners (and weights) are: Egypt (.03), Saudi Arabia and rest of the Middle East (.32), USA (.06), West Germany (.11), France (.06), UK (.12), Italy (.10), India (.06), Japan (.09), Romania (.01), and Yugoslavia (.04). The source of the real effective exchange rate is Elbadawi (1988).

D.4 Monetary variable

This is the commercial banks' claims on the private sector and is obtained from the IFS.

D.5 Prices

The only price data available is the Sudanese consumer price index, obtained from the Bank of Sudan annual report and the IFS. The CPI is based on a 1968 basket of goods for salaried employees in Khartoum, and it includes a number of commodities which are subsidized or subjected to price ceilings. Direct subsidies of key items such as sugar, wheat, petrol and cooking oil, as well as excess demand, fueled black market activity. Black market prices may have exceeded "official" prices by as much as 69% in 1975. This implies that our estimates of price and inflation impacts may be underestimating the actual effects.

D.6 Investment

Investment data is obtained as a total investment of the private and public sectors in the agricultural, nonagricultural tradable and home

good sectors. Capital stock is approximated by aggregating real investment over time investment data is obtained from R. M. Hassan (1989).

D.7 Black market exchange rate

The black market exchange rate data is obtained from various issues of the world currency year book.

D.8 Consumption

Data on consumption is obtained from the IFS, the World Bank (1985) and R. M. Hassan (1989).

D.9 Export

Data on export is obtained from the IFS.

D.10 Government expenditure

Government expenditure data is obtained from IFS and the Ministry of Finance economic surveys various issues.

CHAPTER IV. ECONOMETRIC ESTIMATION

This part deals with estimation issues. It starts with modelling the expected inflation function and goes through output and private investment demand equations to the price inflation equation which concludes this part.

Econometric Estimation

The expected price inflation equation (π^e)

Expected inflation is assumed to be consistent with the "rational expectations" and that economic agents do possess full information about the structure of the model described in Chapter III. Inflation is defined here as

$$\pi_t \equiv \text{Log } P_t - \log P_{t-1} \tag{4.1}$$

where

P_t = CPI, consumer price index

and

$$\pi^e_t = \pi_t - \epsilon_t \tag{4.2}$$

where

ϵ_t = error

or

$$\epsilon_t = \pi_t - \pi^e_t \text{ and } E(\epsilon_t) = 0 \tag{4.3}$$

That is expectations are unbiased, i.e., there is no systematic component in the forecast error. ϵ_t is assumed to be normally distributed and should not be correlated with the information set that is available to the forecaster at the time the prediction is made. If we denote x_{t-1}

the information available at time (t-1) and write

$$\pi_t = \pi^e_t + \epsilon_t \tag{4.4}$$

then π^e_t depends on x_{t-1} and π^e_t is not correlated with ϵ_t. This implies that

$$\text{var}(\pi_t) = \text{var}(\pi^e_t) + \text{var}(\epsilon_t)$$

and that

$$\text{var}(\pi_t) \geq \text{var}(\pi^e_t)$$

Any correlation between ϵ_t and any variables in x_{t-1} imply that not all the available information has been used. Taking mathematical expectations of all the variables in (4.4) we get

$$\pi^e_t = E(\pi_t | x_{t-1}) \tag{4.5}$$

The left hand side of (4.5) is interpreted as the subjective expectation and the right hand side of (4.5) is the objective expectation conditional on the data available when the expectations were formed. Thus, there is a connection between the subjective beliefs of economic agents and the actual behavior of the economic system.

Economic theory might not be very valuable in generating an accurate model of expectations formation because it is difficult on theoretical grounds to exclude any piece of information available at time (t-1) as a useful predictor of an economic variable and thus from the x-vector (Mishkin, 1982). This suggests that a theoretical statistical procedure might be superior to economic theory for deciding on the expected inflation equation. Expected inflation is assumed to depend on a multivariate time series of its own lagged values and a wide range of other macro variables, i.e.,

$$\pi_t = \alpha_o + \alpha_i \sum_{i=1}^{4} \pi_{t-i} + \alpha_j \sum_{j=1}^{4} G_{t-j+1} + \alpha_k \sum_{k=1}^{4} Y_{t-k} + u_t \qquad (4.6)$$

where

$\pi_{i's}$ = lagged values of inflation,

$G_{j's}$ = current and lagged values of the rate of growth of nominal government expenditure,

$Y_{k's}$ = lagged values of the rate of growth nominal income.

u_t is a zero mean, normally distributed, serially uncorrelated random process.

OLS estimation of this equation gives a consistent estimate of the α's. The growth rate is used to account for the nonstationarity of these variables. Other variables like money supply and export growth rates were also tested and excluded on the basis of their statistical insignificance. The results of estimating equation (4.6) are:

$$\begin{array}{lllll}
\pi_t^e = & .094 + .753\pi_{t-1} + .0322\pi_{t-2} - .19\pi_{t-3} + .464\pi_{t-4} \\
& .113 \quad .224 \quad .236 \quad .202 \quad .191 \\
& (.842) \quad (3.087)^{**} \quad (.137) \quad (-.941) \quad (2.437)^{*} \\
& - .312G_t + .383G_{t-1} - .546G_{t-2} + .257G_{t-3} + .049Y_{t-1} \\
& .148 \quad .109 \quad .129 \quad .137 \quad .165 \\
& (-2.114)^{*} \quad (3.53)^{**} \quad (-4.229)^{***} \quad (1.891) \quad (.298) \\
& + .023Y_{t-2} - .423Y_{t-3} + .269Y_{t-4} \\
& .183 \quad .198 \quad .187 \\
& (.123) \quad (-2.141)^{*} \quad (1.439)
\end{array} \qquad (4.6)'$$

$R^2 = .928$, $F = 6.445^{**}$, $DW = 3.246$, $DF = 18$ of the error (Figures in brackets are t-statistics). The statistical significance of the coefficients in each equation estimated here was established by t-tests with n-k degrees of freedom by testing the hypothesis:

H_0: $\alpha = 0$

H_A: negation

where n is the number of observations, k the number of regressors, and α_i is the coefficient of a given regressor. The significance of complete regressions on the otherhand was established by testing the hypothesis:

H_0: $\beta_1 = \beta_2 = . . . = \beta_k = 0$

H_A: negation

where

β's = the joint coefficients of the regression

The F test was then used as:

$$F_{(k,\ n-k-1)} = \frac{R^2/k}{(1-R^2)/(n-k-1)}$$

where n and k are as defined before and R^2 is the multiple correlation coefficient. Statistically significant coefficients are marked with asterisks in each equation, where one, two, and three asterisks denote 10%, 5%, and 1% levels, respectively. Multicolinearity as measured by the variance inflation factor (VIF) is not a problem for equation (4.6). Autocorrelation in the presence of lagged dependent variables in the r-h-s can be tested using h-test.

$$h = \hat{P}\sqrt{\frac{n}{1-n\ \hat{v}\ (\hat{\alpha})}}$$

where

$\hat{P}$ = estimated first order serial correlation

$\hat{v}(\hat{\alpha})$ = estimated variance of OLS estimate of α_t

n = the sample size.

If $n\hat{v}(\hat{\alpha}) > 1$ the test is not applicable which appeared to be the case here. So autocorrelation is tested by regressing the residuals from (4.6)' on its lagged values $\hat{u}_{t-1}$ and the other explanatory variables in the model and then testing the coefficient of $\hat{u}_{t-1}$. The result of fitting the described equation is:

$$\hat{u}_t = \underset{(.841)}{.08} - \underset{(-2.736)}{.829}\ \hat{u}_{t-1} + \hat{\alpha}_i \sum_{i=1}^{4} \pi_{t-i} + \hat{\alpha}_j \sum_{j=1}^{4} G_{t+1-j} + \hat{\alpha}_k \sum_{k=1}^{4} Y_k + \hat{\zeta}_t$$

The estimated coefficient of $\hat{u}_{t-1}$ is statistically not significant at 1% level. The plot of residuals against the fitted values of the dependent variable from equation (4.6)' showed no definite pattern in the magnitude of dispersion about zero, so the variance of the residuals is assumed to be homogenious (Figure 4.1). The normal probability plot of residuals on the other hand appeared as straight line, however, there are two outliers (Figure 4.2). This may cast some doubts in the functional form or the data, nevertheless expected inflation from equation (4.6)' will be used in our model equations.

Because the sample period is small (1968-1986) which limits the flexibility of the used functional form, I decided to estimate another equation for π_t with fewer number of explanatory variables and try both of them in the model equations. All the macro variables mentioned before were again included with the constraint that the maximum number of explanatory variables is eight, the best specification chosen is the one with the highest R^2 and significant F and t statistics.

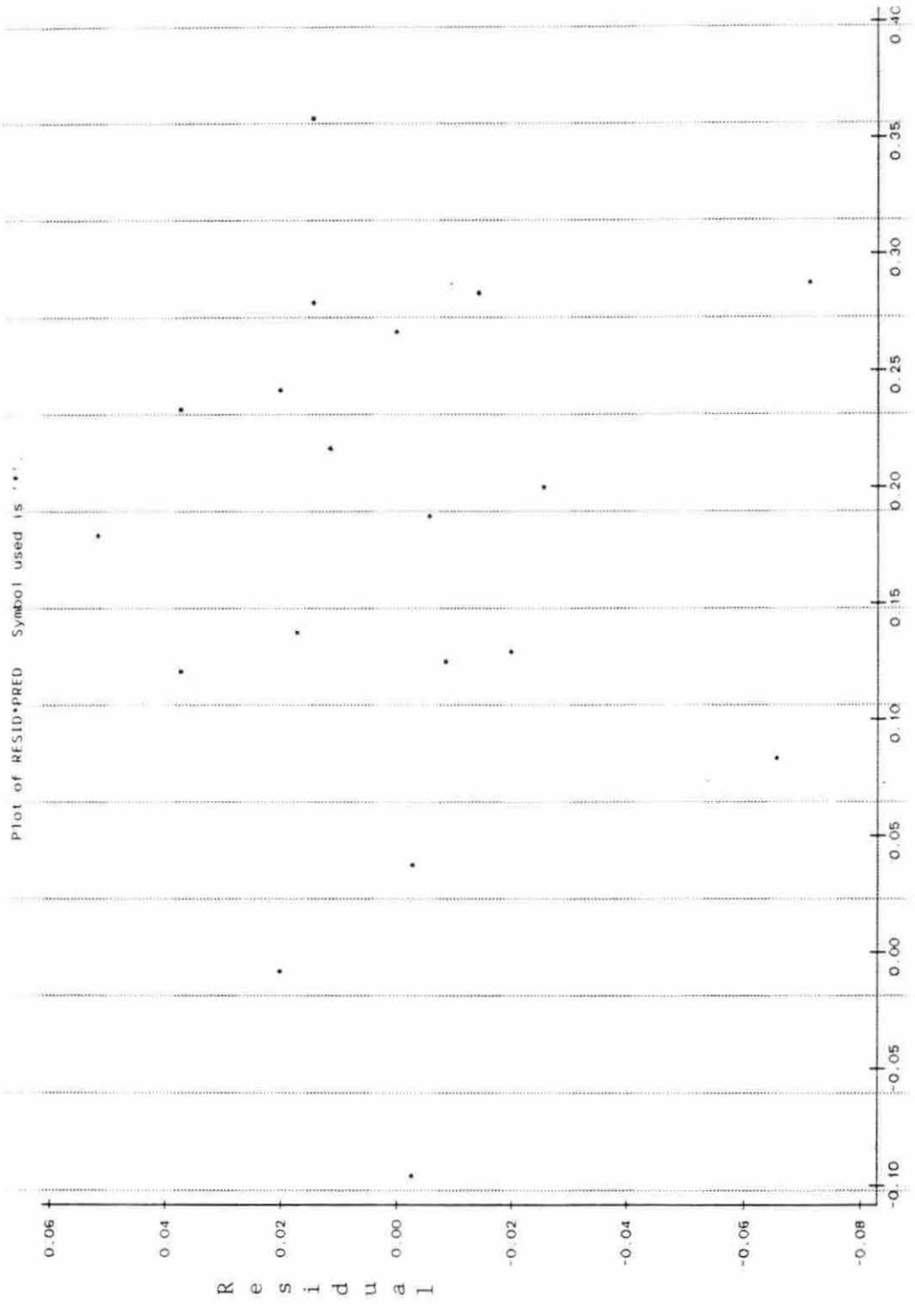

Figure 4.1. Plots of residuals versus π^e

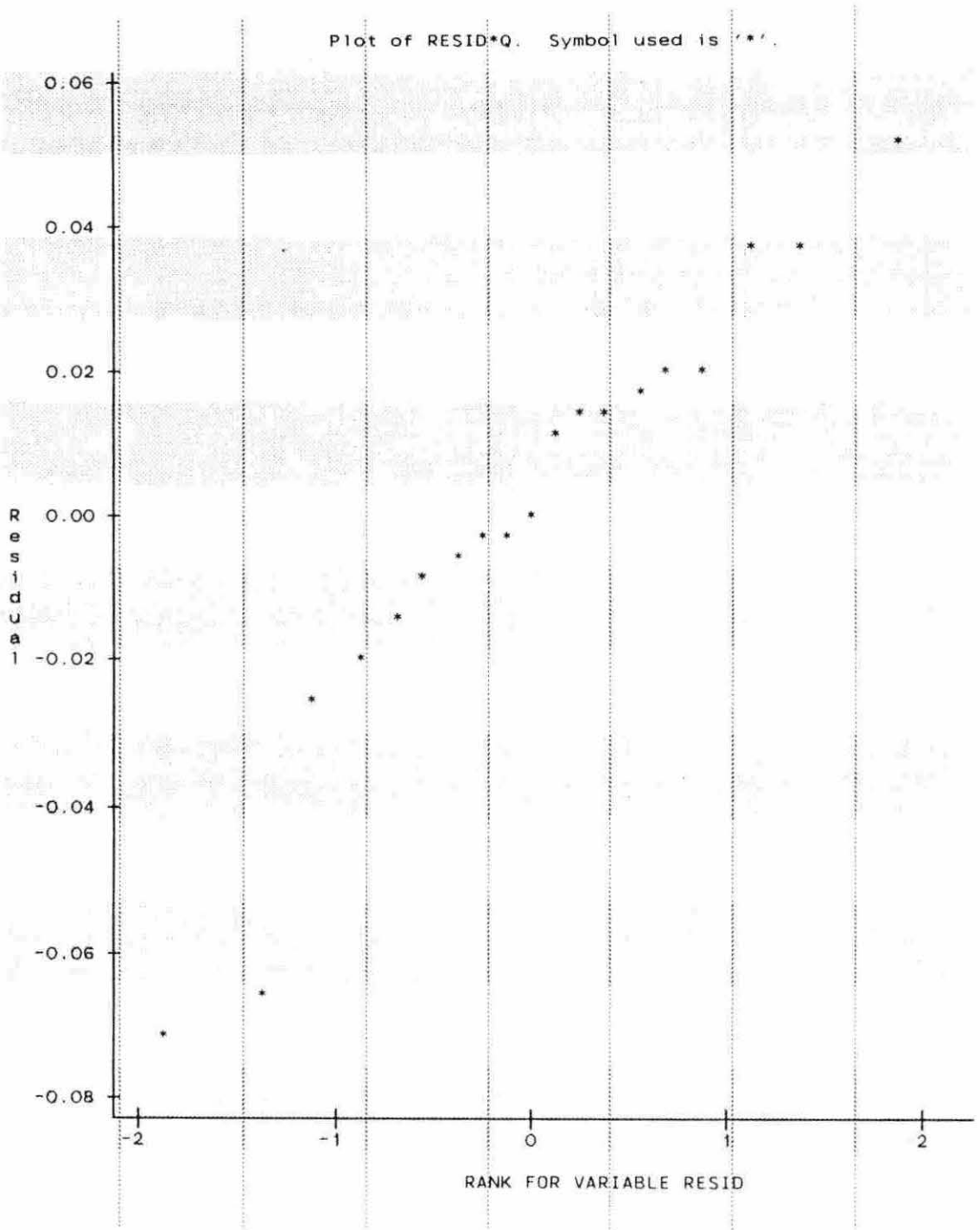

Figure 4.2. Normal probability plots

The best specification generated from this trial was the following estimated equation.

$$\hat{\pi}^{e}_{t} = \underset{(2.427)**}{.161} + \underset{(1.279)}{.289}\,\pi_{t-1} + \underset{(1.668)}{.365}\,\pi_{t-2} + \underset{(.077)}{.0182}\,\pi_{t-3} + \underset{(1.127)}{.258}\,\pi_{t-4}$$

$$- \underset{(-2.019)*}{.278}\,G_{t} - \underset{(2.003)*}{.215}\,G_{t-1} - \underset{(-2.97)**}{.404}\,G_{t-2} \qquad (4.7)$$

$R^2 = .744$, $F = 4.556**$, $DW = 2.056$, $DF = 18$

Again, VIF showed no multicolinearity problem here. Autocorrelation is tested the same way as in equation (4.6)' and for the same reasons.

The result of fitting the residuals of equation (4.7) is as follows:

$$\hat{\mu}_{t} = \underset{(-.06)}{-.003631} - \underset{(-.207)}{.0551}\,\hat{\mu}_{t-1} + \sum_{i=1}^{4} \hat{\alpha}_{i}\,\pi_{t-i} + \sum_{j=1}^{3} \hat{\alpha}_{j}\,G_{t+1-j} + \hat{\mu}_{t}$$

The estimated coefficient of $\hat{u}_{t-1}$ is clearly not significant at 10% level. The plot of residuals against the fitted values of the dependent variable plus the normal probability plot of the residuals from equation (4.7) (see Figures 4.3 and 4.4) indicate that expected inflation generated by equation (4.6)' is better; however, both results will be interpreted with caution, and a third measure for expected inflation will be added. Both equations show that private economic agents form their expectations about inflation on the basis of previous experience of inflation, present and previous experience of government expenditure growth rate and, for equation (4.6)', previous experience of income growth rate. The lag length is determined mainly on the basis of standard econometric principles and was limited by the degrees of

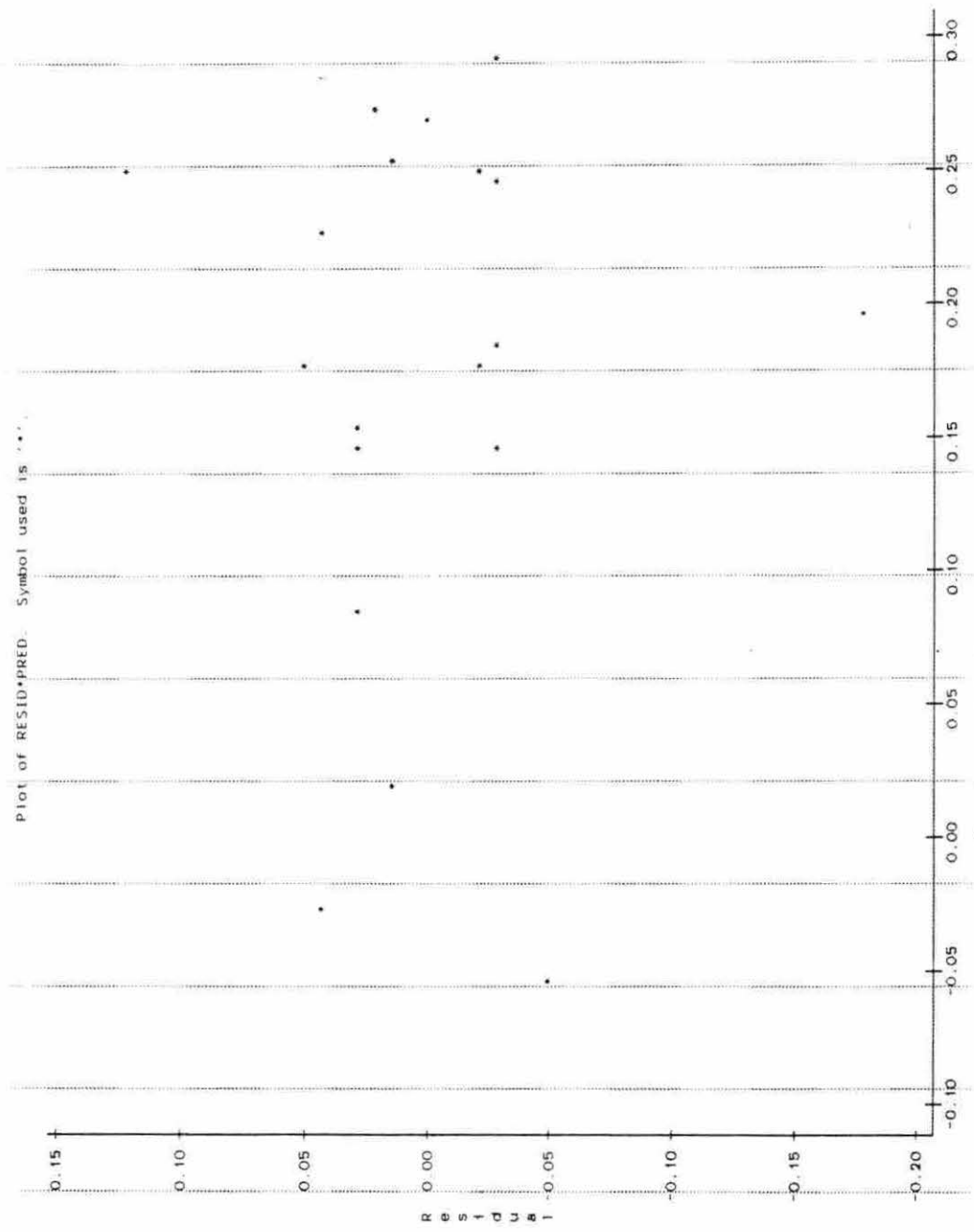

Figure 4.3. Plots of residuals versus $\hat{\pi}^e$

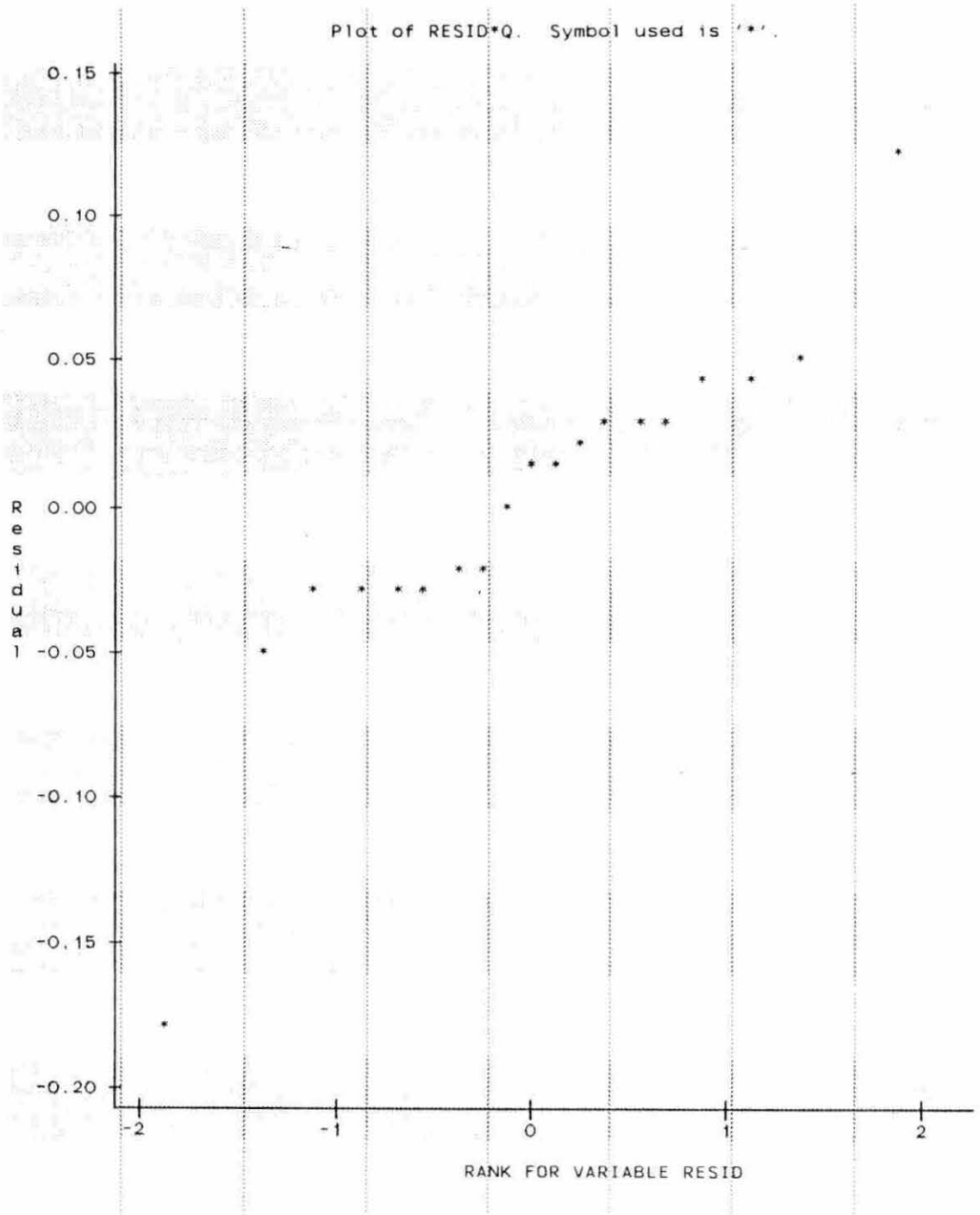

Figure 4.4. Normal probability plots

freedom. This method of estimating the expected inflation is called the instrumental variable method because the predetermined variables are used as the appropriate instruments which are not correlated with the error as described in equation (4.4). The predicted values of π_{t-1} $\hat{\pi}_t$ will then be used as the expected inflation to estimate the rest of the model equations namely output, investment, and prices equations.

The real output equation

Because of the endogeneity of the real bank loans to the private sector variable in the right hand side of equation (3.8), the output equation, the (2SLS) is used to generate predicted values of LO^b_t as $\hat{LO}^b_t$ as a function of its own real lagged values LO^b_{t-1} and the other predetermined variables in the model, namely the real government expenditure and the real export. The existence of the simultaneity bias violate the crucial assumption we make for (OLS) estimation, that is the explanatory variables are independent of the error term u. By regressing LO_t on predetermined variables which are hopefully uncorrelated with the error term but correlated with the explanatory variables in the equation the $\hat{LO}$ will be uncorrelated with u.

The regression of $\tilde{y}$ on $\hat{LO}^b$ and the other explanatory variables in the model then generates a consistent estimator of $\hat{LO}^b$ coefficient. The result of fitting the bank loan equation is

$$\tilde{LO}^b_t = -.468 + .651\ \tilde{LO}^b_{t-1} + .019\ \tilde{E}_t + .757\ \tilde{G} + \hat{u}_t$$

$$(-3.129)\ (5.67) \qquad (.233) \qquad (3.43)$$

$R^2 = .926$, DF = 16

where

$\tilde{LO}^{b}_{t-1}$ = lagged real bank loan.

$\tilde{E}_{t}$ = real export.

$\hat{G}$ = real government expenditure.

The predicted values $\hat{\tilde{LO}}^{b}_{t}$'s are then used in the estimation of the real output equation. A dummy variable is also included to account for the drought of 1984. Three different estimates of inflation will be tested in the output equation first expected inflation as generated by (4.6)' and second as generated by (4.7) and, finally, the measured rate of inflation as defined in (4.1) will also be tested. The rationale for using measured inflation is that rational expectations imply that measured inflation equals expected inflation. All the equations were estimated in the log linear form (Cobb Douglas function). The results of fitting the different specifications are reported in Table 4.1.

where

π = measured inflation

π^{e} = expected inflation as generated by (4.6)'

$\hat{\pi}^{e}$ = expected inflation as generated by (4.7).

The results of estimating the real output equation as shown in Table 4.1 shows that the monetary-related variables do affect supply equation. In particular, the real bank loans variable have significant positive impact in all the equations. The rate of depreciation in the black market exchange rate has a negative impact on the output equation and is statistically significant at 10% level in equation (1) Table 4.1. For

Table 4.1. Output equation

	1	2	3
intercept	3.976 .52 (7.649)***	4.084 .558 (7.313)***	4.173 .624 (6.683)***
$\hat{LO}^b$	0.367 .144 (2.543)**	0.413 .152 (2.721)**	0.475 .184 (2.581)**
$\tilde{w}$	0.363 .062 (5.888)***	0.374 .066 (5.627)***	0.381 .076 (5.05)***
D	-0.109 .057 (-1.893)*	-0.115 .062 (-1.845)*	-0.33 .07 (-2.387)**
$\tilde{eP}_m^*$	-0.295 .114 (-2.574)**	-0.313 .123 (-2.533)**	-0.128 .138 (-1.735)
E^b	-0.106 .058 (-1.828)*	-0.104 .064 (-1.632)	-0.128 .071 (-1.791)
π	-0.482 .229 (-2.101)*		
π^e		-0.418 .272 (-1.538)	
$\hat{\pi}^e$			-0.034 .454 (-0.076)
K	0.131 .044 (2.972)**	0.121 .048 (2.516)**	0.084 .073 (1.147)
R^2	0.9219	0.9079	0.8837
F	15***	12.667***	9.769***
DW	1.997	2.11	1.924
DF	16	16	16

t statistics same as in equation (4.6)'.

the rest of the equations, however, it is significant at only 20% level. The expected inflation variables have a negative impact on the output function and significant at 20% using the predicted values of equation (4.6)'. Measured inflation on the other hand, also has a negative impact and statistically significant at 10% level. The negative sign of the expected inflation could be due to that curb market lender adjust their lending rates immediately and fully in response to any expected increase in inflation. This, in turn, prevents curb market borrowers from receiving loans at a lower real rate and, thus, the effect of expected inflation or inflation is transmitted immediately to higher curb rates and lower output. The other intermediate input variables, the real wage rate and imported intermediate input variables are statistically significant and have positive and negative impact on output, respectively. For the real wage rate this goes against our initial hypothesis and could be explained by that labor shortage is, in fact, one of the major rigidities in the agricultural sector. The demand for labor may exceed supply at the existing wage rates prevailing in the different schemes. This is due to the declining real wage rates for cotton picking and other physically hard manual tasks in agriculture, a decline due in large part to the decline in real returns to cotton growers until 1983/84. The experience of 1984 in Gezira indicates that when wage rates for cotton picking are raised, the necessary labor does, in fact, become available. It is also true that in this case real wages per unit of effort tend to fall when yields are low and tend to rise when yields are high even for the same piece of work rate (The World Bank, 1985).

The aggregate investment variable which is used as a proxy for capital stock has a significant positive effect in two of the equations, however, it has created multicolinearity problem as indicated by the (VIF). The multiple correlation coefficient between the capital stock variable and the rest of the explanatory variables using measured inflation, however, is less than that of equation 1 (R^2=.9187). It is also true that the estimated coefficients are not sensitive to small variations in the data. Based on this we can conclude that multicolinearity is not a serious problem, and we can rely on conclusions drawn from equation 1. I must mention here that, for convenience, the output equation was estimated with the real lending bank rate included and the result was a serious multicolinearity and an insignificant t ratio for the lending rate variable so it will be dropped for the rest of the equations.

The private sector real investment demand equations

Private investment demand is assumed to depend on resources mobilized, to generate the latter as described in equation (3.13). The procedure is simply as follows:

Assume the following estimated consumption function

$C = \hat{\alpha} + \hat{MPC} * (M - K)$

Then predict $(M - K)$, $(M \hat{-} K) = (C - \hat{\alpha})/\hat{MPC}$

where

C, $\hat{\alpha}$, $\hat{MPC}$ are consumption, estimated intercept and marginal propensity to consume, respectively. Consumption, however, is endogenous so

instead we used predicted consumption from the regression of consumption on other exogenous variables in the model, G and E. (M $\hat{}$ K) was then used to estimate equation (3.11). Expected inflation as defined by (4.7) was dropped due to its poor performance in the output equation. The results of estimations are reported in Tables 4.2 and 4.3, where both expected and measured inflation included separately and different specifications were tried.

The result of estimating the private investment demand function showed that there was a serious multicolinearity problem based on the (VIF) which is well above 10 for capital stock, wage rate, resources mobilized and real bank loan variables using both definitions of inflation (equations 1, Tables 4.2 and 4.3). Given the low t ratio of some of the variables then, they were jointly and sequentially excluded from the investment equation on the basis of R^2 and the F test. The hypothesis to be tested is the linear restriction of the form:

$H_0 = \beta_1 = \beta_2 = \ldots = \beta_k$

H_A = negation

where β_1, β_2, ... β_k are the joint coefficients of the variables to be excluded.

The F test was then used as

$$F_{(J,\ n-k)} = \frac{(R^2 - R^2*)/J}{(1 - R^2)/(n-J)}$$

where

R^2* = the multiple correlation coefficient of the restricted model.

J = the number of restrictions and R^2, n as defined before.

Table 4.2. Investment with measured inflation rate

	1	2	3	4
intercept	14.804	17.478	21.002	18.13
	7.056	6.366	4.354	2.714
	(2.098)	(2.746)	(4.824)	(6.68)***
$\hat{LO}^b$	2.08	3.061	3.607	2.9
	2.63	1.21	0.961	0.479
	(1.284)	(2.529)	(3.755)	(6.062)***
$\tilde{w}$	0.325	0.162	0.369	--
	.552	.517	.432	--
	(0.588)	(0.312)	(0.852)	--
$\tilde{e}P_m^*$	0.577	0.425	--	--
	.577	.547	--	--
	(0.999)	(0.777)	--	--
π	-3.42	-3.072	-3.074	-3.154
	.934	.846	.825	.807
	(-3.66)	(-3.631)	(-3.727)	(-3.91)***
E^b	-1.102	-1.262	-1.339	-1.192
	.448	.409	.387	.341
	(-2.461)	(-3.09)	(-3.464)	(-3.5)***
$M \hat{-} K$	-7.086	-7.814	-8.413	-7.406
	2.006	1.825	1.613	1.08
	(-3.53)	(-4.281)	(-5.218)	(-6.859)***
D	-0.588	-0.693	-0.808	-0.671
	.395	.374	.335	.29
	(-1.489)	(-1.853)	(-2.408)	(-2.314)**
K	0.294	--	--	--
	.319	--	--	--
	(0.923)	--	--	--
$\tilde{IG}$	0.393	0.413	0.298	0.418
	.271	.267	.216	.162
	(1.453)1	(1.547)	(1.376)	(2.585)**
R^2	0.9235	0.9126	0.9051	0.8965
F	8.047**	9.14***	10.899***	12.99***
DW	2.822	2.804	2.635	2.19
DF	15	15	15	15

t statistics same as in equation (4.6)'.

Table 4.3. Investment with expected inflation rate

	1	2	3	4
intercept	11.045	13.782	17.704	15.304
	10.933	9.009	5.98	3.474
	(1.01)	(1.53)	(2.96)	(4.405)***
$\hat{LO}^b$	1.49	2.419	3.025	2.442
	2.567	1.713	1.33	.631
	(0.581)	(1.412)	(2.274)	(3.868)***
$\tilde{w}$	0.192	0.081	0.315	--
	.83	.757	.673	--
	(0.232)	(0.107)	(0.505)	--
$\tilde{e}P_m^*$	0.62	0.474	--	--
	.879	.787	--	--
	(0.705)	(0.603)	--	--
π^e	-2.55	-2.121	-2.094	-2.232
	1.587	1.273	1.22	1.4
	(-1.606)	(-1.666)	(-1.716)	(-1.958)*
E^b	-0.848	-1.022	-1.108	-0.98
	.705	.584	.543	.46
	(-1.202)	(-1.75)	(-2.04)	(-2.131)*
$M \hat{-} K$	-5.692	-6.459	-7.124	-6.281
	3.088	2.551	2.207	1.381
	(-1.843)	(-2.53)	(-3.228)	(-4.547)***
D	-0.413	-0.526	-0.654	-0.538
	.607	.534	.471	--
	(-0.681)	(-0.985)	(-1.388)	(-1.366)
K	0.264	--	--	--
	.517	--	--	--
	(0.51)	--	--	--
$\tilde{IG}$	0.468	0.474	0.345	0.446
	.408	.385	.307	.222
	(1.149)	(1.23)	(1.122)	(2.011)*
R^2	0.827	0.8195	0.8102	0.8041
F	3.188	3.974	4.878**	6.158**
DW	3.099	3.099	2.985	2.731
DF	15	15	15	15

t statistics same as in equation (4.6)'.

Dropping capital stock variable did not remove the problem (equations 2) nor did the dropping of the intermediate imported input variable (equations 3). Finally, the problem was removed by dropping capital stock, real wage and the intermediate input variables (equations 4). Note that the F ratio in Table (4.3) equations 1 and 2 is not significant, also based on the described F test the excluded variables do not jointly affect the investment equation. Equations 4 in both tables can thus be used as a base for our conclusions. Both equations show that real bank loans have a significant, positive effect on the investment equation. Black market exchange rate, rate of depreciation, inflation and expected inflation have significant negative impact on private investment demand. Public sector investment variable is also significant and has a positive impact indicating the complementarity of private and public sectors investments. The real resources mobilized variable has a significant negative impact. This could be explained by the negative average rate of growth of gross fixed capital formation which was -4.7 during 80/86 (The UN National Account Statistics, 1989), also by 1981/82 domestic savings turned negative meaning all investment was financed either by transfers or by borrowing from abroad (The World Bank, 1985).

Finally, the dummy variable for the drought of 1984 has a significant negative impact on private sector demand. Although we were not able to see the effect of the other variables that were used to represent the opportunity cost of borrowing from the curb market, namely the wage rate and the imported intermediate inputs variables, because of multicolinearity, still the conclusion could be made on the basis of the real

bank loan inflation and the black market variables. The results show strong impact of financial market variables on private investment with quantity signals (real, credit to the private sector outstanding) of relevance in the regulated markets, and price signals (the black market exchange rate depreciation, the inflation rate and the real bank loans to the private sector which can be interpreted in both ways) in the unregulated curb market.

The price inflation equation

The use of the black market rate of depreciation in the right hand side of the price inflation equation may raise questions about the causality between the two. The rate of depreciation is expected to follow the trend of the domestic inflation (Blejer, 1978). This led to the use of the first difference of the rate of depreciation of the instrument of the black market exchange rate in equation (3.18). Rate of growth of the instrument of the real bank loan was also used in (3.18) as we indicated earlier. The results of fitting equation (3.18) are reported in Table 4.4. (The primary results of estimation of the inflation equation showed exports and government expenditure variables caused massive multicolinearity in the regression equation.) Dropping sequentially the variables with t ratio less than one on the basis of R^2 and the F test, the result for fitting the inflation equation (Table 4.4, equation 1) showed that the real bank loan to the private sector variables have strong negative impact on all equations. The wage variable, however, has a negative (wrong) sign. As we mentioned before this could

Table 4.4. The price inflation equation

	1	2	3
intercept	0.158	0.194	0.195
	.047	.014	.015
	(3.353)**	(13.557)***	(13.182)***
$\hat{LO}^b$	-0.532	0.628	-0.582
	.205	.165	.166
	(-2.591)**	(-3.813)***	(-3.515)***
$\hat{\tilde{w}}$	-0.469	-0.5323	-0.527
	.133	.106	.12
	(-3.518)	(-5.006)	(-4.812)***
$\hat{\tilde{e}}P_m^*$	0.074	0.102	--
	.089	.081	
	(0.83)	(1.256)	
$M \hat{-} K$	0.786	0.928	0.897
	.441	.396	.408
	(1.781)	(2.342)**	(2.199)*
$\hat{\tilde{G}}$	-0.404	-0.385	-0.413
	.22	.214	.22
	(-1.837)	(-1.799)	(-1.879)*
D	0.073	0.0926	0.065
	.058	.052	.049
	(1.242)	(1.785)	(1.344)
$\hat{K}$	-0.027	--	--
	.027		
	(-0.812)		
R^2	0.8974	0.8877	0.8656
F	8.744***	10.541***	11.591***
DF	14	14	14
DW	2.736	2.675	2.298

t statistics same as in equation (4.6)'.

be due to that, as has been the case in agriculture, output increases as wages go up. This could imply that it is more profitable for producers to increase wages--higher curb rate and higher cost--than to reduce output. This also implies that the overall effect is greater output. This result again implies that restrictions of credit to the private sector increase cost of production but not necessarily prices. The intermediate imported input variable has the expected positive effect but is insignificant in equations 1 and 2. The resources mobilized and the goverment expenditure variables appeared with significant positive and negative impacts, respectively, in equations 2 and 3. For the former, this could be due to the increasing borrowing and for ther latter, this could be a sign that public sector real investment dominates government real expenditure. Finally, the drought dummy appeared with an insignificant positive impact.

The real private sector loans variable and the sign of the imported intermediate input variable (equations 1 and 2 for the latter) seems to point to a stronger supply side, working capital cost-push inflation than to the demand-side, monetarist deflationary pull in the short run. In the long run, however, prices could go down, if other things remain equal, when aggregate demand go down as a result of monetary cutback (a direct impact on private sector investment here, and an indirect one on consumption through the reduction of output).

CHAPTER V. CONCLUSION

Stabilization programs supported by use of fund resources typically contain among other things limitations on domestic credit expansion to the private sector by the banking system. Through the combination of limitations on overall domestic and foreign credit, stabilization programs aim to contain overall credit expansion to a magnitude consistent with the balance of payments, growth, and price objectives (Keller, 1980). In the formulation of financial programs, attention has been focused primarily on the aggregate demand effects of the financial variables and their implications for balance of payments and prices.

The new structuralists argue that tight money forces many firms to turn to an underground curb market (where higher illegal interest rates are charged for loans) to finance their working capital needs. The normal business response would be to cut back on activity and attempt to pass increased costs through to higher prices. The argument, thus, then as stated by Taylor (1983) is that even if aggregate demand falls under monetary constraint, aggregate supply may fall by more so that eaxcess demand for commodities (demand minus supply) goes up. Further inflationary pressure results. The new structuralists contend that in the short run at least the 'working capital cost-push' effect may offset the monetarist effect.

The purpose of this study was, therefore, to test the new structuralist hypothesis in the Sudan through the use of a model that combines the monetarist and the new structuralist hypothesis. Specifically, the

output function is modelled as a function of the cost of capital stock as well as the costs of variable factor inputs inclusive of the curb market rate (credit effect on aggregate supply).

The curb market rate is also included in the private sector investment demand equation (standard monetarist effect on aggregate demand), a price inflation equation then is derived from the equilibrium of supply and demand where both monetarist and new structuralist effects work in the opposite directions. The econometric estimation thus answers the following questions:

1. How do monetary related variables affect supply?
2. How do monetary related variables affect demand?
3. Which of the two effects is stronger and thus has greater impact on the price inflation equation in the short run.

Given the limitations of the data base, e.g., small sample period, measurement error, etc., the results seem to indicate that monetary related variables do affect aggregate supply in a manner consistent with the new structuralist argument. They also seem to affect aggregate demand through the standard monetarist impact. The results also seems to suggest that in the short run the price inflation equation is dominated by the cost push inflation coming from the supply side. Another source of support for our findings is R. Hassan (1989), where his results suggest that total area cropped in the mechanized rainfed sector is highly responsive, particularly to the availability of short-term bank loans and the expected premium on holding foreign assets.

To conclude, we say that one of the main constraints imposed on stabilization policies through their effect on inflation and unemployment is the existence of unofficial credit markets in Sudan. The need for monetary reform and the building up of efficient economy-wide monetary intermediaries is of crucial importance if conventional macro policy is to play a major role in Sudan. In the absence of such reform, extreme monetary restraint, often advocated as the major component of stabilization policy, will defeat its purpose and do more harm than good.

The process of reform and institution-building is slow and gradual, however, and in the meantime it is important to beware of hasty transfers of theories and policies from developed institutional set-up to where they may be inappropriate.

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