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MILITARY EXPENDITURES AND ECONOMIC PERFORMANCE: LESSONS FROM THE ETHIOPIAN ECONOMY

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ABSTRACT

This paper examines the impacts of military expenditures on various sectors of the Ethiopian economy in general and on social programs (education and health expenditures) in particular. Unlike most similar studies, a medium-sized macroeconmetric model and a specific country data set are used to estimate the impacts of defence expenditures. The simulation results indicate that an increase in military expenditures adversely affect output growth and the current account balance. The results also show that there was a trade-off between military expenditures and social programs.

1. INTRODUCTION

1.1. Objective

Due to the significant increases in military expenditures in many LDCs, the impact of defence expenditures has attracted the attention of economists in recent years. In particular, this interest gained momentum following Benoit's 1978 conclusion regarding the relationship between defence spending and economic growth. In this study, Benoit (1978: 271) concluded that, '[c]ontrary to my expectations, countries with a heavy defence burden generally had the most rapid rate of growth, and those with the lowest defence burden tended to show the lowest growth rates'. This conclusion, according to Grobar and Porter (1989:318), '[s]hocked development economists by presenting positive cross-country correlations between military expenditure rates and economic growth rates in less developed countries (LDCs)'. Consequently, scrutiny of the methodology and the results of the study intensified. Specifically beginning the early 1980s, various studies have examined whether such an allocation of resources negatively affects the performance of the economies or not, and if so to what extent. Such studies include: Lim (1983), Frederiksen and Looney

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(1983), Nabe (1983), Faini, Annez and Taylor (1984), Deger (1986), Weede (1986), Gyimah-Brempong (1989a), Grobar and Porter (1989), Stewart (1991), Grobar and Gnanaselvam (1993), and Knight, Loayza, and Villanueva (1996), to name a few. These and most other similar studies are carried out using cross-section data (multi-country studies), and focus on the impact of military expenditures on economic growth.

But as Chan (1985: 35) in his survey of the literature noted, '[t]here are definite limits in the extent to which cross-sectional analyses of aggregate data can inform us about the complex causal interactions that characterise the relationship between military spending and economic performance'. That is, in addition to multi-country tests, country-specific interactions between defence spending and other economic aggregates are required. In contrast to most studies, therefore, this study has three main objectives: First, to examine the effect of military expenditures on output growth and other macroeconomic aggregates using a specific country data set; second, to asses possible trade-offs between military expenditures and social programs, especially expenditures on health and education; and the third, most important objective is to examine these issues in an integrated macroeconomic framework. Such an approach has two distinct advantages: First, using a specific country data set limits the prevalence of potentially offsetting interactions, as is usually the case in some cross-sectional analyses; second, examining the issue in an integrated macroeconomic framework helps identify the transmission mechanism and the impact of military expenditures on various sectors of the economy. Accordingly, this study uses a medium-sized macroeconometric model to address the above issues. The study is organised as follows: After giving descriptive background on the size of military expenditures in the next sub-section, a brief review of previous studies and an outline of the model used in this study are presented in the second section. And simulation and conclusions of the study are presented in the third and fourth sections, respectively.

1.2. The Relative Size of Military Expenditures in Ethiopia

Successive Ethiopian governments have played a significant role in the Ethiopian economy. This is particularly true beginning the mid-1970s, after the then new government adopted a 'socialist' economic development path. Following such policies, both the share of public expenditures in GDP and degree of intervention significantly increased. Public expenditures as a percentage of GDP increased from 13 percent in the 1960s to 34 percent in the 1980s. Such an expansion of government expenditures was taking place in the absence of any increases in government revenue. On average, government revenue only covered about 67 percent of total current government expenditures between 1975 and 1988. Consequently, the central government budget deficit as a percentage of GDP increased from a low of about 1 percent in the 1960s to

about 8 percent of GDP in the 1980s. By 1990 it reached 17 percent of GDP.

Ethiopia's military expenditures and arms imports as a percentage of GNP (see Fig. 1.1) were lower than the all-Africa average until 1974. Beginning 1975, however, both the level of military expenditures and the size of the armed forces significantly increased. By 1980, domestic military outlays (excluding foreign military aid) as a percentage of GNP reached 9.7 percent while the all-Africa average was only 2.9 percent. That is, over the decade (1971-1980), domestic military outlays in Ethiopia increased by 262.5 percent compared to only 3.6 percent for the all-Africa average. On the other hand, the respective growth rates in per capita GNP, during the same period, were 1.7 percent and 6.6 percent. This pattern of military expenditures continued during the 1980s. Ethiopian domestic military expenditures as a percentage of GNP averaged roughly twice that of the all-Africa average between 1981-1987[1] , while the average standard of living deteriorated (negative growth rate of per capita GNP) in both Ethiopia and in all of Africa on average.

Figures 1.1 and 1.2 also indicate a similar picture regarding the level and changes in military expenditures in Ethiopia relative to the all-Africa average. Military expenditures as a percentage of the central government budget (Fig.1.2) and arms imports as a percentage of total exports (Fig. 1.3) have been higher in Ethiopia than the all-Africa average. This is probably because Ethiopia had a well-established domestic army while most of the rest of African countries were under colonial rule. Consequently, Ethiopian domestic military expenditures as a percentage of the central government budgets were almost twice the all-Africa average between 1971 and 1974. After 1974, military expenditures as percentage of the central government budget dramatically increased in Ethiopia relative to the all-Africa average. By 1987, it increased to 24 percent while for all-Africa it was only 13.1 percent. Compared to 1974, this represents an increase of 72.6 percent and 18 percent, respectively. Similarly, between 1974 and 1987, arms imports as a percentage of total exports averaged 13.2 percent per annum for all-Africa, while that of Ethiopia reached 158 percent of its total exports. Given that the main source of foreign exchange is export earnings and the scarcity of foreign exchange, such an allocation of resources suggests a high opportunity cost in terms of, say, forgone imports of intermediate inputs.

In addition to the material resources allocated for military purposes, the size of the Ethiopian armed forces also grew between 1971 and 1987. As shown in Figure 1.4, between 1976 and 1987, the size of the armed forces per 1000 inhabitants in Ethiopia was twice the size of the all-Africa average.

The extent to which military expenditures in Ethiopia were much higher than for the

[1] Editor's Note: Just before the 1998 Ethio-Eritrean conflict, this figure has considerably declined to around 2% of GDP.

all-Africa average is more apparent from Table 1.1. The level of Ethiopian GNP per capita averaged about 17 percent of the all-Africa average per annum between 1971 and 1987. But during the same period, domestic military outlays as a percentage of GNP and as a percentage of central government budget, arms imports as a percentage of total exports, and armed forces per 1000 inhabitants averaged 164, 202, 1643, and 154 percent of the all-Africa average, respectively. When military outlays as a percentage of GNP and as a percentage of central government budget are weighted by relative GNP per capita (Ethiopian values relative to the all-Africa average), the respective Ethiopian outlays were 947 and 1172 percent of the all-Africa average. That is, for equivalent GNP per capita Ethiopia was allocating 9.5 dollars, on average, for military purposes for every dollar allocated by the all-Africa average.

Due to the severity of the internal conflict, therefore, Ethiopia allocated more resources, both human and material, for military purposes than the average for all of Africa. Clearly, this significantly contributed to both the overall public expenditures and hence the total government debt directly. Given that most of the military equipment was imported, and therefore competing for scarce foreign exchange resources that could be used to import intermediate inputs, what was the impact of such an allocation on the growth of output? Further, how did such a big increase in military expenditures affect various sectors of the economy? And was there a trade-off between defence expenditures and social programmes?

MILITARY EXPENDITURES AS A PERCENTAGE OF GNP: ETHIOPIA AND ALL AFRICA

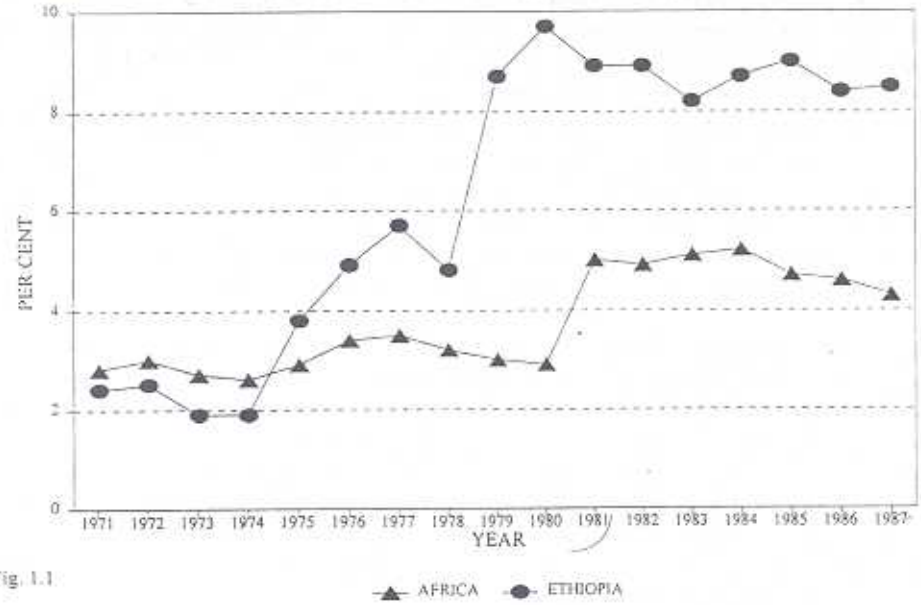

Fig. 1.1

MILITARY EXPENDITURE AS PERCENTAGE OF CENTRAL GOVERNMENT OUTLAYS

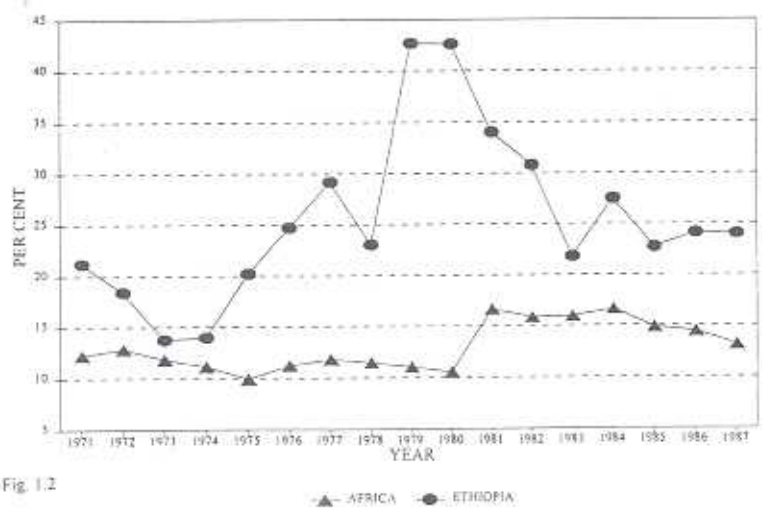

Fig. 1.2

ARMS IMPORTS AS PERCENTAGE OF TOTAL EXPORTS

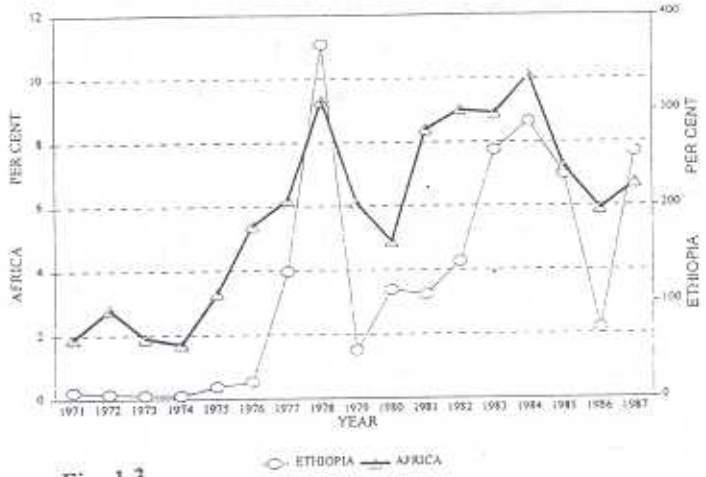

Fig. 1.3

ARMED FORCES PER 1000 INHABITANTS:
AFRICA AND ETHIOPIA

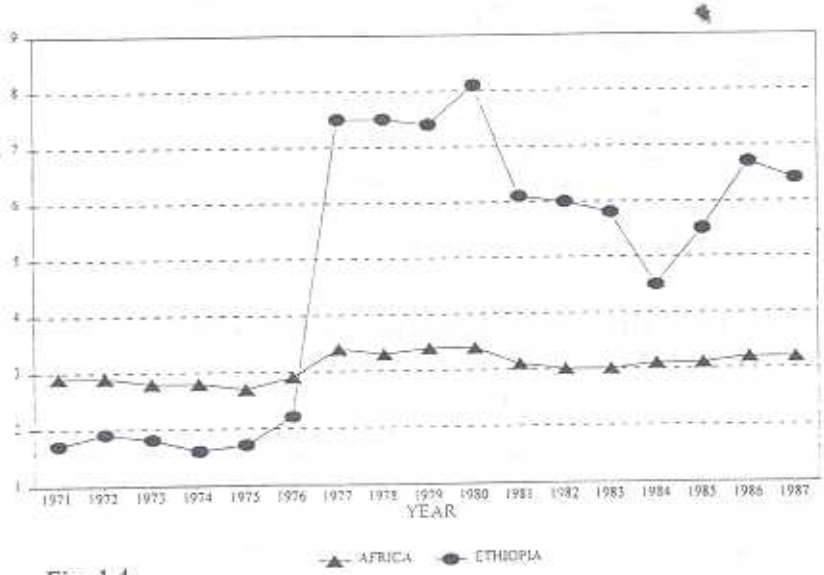

Fig. 1.4

Table 1.1. Military Outlays Relative to the All-Africa Average

ETHIOPIAN GNP PER CAPITA, MILITARY EXPENDITURES CENTRAL GOVERNMENT EXPENDITURE, ARMS IMPORTS AS A % OF TOTAL EXPORTS AND ARMED FORCES PER 1000 INHABITANTS RELATIVE TO TOTAL AFRICAN AVERAGE (%)							
YEAR	1	2	3	4	5	6	7
1971	18	86	471	955	174	59	416
1972	18	83	451	778	144	66	207
1973	18	70	383	631	116	64	211
1974	17	73	433	742	125	57	218
1975	17	131	774	1205	204	63	385
1976	16	144	887	1357	221	76	328
1977	16	163	999	1518	247	221	2135
1978	16	150	949	1277	202	227	3978
1979	16	290	1793	2400	388	218	823
1980	17	334	1912	2319	406	238	2306
1981	18	178	1014	1167	205	197	1286
1982	18	182	1001	1075	195	200	1583
1983	19	161	843	719	137	193	2907
1984	18	167	908	899	166	145	2852
1985	17	191	1149	920	153	177	3235
1986	17	183	1053	965	167	209	1231
1987	18	198	1078	999	183	200	3827
Average	17	164	947	1172	202	154	1643

Formula: (i) relative measure - (value / value)*100; (ii) GNP per capita weighted measures - (value/value)*(GNP^A/GNP^E)*100, where superscripts A and E represent total Africa and Ethiopia, respectively and GNP is GNP per capita.

1. Relative GNP per capita.
2. Relative domestic military outlays to output ratio.
3. Relative domestic military outlays to output ratio weighted by GNP per capita.
4. Relative domestic military outlays to total central government budget weighted by GNP per capita.
5. Relative domestic military outlays to total central government budget.
6. Relative armed forces per 1000 inhabitants.
7. Relative arms imports as a ratio of total exports.

2. THE IMPACT OF CHANGES IN MILITARY EXPENDITURES

2.1. A Brief Review of Previous Studies

As stated earlier, despite various efforts, the answer to the above stated questions and the overall evidence regarding the net impact of military spending on economic growth to date is mixed, at best. For instance, among the above cited studies, Benoit (1978), Frederiksen and Looney (1983), Weed (1986), and Stewart (1991) concluded, using a single equation model and a multi-country data, that there is a positive and, in many cases significant, relationship between defence spending and economic growth. The main arguments given to defend these results are based on the familiar

Keynesian explanations and technological spin-offs. That is, an increase in military expenditures leads to an increase in demand and hence to an employment of otherwise idle resources. Further, since the military sector is more modernised relative to other sectors in LDCs, this will lead to an increase in skill level and other positive externalities to the economy at large. Studies by Lim (1983), Faini, Annez and Taylor (1984), Deger (1986), Gyimah-Brempong (1989a), Grobar and Porter (1989), and Knight, Mohammed and Suleiman (1994), Loayza and Villanueva (1996) on the other hand, indicate negative relationship between military expenditures and economic growth. According to the last set of studies, the main reason why economic growth and defence spending are negatively related is due to the opportunity cost of allocating scarce government resources for military purposes, instead of say for investment and other foreign exchange-starved sectors.

Among the above cited studies, that of Nabe (1983), Gyimah-Brempong (1989a) and Mohammed and Suleiman (1994) deserve special attention due to their focus on the African economies. The first two studies used cross-sectional data of African countries. The methodologies used, sample period and country coverage, however, differ. Nabe (1983) used co-variation and path analysis to test the relationship between military expenditures and economic development over the sample period 1967 to 1976. On the basis of pooled data of 26 African countries, Nabe (1983: 584) concluded that, '[t]here is a repeated absence of co-variation between military expenditures and economic development...[therefore] the weight of our statistical evidence is contrary to the proposition that military expenditures have a positive effect on development'. Gyimah-Brempong's study is extensive both in terms of country coverage (39 African countries) and the length of sample period (1973 to 1983) as compared to that of Nabe (1983). Gyimah-Brempong (1989a) estimated a four-equation simultaneous model using the three stage least square method with defence burden (military expenditures to GDP ratio) as one of the explanatory variables. His results indicate that a unit increase in military expenditures would have a negative multiplier impact of 0.12 on GDP. Gyimah-Brempong (1989a: 79), therefore concluded that, '[t]he implication of this result is that African countries cannot use increased defence spending to simulate economic growth because there is a trade-off between high defence burden and economic growth'.

Studies that have examined the trade-offs between military expenditures and social programs are relatively limited, particularly in the less developed countries. In the African context, Gyimah-Brempong (1989b) examined a possible trade-off between defence spending and social expenditures (expenditures on education, health, housing and other social services) using a utility maximisation model and three stage least square estimation technique. His study covered 20 Tropical African countries over a 10-year period (1973-1983). The estimated results indicate that there is a significant budgetary trade-off between military and social expenditures. That is, an

increase in military expenditures negatively affects spending on social programmes. Similarly, Mohammed and Suleiman (1994) examined the same issue as applied to the case of Ethiopia using simple correlation and a regression equation. Their findings indicate that there was indeed a negative relationship between defence expenditures on the one hand and education and health expenditures on the other.

2.2. Model Specification: Basic Attributes

In addition to the relevant identities and definitions, the basic model[1] used to examine these issues contains twenty-two behavioural equations pertaining to four sectors of the economy. These sectors include: output supply, labour demand, domestic aggregate demand and external sectors. Within the aggregate demand category, government expenditure is disaggregated into total expenditures, expenditures on education and expenditures on health services. Military expenditure as ratio of GDP is one of the explanatory variables in the equations for health and education expenditures. Another equation is also specified for arms imports as one of the components of import demand to account for possible trade-offs between military and non-military imports.

In broad terms, the model is specified along the lines of the structuralist hypothesis in which supply constraints dominate economic activity. For instance, due to the importance of resource constraints on the supply side of the economy, an effort is made to incorporate the role of capital and intermediate inputs on output supply. In brief, consistent with the dominance of supply constraints and the subsistence level of the economy, the workings of the model are structured as follows: Export earnings are the main sources of foreign exchange (capacity to import), which determines the level of imported inputs (both military and non-military goods). The level of imported production inputs determines the level of capacity utilisation, which in turn determines actual output directly and via its impact on the utilisation of domestic inputs indirectly. The level of output, in conjunction with government policy in the financial sector, determines both the level and the composition of aggregate demand. As the military government increased its defence expenditures, therefore, it is likely to affect the level of aggregate demand and alter its composition as well. The role of aggregate demand is to determine the allocation of available output between its various components. This allocation will influence and be influenced by the behaviour of the financial sector, and will determine the external balance via patterns of expenditure (domestic goods vs. imports), growth (consumption vs. investment) and hence will indirectly influence output.

The main data sources used to estimate the model are various official publications of international agencies, and published and unpublished government reports. Where choice is available, however, data from international agencies are used to maintain consistency in updating and facilitating comparisons over time. The primary data

sources include: International Financial Statistics, Government Financial Statistics, and Balance of Payments Yearbook published by the International Monetary Fund; Yearbook of National Income Statistics and World Tables published by the United Nations. Additional data from the National Bank of Ethiopia and the Ethiopian Statistical Office were also used to supplement the international data sources.

3. ESTIMATION AND SIMULATION RESULTS

To estimate[1] the impact of military expenditures on various sectors of the economy in general and social programs in particular, the basic model is re-simulated by incorporating the following changes: (1) real military expenditures are kept at 1973 level and any deviation from this level is treated as additional injection to the supply of non-military goods and services; and (2) the size of the armed forces is also kept at its 1973 level, and the additional members of the armed forces are included as part of the total labour force[2]. The main objective of the policy design is then to answer the question of how the economy would have performed had the government kept its military expenditures and the size of its armed forces at their 1973 level. It should be noted that the per capita GNP weighted military expenditures, as ratios of GNP and total central government budget, were much higher in Ethiopia relative to the all-Africa average even in 1973. An increase in military expenditures above the 1973 level, therefore, should suggest that military expenditures in Ethiopia was excessive, on a GNP per capita basis, even by African standards, which are considered relatively high.[3]

A positive increase in any endogenous variable as a result of the incorporated changes would indicate that the increase in military expenditures after 1974 had a negative impact on the endogenous variables concerned. A comparison of the basic simulation (control run) and the results obtained after incorporating the above changes are summarised in Tables 1.2 to 1.4.

As can be seen from Table 1.2, a reduction in military expenditures and the size of the armed forces would have increased, on average, total output (RY) and sectoral outputs (agricultural output - RAO, and manufacturing output - RMO). Consequently, private consumption (RC) and investment expenditures (RI), in Table 1.3, would have also increased. For instance, manufacturing output, agricultural output and total output would have increased, over the sample period, by about 0.3, 0.1 and 0.75 percent per annum, respectively, if the size of the armed forces and the ratio of military expenditures to total output had been maintained at their 1973 levels. Private consumption and investment would also have increased by 0.75 and 0.6 percent,

[1] Editor's Note: Estimation of model parameters using the new time series approach is not carried out owing to shortage of longer series. Since the model is used for simulation purpose, the model's weakness in this respect is openly acknowledged and considered not to be detrimental.

respectively. This is because reductions in military expenditures and the size of the armed forces affect the output sector by increasing the capital available for investment purposes and adding to the labour force engaged in production. It is worth noting that the increases in output due to an increase in the labour force, both expressed as per unit of capital, are modest. This indicates that labour shortage is not a serious problem for such economies.

With regard to the possible trade-off between military expenditures and social programs, both expenditures on education and health (as ratios of GDP) would have been higher if military expenditures had been kept at the 1973 level. Due to the negative relationship between military expenditures and expenditures on education and health, military expenditures were increased at the expense of social programs (education and health, in this case). As indicated in Table 1.3, expenditures on education (RGEE) and on health (RGEH) would have increased, on average, by about 94.1 percent and 86.5 percent, respectively, over the simulation period. The significant portion of the increase in military expenditures could not be financed without sacrificing other government programs, especially programs with relatively large budget shares like education and health.

Table 1.2. The Impact Of Defence Expenditures

The Impact of Reductionsin Military Expenditures							
Deviations From Control Run - %							
YEAR	CUR	RAO	RMO	RY	IT	RMCD	RMCND
1973	-0.02	0.00	0.25	-0.03	-0.22	0.00	0.00
1974	-0.01	0.02	0.29	0.06	-0.05	-0.01	0.00
1975	0.21	0.02	0.39	0.34	1.93	0.01	0.00
1976	0.07	0.05	0.20	0.32	0.73	0.10	0.01
1977	0.25	0.11	0.49	0.90	2.25	0.13	0.01
1978	0.99	0.11	0.98	1.76	8.21	0.29	0.02
1979	0.75	0.12	0.32	1.50	6.82	0.61	0.04
1980	0.53	0.11	0.26	1.20	5.44	0.67	0.04
1981	0.23	0.11	0.11	0.81	3.31	0.55	0.04
1982	0.17	0.11	0.26	0.71	2.59	0.40	0.03
1983	0.19	0.08	0.26	0.56	2.37	0.31	0.02
1984	0.08	0.12	0.20	0.54	1.42	0.25	0.02
1985	0.21	0.15	0.25	0.73	2.24	0.22	0.02
1986	0.49	0.14	0.30	0.97	3.81	0.27	0.02
1987	0.50	0.17	-0.05	0.95	3.85	0.37	0.02
Average	0.31	0.09	0.30	0.75	2.98	0.28	0.02

Table 1.3. The Impact of Defence Expenditures

The Impact Of Reductions In Military Expenditures							
Deviations From Control Run - %							
Deviations From Control Run - %							
YEAR	RC	RI	RGEE	RGEH	RG	P	RXCOF
1973	-0.02	-0.10	-0.56	4.52	-0.02	0.18	-0.08
1974	0.06	0.00	7.20	11.61	0.02	0.11	-0.05
1975	0.31	0.92	14.30	18.04	0.13	-1.54	0.71
1976	0.30	0.21	21.43	24.45	0.09	-0.46	0.21
1977	.87	.17	44.45	44.81	0.18	-1.74	0.80
1978	1.74	1.11	90.13	84.08	0.23	-7.51	3.33
1979	1.52	1.01	128.36	116.02	0.07	-6.58	2.94
1980	1.23	0.50	143.57	128.52	0.03	-5.32	2.40
1981	0.81	0.35	137.58	123.60	0.07	-3.07	1.40
1982	0.70	1.07	138.82	124.63	0.10	-2.28	1.05
1983	0.56	0.65	136.62	122.82	0.06	-2.17	1.00
1984	0.52	0.52	140.03	125.62	0.10	-1.09	0.51
1985	0.70	0.37	134.44	121.03	0.14	-1.81	0.83
1986	0.97	0.52	133.70	120.42	0.10	-3.52	1.61
1987	0.93	0.41	141.94	127.18	0.13	-3.43	1.57
Average	0.75	0.58	94.13	86.49	0.10	-2.68	1.22

where:

RC	= real private consumption
RI	= real investment expenditures
RGEE	= real government expenditures on education to output ratio
RGEH	= real government expenditures on health to output ratio
RG	= real government expenditures
P	= domestic consumer price index - 1985=100
RXCOF	= real exports of coffee

Table 1.4. The Impact of Defence Expenditures

The Impact Of Reductions In Military Expenditures							
Deviations from Control Run - %							
YEAR	RX	RXHK	RXOSN	RMNT	RGUN	RMFL	CA
1973	-0.03	-0.18	-0.22	0.25	0.00	-9.76	6.88
1974	-0.02	-0.11	-0.14	0.32	-66.47	-18.55	136.63
1974	-0.02	-0.11	-0.14	0.32	-66.47	-18.55	136.63
1975	0.26	1.53	1.87	0.38	-74.50	-25.38	-58.30
1976	0.08	0.46	0.56	-0.08	-89.16	-31.30	824.03
1977	0.30	1.72	2.11	0.40	-97.12	-45.79	157.64
1978	1.25	7.03	8.55	0.53	-97.12	-62.74	158.17
1979	1.10	6.22	7.57	1.30	-97.63	-70.99	154.43
1980	0.89	5.09	6.20	1.02	-97.39	-73.44	186.47
1981	0.52	3.00	3.66	-0.86	-97.39	-72.53	197.42
1982	0.39	2.25	2.75	-0.23	-97.39	-72.73	202.45
1983	0.37	2.14	2.61	-0.15	-95.51	-72.39	-2416
1984	0.19	1.09	1.33	-0.14	-97.39	-72.92	212.41
1985	0.31	1.79	2.19	0.08	-98.45	-72.03	126.70
1986	0.60	3.43	4.18	0.08	-98.45	-71.91	150.82
1987	0.58	3.34	4.08	0.48	-98.84	-73.20	134.35
Average	0.45	2.59	3.15	0.22	-86.86	-56.38	11.58

where:

RX = total real exports
RXHK = real exports of hides and skins
RXOS = real exports of oil seeds & nuts
RMNT = real imports of intermediate inputs
RGUN = real arms imports
RMFL = real imports of fuel and lubricants
CA = current account balance

As can be seen from Table 1.2, a reduction in military expenditures and the size of the armed forces would have increased, on average, total output (RY) and sectoral outputs (agricultural output - RAO, and manufacturing output - RMO). Consequently, private consumption (RC) and investment expenditures (RI), in Table 1.3, would have also increased. For instance, manufacturing output, agricultural output and total output would have increased, over the sample period, by about 0.3, 0.1 and 0.75 percent per annum, respectively, if the size of the armed forces and the ratio of military expenditures to total output had been maintained at their 1973 levels. Private consumption and investment would also have increased by 0.75 and 0.6 percent, respectively. This is because reductions in military expenditures and the size of the armed forces affect the output sector by increasing the capital available for investment purposes and adding to the labour force engaged in production. It is worth noting that the increases in output due to an increase in the labour force, both expressed as per unit of capital, are modest. This indicates that labour shortage is not a serious problem for such economies.

With regard to the possible trade-off between military expenditures and social programs, both expenditures on education and health (as ratios of GDP) would have

been higher if military expenditures had been kept at the 1973 level. Due to the negative relationship between military expenditures and expenditures on education and health, military expenditures were increased at the expense of social programs (education and health, in this case). As indicated in Table 1.3, expenditures on education (RGEE) and on health (RGEH) would have increased, on average, by about 94.1 percent and 86.5 percent, respectively, over the simulation period. The significant portion of the increase in military expenditures could not be financed without sacrificing other government programs, especially programs with relatively large budget shares like education and health.

Further, a reduction in arms imports (RGUN in Table 1.4) in the mid-1970s would have had a significant positive impact on the current account balance. The current account balance (CA in Table 1.4) would have improved by about 11.6 percent, on average, if the government had kept its military expenditures at its 1973 level. This result probably is not surprising since most of the arms, vehicles and other related army requirements are imported. More specifically, a reduction in military expenditures would have decreased arms imports and imports of fuel (RMFL in Table 1.4) by 86.9 and 56.4 percent per annum, respectively, while all exports would have slightly increased on average, over the simulation period. The increase in exports is due to an increase in excess supply, which reduces the supply and demand gap, which in turn decreases domestic prices leading to an increase in the real exchange rate (depreciation).

It should be noted that due to the differences in modelling approaches and the data set used, one cannot directly compare the quantitative magnitudes reported in this studies with most of the studies reviewed earlier. One of the few exceptions to this approach is the study by Grobar and Gnanaselvam (1993) which examined the effects of defence spending on the Sri Lankan economy. Using Sri Lankan data from 1960 to 1988, they estimated the effect of military spending on investment. On the basis of their estimates, Grobar and Gnanaselvam (1993: 403) concluded that, given a fixed incremental capital-output ratio (ICOR) of 2.5, a 3.8 percentage point increase in military spending would lead to a 5.5 and 2.2 percentage points decline in investment to GDP ratio and in GDP, respectively. Clearly, the results obtained in this study are qualitatively similar to that of Sri Lanka, and the impact of military spending on the growth of output, in particular, is of the same order of magnitude. Further, In terms of broad qualitative indicators, the results of this study are consistent with the studies that found a negative relationship between military expenditures and economic growth and with those that found a trade-off between defence spending and social programs. This is particularly true in the case of studies that used African data exclusively. Of particular interest in this regard is the study by Mohammed and Suleiman (1994) who used Ethiopia as a case study. Even though their approach is slightly different than the one used in this study, their results are consistent with the

above reported results. More specifically, they indicate that a unit increase in defence expenditures leads to about 13 and 3 percent decrease in education and health expenditures, respectively. Military expenditures in Ethiopia exceeded that of African average by a wide margin, particularly since the mid-1970s, while its GDP per capita and its growth were among the lowest in the continent. It is not surprising, therefore, that military expenditures in an economy with limited resources would have an adverse effect on economic growth and a significant trade-off in terms of other social programs.

4. CONCLUSION

The comparative actual data and the simulation results indicate that military expenditures in Ethiopia negatively affected the performance of the economy. In summary, the results of this study indicate that an increase in military expenditures decreased total and sectoral outputs, components of aggregate domestic demand, expenditures on education and health (indicating the existence of a budgetary trade-off), increased arms imports, and worsened the current account balance.

The policy implications of the above results are obvious. To the extent that military expenditure adversely affect economic performance, at least in the least developed countries, governments may have to rearrange resource allocation priorities away from defence expenditures. This is particularly essential in countries like Ethiopia where military expenditures increased at the expense of investment in human capital (education) and health facilities. Whatever the noneconomic arguments might be, the results of this study and many others indicate the high opportunity cost of military expenditures. Such expenditures, therefore, cannot be justified on the grounds of stimulating aggregate demand since such expenditures lead to direct budgetary trade-offs and create supply bottlenecks by competing for the scarce foreign exchange resources.

Unavailability of data preclude projecting the likely economic impacts of the pending an all out Ethio-Eritrean war, but it is likely to have a significant negative effect on both economies which just started some signs of recovery from years of devastation. Preliminary evidence supports this conjecture as there is already a significant shift in allocation of resources to the war effort at the expense of productive use of such resources.

NOTES

[1] For brevity, model structure, estimates and their statistical attributes are not given in the annex. Interested readers could obtain the complete model by contacting the author.

[2] Including the excess military personnel into the labour force may seem to contradict the common assumption of excess supply of labour in such economies. But since most of the people called for military service were the most productive members of the work force and whatever underemployment that might have existed was adjusted by capacity utilisation, any additional recruitment for military service should represent a decrease in the effective labour force - especially in the non-agricultural sector.

[3] For instance, according to Sivard (1985:14), military expenditures as a percentage of GNP for Latin American countries was only 1.32 percent of GNP, which is lower than the all-Africa average.

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ANNEX: THE MODEL

The model specified and estimated results are reported below. This will serve as a supplement to the paper. This is one version of the model used in forecasting (simulating) the results included in the paper. Additional equations and other versions are also available (can be obtained for the author) but do not change the basic results.

A1. MODEL ESTIMATION

A1.1. SYSTEMS ESTIMATION (2SLS)

EXOGENOUS VARIABLES: COFPI, D1, MP, MPI, POP, RF, RFR, RGR, RMILEX1, RMS, RTGB, RWR, T, WWPI, WY, XPI, XPK.

A1.1.1. OUTPUT SUPPLY

$$\ln\left(\frac{RY}{RFCA}\right) = \underset{(24.01)}{6.01} + \underset{15.5}{0.79}\ln\left(\frac{STR}{RFCA}\right) - \underset{(3.3)}{0.19}D_1 \qquad [1]$$

$$\bar{R}^2 = 0.94 \quad DW = 0.57 \quad \rho = 0.88 \quad SSE = 0.08 \quad \bar{Y} = 1.78$$

$$Ln(CUR) = \underset{(0.14)}{0.31} + \underset{(2.51)}{0.26}Ln\left(RMNT/RMO_{-1}\right) + \underset{(2.66)}{0.12}Ln\left(RMS/RY\right)_{-1} + \qquad [2]$$

$$+\underset{(3.08)}{0.48}Ln(CUR_{-1}) - \underset{(4.72)}{0.75}$$

$$R^{-2} = 0.82 \quad D.H. = 0.49 \quad SSE = 0.09 \quad \bar{Y} = 0.10$$

$$Ln(RAO) = \underset{(8.16)}{6.10} + \underset{(8.38)}{1.26}Ln(LAFI) + \underset{(4.68)}{0.07}Ln(RF_{-1}) - \underset{(5.73)}{0.04}T \qquad [3]$$

$$R^{-2} = 0.75 \quad D.W. = 1.6 \quad \rho = 0.13 \quad SSE = 0.21 \quad \bar{Y} = 8.80$$

$$Ln(RMO) = \underset{(2.19)}{1.84} + \underset{(2.69)}{0.46}\, Ln(LM) + \underset{(2.17)}{0.26}\, Ln(RMNT) + \underset{(4.45)}{0.44}\, Ln(RFCA) \quad [4]$$

$R^{-2} = 0.51$ D.W. = 0.85 $\rho = 0.71$ SSE = 0.21 $\bar{Y} = 7.2$

$$Ln(RC) = \underset{(1.55)}{0.52} + \underset{(25.93)}{0.92}\, Ln(RDY) + \underset{(1.2)}{0.01}\, Ln(RC_{-1}) \quad [5]$$

$R^{-2} = 0.97$ D.h. = 2.1 SSE = 0.02 $\bar{Y} = 9.29$

$$Ln(RMCD) = \underset{(6.35)}{3.02} + \underset{(4.71)}{0.26}\, Ln\left(\left(RDY_{-1} + RDY_{-2}\right)/2\right) - \underset{(1.72)}{0.70}\, Log\left(MPI/P\right) - \underset{(1.22)}{0.02}\, T$$

$R^{-2} = 0.31$ D.W. = 2.7 SSE = 2.65 $\bar{Y} = 5.00$

$$Ln(RMCND) = \underset{(20.65)}{5.08} + \underset{(0.61)}{0.02}\, Ln(RDY_{-1}) - \underset{(7.09)}{1.49}\, Ln\left(MPI/P\right) + \underset{(5.44)}{0.04}\, T \quad [7]$$

$R^{-2} = 0.70$ $D.W. = 1.6$ $\rho = 0.15$ $SSE = 0.71$ $\bar{Y} = 5.73$

$$IT = \underset{(4.96)}{-173.76} + \underset{(6.40)}{0.09}\, Y + \underset{(3.13)}{3.11}\, ETI$$

$R^{-2} = 0.98$ $D.W. = 1.5$ $R^{-2} = 0.98$ $D.W. = 1.5$ [8]

$\rho = 0.25$ $SSE = 35690$ $\bar{Y} = 589.05$

$$Ln(RG) = \underset{(4.35)}{4.97} + \underset{(0.14)}{0.00}\Delta Ln(RY) + \underset{(2.00)}{0.33}Ln(RIT) + \underset{(4.75)}{0.02}T \qquad [9]$$

$$R^{-2} = 0.70 \quad D.W. = 1.8 \quad SSE = 0.11 \quad \bar{Y} = 7.55$$

$$Ln(RGEE) = \underset{(21.15)}{3.47} - \underset{(10.23)}{0.44}Ln(RMILEX) + \underset{(4.33)}{0.04}\Delta Ln(RY) + \underset{(1.05)}{0.58}D1 \qquad [10]$$

$$R^{-2} = 0.82 \quad D.W. = 2.20 \quad SSE = 0.35 \quad \bar{Y} = 1.75$$

$$Ln(RGEH) = \underset{(19.38)}{2.13} - \underset{(13.98)}{0.38}Ln(RMILEX) + \underset{(2.53)}{0.03}\Delta Ln(RY) + \underset{(7.05)}{0.48}D1 \qquad [11]$$

$$R^{-2} = 0.91 \quad D.W. = 2.30 \quad SSE = 0.16 \quad \bar{Y} = 0.62$$

$$Ln(RI) = \underset{(10.55)}{4.39} - \underset{(3.20)}{0.29}Ln(RER) + \underset{(7.38)}{0.51}Ln(RFCAI_{-1})$$

$$+\underset{(8.22)}{0.64}\Delta Ln(RY) + \underset{(2.29)}{0.08}\Delta Ln(P) \qquad [12]$$

$$R^{-2} = 0.77 \quad D.W. = 1.6 \quad \rho = 0.20 \quad SEE = 0.22 \quad \bar{Y} = 7.39$$

$$Ln(P) = \underset{(3.56)}{0.71} - \underset{(3.84)}{0.05}RGAP_{-1} + \underset{(7.58)}{0.70}Ln(MPI) + \underset{(1.91)}{0.09}Ln(P_{-1}) \qquad [13]$$

$$R^{-2} = 0.95 \quad D.h. = 2.20 \quad SSE = 0.09 \quad \bar{Y} = 3.80$$

EXTERNAL SECTOR

$$Ln(RX) = 3.20 + 1.37\,Ln(WY) - 0.63\,Ln(XPI) + 0.17\,Ln(RER) \quad [14]$$
(3.88) (5.55) (7.63) (2.56)

$R^{-2} = 0.76$ $D.W. = 1.5$ $\rho = 0.23$ $SSE = 0.12$ $\bar{Y} = 6.80$

$$Ln(RXCOF) = 3.52 + 0.65\,Ln(WY) + 0.10\,Ln(XPK) \quad [15]$$
(1.92) (1.47) (2.41

$$+ 0.28\,Ln(RER) - 0.12\,Ln(COFPI)$$
(1.98) (1.58)

$R^{-2} = 0.37$ $D.W. = 2.1$ $SSE = 0.56$ $\bar{Y} = 6.28$

$$Ln(RXHK) = -8.67 + 4.04\,Ln(WY) - 1.38\,Ln(XPI) + 1.01\,Ln(RER) \quad [16]$$
(2.66) (4.15) (4.23) (3.77)

$R^{-2} = 0.46$ $D.W. = 1.18$ $\rho = 0.32$ $SSE = 1.9$ $\bar{Y} = 4.68$

$$Ln(RXOSN) = -5.68 + 2.30\,Ln(WY) - 0.04\,Ln(XPI) + 1.28\,Ln(RER) \quad [17]$$
(1.79) (3.05) (8.27) (4.97)

$R^{-2} = 0.90$ $D.W. = 1.6$ $\rho = 0.21$ $SSE = 2.00$ $\bar{Y} = 3.71$

$$Ln(RMNT) = 6.13 + 0.20\,Ln(RMO) - 0.55\,Ln\left(MPI/P\right)$$

(4.40) (0.94) (4.76

$$-0.27\,Ln(RFCA_{-1}) + 0.32\,Ln(RX_{-1}) \qquad [18]$$

(2.94) (3.72)

$$R^{-2} = 0.50 \;\; D.W. = 1.70 \;\; SSE = 0.14 \;\; \bar{Y} = 7.76$$

$$Ln(RMFL) = 1.26 + 0.06\,Ln(RDY_{-1}) - 0.88\,Ln\left(MPI/P\right) + 0.60\,Ln(RMILEX1)$$

(2.91) (1.28) (3.12) (6.64) [19]

$$R^{-2} = 0.87 \;\; D.W. = 2.20 \;\; SSE = 2.50 \;\; \bar{Y} = 6.11$$

$$Ln(RGUN) = 12.02 + 2.32\,Ln(MP) - 1.23\,D1$$

(11.64) (7.14) (2.27) [20]

$$R^{-2} = 0.74 \;\; D.W. = 1.50 \;\; \rho = 0.20 \;\; SSE = 12.09 \;\; \bar{Y} = 5.14$$

IDENTITIES AND DEFINITIONS

RY	= RRY*RFCA	(24)
Y	= (RY*P)/100	(25)
OY	= Y - AO - MO	(26)
AO	= (RAO*P)/100	(27)
MO	= (RMO*P)/100	(28)
STR	= STR1*CUR	(29)
RFCA	= (RFCA1/CUR)	(30)
FCA	= (RFCA*P)/100	(31)
RDY	= RY - RIT	(32)
RIT	= (IT*100)/P	(33)
DY	= Y - IT	(34)
DC	= PC - MCD - MCND	(35)
PC	= (RC*P)/100	(36)
MCD	= (RMCD*P)/100	(37)
MCND	= (RMCND*P)/P	(38)
I	= (RI*P)/100	(39)
ROG	= RG - RGEE1 - RGEH1 - RMILEX1	(40)
RGEE1	= RGEE*RY	(41)
RGEH1	= RGEH*RY	(42)
GEE	= (RGEE1*P)/100	(43)
GEH	= (RGEH1*P)/100	(44)
OG	= (ROG*P)/100	(45)
G	= GEE + GEH + MILEX + OG	(46)
X	= (RX*XPI)/100	(47)
OX	= X - XCOF - XHK - XOSN	(48)
XCOF	= (RXCOF*COFPI)/100	(49)
XHK	= (RXHK*XPI)/100	(50)
XOSN	= (RXOSN*XPI)/100	(51)
TX	= XCOF + XHK + XOSN + OX + GR	(52)
TM	= MCD + MCND + MNT + MFL + GUN + OM	(53)
MNT	= (RMNT*MPI)/100	(54)
MFL	= (RMFL*MPI)/100	(55)
GUN	= (RGUN*MPI)/100	(56)
MT	= TM - GUN	(57)

AP	= MPI/P	(58)
RER	= (EXR*WWPI)/P	(59)
Y1	= PC + G + I + TX - TM	(60)
GAP	= Y - Y1	(61)
RGAP	= (GAP/P)*100	(62)
CA	= TX - TM	(63)

LIST AND DEFINITIONS OF VARIABLES

N.B: all real variables are in 1985 prices.

A. ENDOGENOUS VARIABLES

AO	= agricultural output (nominal) - million birr
AP	= ratio of import to domestic prices (MPI/P)
CA	= current account balance - million birr
CUR	= capacity utilization rate (RMO/CMO)
DC	= private consumption expenditures on domestic goods - million birr
GAP	= gap between aggregate expenditures and total output (nominal) as a ratio of nominal output
GEE	= government expenditures on education (nominal)- million birr
GEH	= government expenditures on health (nominal)- million birr
GUN	= nominal arms imports - million birr
I	= nominal investment expenditures - Million birr
IT	= indirect taxes - million birr
LAFI	= agricultural labor force index (1980=100)
LM	= labor force in manufacturing-thousands of individuals
MCD	= imports of consumer durables (nominal) - million birr
MCND	= imports of consumer non-durables (nominal)- million birr
MFL	= imports of fuel and lubricants (nominal) - million birr
MNT	= imports of intermediate inputs (nominal) - million birr
MO	= manufacturing output (nominal) - million birr
MT	= total non-military imports (nominal)- million birr
OG	= other government expenditures - million birr
OY	= output of other sectors - million birr (nominal)
OX	= other exports - million birr
P	= domestic consumer price index - 1985=100
PC	= total private consumption (nominal) - million birr
RAO	= real agricultural output - million birr
RC	= real private consumption - million birr
RDY	= real disposable income - million birr
RER	= real exchange rate (based on world whole sale price index - WWPI)
RFCA	= real capital stock, adjusted for capacity utilization - million birr
RFCA1	= real capital stock, unadjusted for capacity utilization - million birr
RG	= real government expenditures - million birr
RGAP	= gap between aggregate expenditures and total output (real)
RGEE	= real government expenditures on education to output ratio
RGEE1	= real government expenditures on education - million birr
RGEH	= real government expenditures on health to output ratio
RGEH1	= real government expenditures on health - million birr

RI	= real investment expenditures - million birr
RIT	= real indirect taxes - million birr
RMCD	= real imports of consumer durables - million birr
RMCND	= real imports of consumer non-durables - million birr
RMILEX	= the ratio of military expenditures to output
RMNT	= real imports of intermediate inputs - million birr
RMO	= real manufacturing output - million birr
RMFL	= real imports of fuel and lubricants - million birr
ROG	= real other government expenditures - million birr
RRY	= ratio of real output to capital stock- RY/RF
RX	= total real exports - million birr
RXCOF	= real exports of coffee - million birr
RXHK	= real exports of hides and skins - million birr
RXOSN	= real exports of oil seeds & nuts - million birr
RY	= real total output at factor cost - million birr
STR	= total employed labor force - millions of individuals
TM	= total imports (nominal) - million birr
TX	= export earnings and net transfers - million birr
XCOF	= nominal value of coffee exports - million birr
XHK	= exports of hides and skins (nominal) - million birr
XOSN	= exports of oil seeds & nuts (nominal)- million birr
Y	= nominal total output - million birr
Y1	= aggregate demand - million birr (nominal)

B. EXOGENOUS VARIABLES

CAPI	= capital inflow (net changes in reserves plus current account balance as a ratio of output)
COFPI	= export price index of coffee - 1985=100
CMO	= capacity manufacturing output - million birr
BD	= central government budget deficit - million birr
D1	= dummy variable (1975 - 1987 = 1)
ERR	= statistical error in national account
ETI	= weighted import and export price index, 1985=100
EXDC	= excess domestic credit (difference between growth in domestic credit and real GDP growth
EXR	= nominal exchange rate (birr/$US)
GR	= net transfers (grants+aid) - million birr
MP	= size of armed forces - thousands of individuals
MPI	= import price index - 1985=100
MS	= total money supply (currency + demand deposit) - million birr
MILEX	= military expenditures - million birr (nominal)
OM	= other imports - million birr
POP	= population - millions of individuals
RF	= rainfall - millimetres
RFR	= real international reserves - millions of SDRs
RGR	= real net transfers (grants+aid) - million birr
RMD	= real money demand - million birr
RMILEX1	= real military expenditures - million birr
RMS	= real money supply (currency + demand deposits) - million birr
ROP	= relative openness (the ratio of imports & exports to GDP)
RTGB	= total government borrowing - million birr
RWR	= real wage rate in manufacturing

STR1 = total labor force - millions of individuals
T = time trend
TLF = ratio of total labor force to capital stock
TOT = terms of trade (export/import)
V = income velocity (ratio of total output to money supply)
W = wage bill in manufacturing - thousands of birr
WWPI = world wholesale price index (1985=100)
WY = world GDP index - 1985=100
XPI = export price index - 1985=100
XPK = unit price index of Kenyan exports (1985=100)

ESTIMATING RETURNS TO EDUCATION IN OFF-FARM ACTIVITIES IN RURAL ETHIOPIA

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ABSTRACT

I have used an extended version of Mincer's original model to estimate the returns to schooling in rural Ethiopia. In a first step, a multinomial logit model is applied to distinguish between four groups of people, (1) full-time farmers, (2) part-time farmers and part-time wage workers, (3) part-time farmers and part-time traders and (4) full-time non-farmers. In a second step, a correction for sample selectivity is made using the Lee-Heckman method and the returns are estimated. The results show that returns on schooling are high in group (4) and lower in groups (2) and (3). Entry in well-paid jobs is constrained for non-educated people. Women are particularly well represented in the third group but strongly underrepresented in the fourth group. The estimation shows overall that education is a worthwile investment in rural Ethiopia and the fact that households underinvest in education can be attributed to the lack of resources at the household level.

1. INTRODUCTION

Ethiopia has one of the lowest enrolment rates in the world. Only 20% of all school-aged children in rural Ethiopia are going to school. The causes for this low degree of participation in schooling are to be found at the level of the household, the provider as well as the labour market.[1] In this paper, I want to take a close look at one aspect of the problem. I address the question whether or not education is a worthwhile investment in rural Ethiopia. Can we make general statements about the return to education or is the return conditional on entry in certain jobs? This research follows up on previous research where I examined the determinants of household schooling decisions. Lack of resources at the household level is one of the major reasons why children are not attending school in rural Ethiopia.[2]

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The organization of the paper is as follows. After a review of the literature on education, returns and off-farm activities, I present the Mincerian model, the occupational choice model and the Lee-Heckman correction method for sample selectivity. Section four of the paper gives descriptive statistics and section five discusses the econometric specification. I present estimation results in part six and a conclusion at the end of the paper.

2. REVIEW OF THE LITERATURE

Many studies report parental education as an important determinant of child schooling. Strauss and Thomas (1995) for example refer to a number of studies where a positive relation is found between parental and child schooling. An explanation for this positive relation is found in two papers by Appleton and Mackinnon (1993). These authors call this effect the intergenerational transmission of education and they give several reasons for it: (1) educated parents have the skills to help children in homework, (2) educated parents are mostly richer and can devote more resources to education than other parents, (3) educated parents stimulate and motivate their children strongly, (4) educated parents derive more direct utility from their child's education and will therefore devote more resources to education, (5) educated parents expect a higher return from investment in education and will therefore invest more, and (6) educated parents have access to more accurate information.

Psacharopoulos (1985) reports high returns on primary and secondary education in African countries. He summarised estimates of returns to education for 60 different countries in the 1970s. Developing countries had a return of 15 percent on average per year of education, whereas the average for high-income countries was 9 percent per year. The first explanation for these high returns is just the law of supply and demand. Wages for schooled workers (and therefore returns) are high because they reflect the relative scarcity of human capital.

The methodological problem here is that if education is correlated with family background, then returns to education are overestimated, because part of the return has to be devoted to family background characteristics. Lam and Schoeni (1993) for example report that returns to schooling fall by one-third when parental schooling is added to wage equations. The authors interpret this as evidence that parental characteristics represent unobservable worker attributes. Direct effects of parental schooling on wages are substantial according to Lam and Schoeni, but well below the returns to a worker's own schooling. Schooling as well as unobservable characteristics can also be important determinants of entry in the paid labour force.

Most of the recent works on returns to education in developing countries correct for selectivity in the labour force. Alderman, Behrman, Ross and Sabot (1996) for

example perform a joint maximum likelihood estimation of the wage relation and of current wage-labour participation as a comparison between wages and the returns to alternative activities in rural Pakistan. The returns to alternative time use, in turn, are affected in part by a set of variables that do not enter directly into the wage relation, so they permit identification of the selectivity control in the wage equation. As Krishnan (1996) points out, the problem is to find identifying instruments for this selection equation, since many of the variables which determine earnings are also likely to determine entry in the paid labour force. To do the selectivity-correction correctly, an equation explaining the probability that a person is in a particular group is specified, using land, livestock and other variables in the selection equation and making sure that at least one of these variables differs from the variables used in the wage equation.

Heckman and Hotz (1986) estimated earnings equations for Panamanian males and found also that estimated returns to the worker's own schooling drop by about one-third when father's and mother's education is included in the regression. Controlling for a large set of family background variables, Lam and Schoeni (1983) estimated a return on schooling of over 10 percent per year using Brazilian data. They pay attention to the problem of measurement error and suggest that the decline in returns to schooling by introducing family background characteristics may be explained by measurement error in schooling. The decline in rate of return to schooling can therefore be overestimated, too.

In this paper, the researcher focuses on the economic return of human capital investments, being entry in the labour market and earnings. Schooling also has social returns, which are however difficult to quantify. A good example of a social return is found in Dercon (1996). He reports a strong health effect of female education on children: mothers who had primary education will seek medical treatment for their child in case of illness much more than uneducated mothers, namely 25% more. Dercon and Krishnan (1996) found intergenerational social effects of education: the father's education had a strong effect on his son's behaviour towards the use of contraception. This however, demands a long planning horizon, probably too long for poor people.

If education is important for entry in the labour market, then parents have an incentive to invest in child schooling. One therefore expects that parents have a reason to send their child to school even when direct economic returns from this investment are low. The economic return from schooling is the difference in wages between educated and non-educated workers. There are two main explanations for these wage differentials in the iterature. The first one is the pure human capital thesis that wages reflect marginal productivity and that education increases a worker's productivity. The second is the screening hypotheses which argues that education serves as a screen for unobserved innate characteristics. In this case we should observe a 'diploma

effect[1]: completing primary and secondary education should increase income significantly. I will test these hypotheses by using dummies for educational levels in one regression and number of years in school in another regression.

The focus on off-farm activities in this paper is partly justified by data limitations (see further on) but also because several authors point out the importance of off-farm work for the diversification of income in rural households. Reardon (1997) gives an interesting summary of recent findings. The simple average share of income earned in off-farm activities over 25 studies of African households is 45%. He also finds evidence showing the poor distribution of off-farm earnings in rural areas. Richer households earn substantial income in off-farm self-employment and hire in (poorer) farm labourers to work on their farms. Reardon interprets these findings as (at least rough) evidence for entry barriers and labour market segmentation in rural Africa.

3. OUTLINE OF THE MAIN MODEL

3.1. Mincer's Model

One of the main contributions of human capital theory is the relation made between earnings, costs and rates of return. According to Becker (1993) the most important single determinant of the amount invested in human capital may well be its profitability or rate of return'. Both he and Mincer (1974) develop a model that relates earnings, opportunity costs and investment in education. Becker derives his model by taking differences in earnings of an individual that invested in education and an individual that not invested in education. Mincer uses earnings ratio's between these two individuals. I will follow Mincer's approach since his model leads directly to a specification that can be estimated and where the coefficient of schooling can be interpreted as the rate of return on investment in schooling.

Mincer's basic model goes as follows:

let Y_s be the annual earnings of an individual with s years of schooling

let V_s be the present value of an individual's lifetime earning

let n be the fixed span of earning life (the cost of schooling must be recouped during a fixed period)

let δ be the discount rate

let d be the difference in the years of schooling

let K be the earnings ratio

$V_s = Y_s \sum_t \left(1/1+\delta\right)^t$, when the process is discrete [1.1]

$V_s = Y_s \int_s^{n+s} e^{-\delta t} dt = Y_s / \delta\left(e^{-\delta s}\left(1 - e^{-\delta n}\right)\right)$, when the process is continuous and [1.2]

$V_{s-d} = Y_{s-d} \int_{s-d}^{n+s-d} e^{-\delta t} dt = Y_{s-d} / \delta\left(1 - e^{\delta n}\right) e^{-\delta(s-d)}$ [1.3]

Solving for $K_{s,s-d}$ from the equalisation of present values, we get[4]

$K_{s,s-d} = Y_s / Y_{s-d} = e^{-\delta(s-d)} / e^{-\delta s} = e^{\delta d}$ [1.4]

We see that K, the earnings ratio, does not depend on the levels of schooling nor on the length of earning life.

Now we define, $K_{s,o} = Y_s / Y_0 = K_s$. [1.5]

According to equation (1.4) $K_s = e^{\delta s}$ [1.6]
In logarithms, this means

$\ln Y_s = \ln Y_0 + \delta s$ [1.7]

Equation [1.7] shows a relationship between earnings and years in school whereby δ is the rate of return of investment in schooling. δ shows the percentage increase in wage when schooling is prolonged by 1 year. It is a percentage increase because $\ln Y = dY/Y = (Y_2 - Y_1)/ Y_1$. The percentage increase in earnings are strictly proportional to the absolute difference of the time spent in school.

Equation [1.7] is the basic Mincerian earnings equation. One can estimate it in a semi-log formulation with the log of earnings as the dependent variable and years of schooling as the independent variable.

Mincer formulated his model originally under the assumption of perfect credit markets, meaning that individuals face the same interest rate. Furthermore he assumes that interest rates and discount rates are the same. His model can thus be written in the following way:

$$\ln Y_s = \ln Y_o + rs \qquad [1.8]^5$$

There are four major problems with this approach. The first is the assumption of perfect credit markets which are hardly found in developing countries. The second that it is far from obvious that rural people adopt their preferences (discount rate) to market conditions (interest rate)[6]. This is only the case in a highly integrated labour market. Third, all other factors affecting earnings are summarised in ln Yo. And fourth, all years of schooling have the same return to the individual, as if the first year of primary schooling gives the same return as the third year. The first two remarks will be discussed in the empirical part of this paper. The model is extended to deal with the third remark and the fourth problem is discussed at the end of this section.

A first extension of the model in [1.8] is done by including years of labour market experience and its square as independent variables. People namely do not stop the learning process once they finish schooling, they also develop skills while working. According to human capital theory, this enhances the productivity of the workers. We also include the square of the years of experience to capture the non-linear effect of experience.

This gives the following model,

$$\ln Y_s = \ln Y_o + rs + b_1 \exp + b_2(\exp)^2 \qquad [1.9]$$

Following Lam and Schoeni (1993), we also extend the model with family background variables. The real equation is thus

$$\ln Y_s = \ln Y_o + rs + b_1 \exp + b_2(\exp)^2 + c_1.FB \qquad [1.10]$$

where FB is the unobserved family background of a child. Assume now that family background and schooling are positively correlated, then we have a missing variable problem in [1.8]. Returns on education are overestimated because earnings are also determined by FB. In the extreme case, both schooling and earnings are entirely determined by FB which makes the content of formal education useless for economic life.

Mincer makes the assumption that all years of education have the same return. Several authors however report high marginal returns to primary education and low marginal returns to secondary education. Psacharopoulos (1994), using the Mincerian

method, reports a marginal return to completed primary education of over 40%. In order to pick up a different effect from primary and secondary education, dummy variables for education are introduced. When a person has completed primary education, the dummy is one. The same counts for other levels of education. In this way, one can measure the additional effect of having completed junior and secondary education. In the approach chosen here, the secondary education variable for example catches the marginal effect of having completed secondary education. Most pupils indeed stop education in the age between 12 and 15. One can ask the question if it is worth continuing for the secondary school level? Does this level of schooling add a return? When not, it is economically rational to quit school after junior or primary school.

This model can be written as follows:

$$\ln Y_s = \ln Y_o + a_1.pr + a_2.jun + a_3.\sec + b_1\exp + b_2(\exp)^2 \qquad [1.11]$$

One can argue that a separate variable for the number of years in primary school and a number of years in secondary school should be introduced. In this way, the difference in the marginal effect of each year of primary and each year of secondary education on the wages can be determined.

3.2. A Model of Occupational Choice

The schooling variable in Mincer's model only captures the direct effect of schooling on wage. From previous studies we know that schooling also has an indirect effect, namely it is one of the determinants of entry into an occupation. In order to account for this, we have to construct a choice model where a set of independent variables determine the kind of occupation that an individual is engaged in.

According to Dercon and Krishnan (1995), the characteristics of individuals explain the kind of economic activity these individuals choose. In a paper on income portfolios in Tanzania and Ethiopia, Dercon and Krishnan explain this as follows:

> *certain activities will offer higher returns to households with particular skills, ability or composition than to households without such advantages. However, some activities will require substantial investment, so that poorer or credit constrained households will not be able to enter them. In fact, skill or ability constraints may be sufficient to exclude certain households from particular activities. Comparative advantage and entry constraints will not just help to explain differences in portfolios within particular areas or villages, but also across areas or countries. Access to public infrastructure*

such as market places and roads, proximity to towns, common property resources such as forest, and other public goods will also contribute to the different portfolio patterns across regions.

From the work of Bevan and Pankhurst (1996) we know that there is a clear division of labour between the sexes in rural Ethiopia. Women are responsible for domestic work (cooking, cleaning, looking after the small children, repairing clothes, looking after elderly and ill people) and for light agricultural work and income generating activities. While the shadow price of labour for males and boys is determined by the cultivated area of land per capita, the shadow price of female labour is determined by the size of the household. In large households, therefore, little time is left for a woman to be engaged in paid activities, since her labour is valued high in the household.

And, in many villages, traditional income generating activities (weaving, tanning, pottery) have been looked down on. Nevertheless and in spite of their domestic work, women are active in trading at market places and in selling agricultural products in Africa. Women allocate their time in such a way that they combine their work at home with their work for pay.

These kinds of problems require the use of a multinomial model. A multinomial logit model determines the probability of ending up in one occupation or, a category of occupations. The model is a natural extension of the binary logit model. The categories in the dependent variable are discrete, nominal or unordered.

Let us first look at the binary choice model.[7]

The probability of having y = 1 instead of zero can be written as follows.

$$\text{Prob}\{y = 1\} = G(x_k, \beta) \qquad [2.1]$$

where G is a functional form containing the vectors x and β. Usually, the functional form is restricted to

$$G(x_k, \beta) = F(x_k'\beta) \qquad [2.2]$$

where F is a cumulative distribution function.

It is possible to derive a binary choice model using a latent variable presentation of the model.

$$y^* = \sum_k \beta_k + \varepsilon \qquad [2.3]$$

where y^* is an unobserved latent variable and ε symmetrically distributed with zero mean and cumulative distribution function $F(\varepsilon)$. What we observe is a dummy variable y, a realisation of a binomial process, defined by

$$y = 1 \quad \text{if} \quad y^* > 0 \quad \text{and} \quad y = 0 \quad \text{otherwise}.$$

Therefore,

$$\begin{aligned} \text{Prob}(y = 1) &= \text{Prob}\left(\sum_k \beta_k + \varepsilon > 0\right) \\ &= \text{Prob}\left(\varepsilon > -\sum_k \beta_k x_k\right) \\ &= 1 - F\left(-\sum_k \beta_k x_k\right) \end{aligned} \qquad [2.4]$$

The specific functional form of F depends on the assumptions that one makes concerning the distribution of ε. In case of the binary logit model, we assume that ε follows a logistic distribution. This distribution is almost similar to the standard normal distribution but instead of a variance of 1 it has a variance of $\pi^2/3$.

In that case,

$$\text{Prob}(y = 1) = L\left(\sum_k \beta_k x_k\right) = \left(e^{\sum_k \beta_k x_k}\right) \Big/ 1 + \left(e^{\sum_k \beta_k x_k}\right) \qquad [2.5]$$

The model in [2.5] is the binary logit model, and it represents the probability of the event occurring (y = 1).[8]

The multinomial logit model is a straight forward extension of the model in [2.5]. The multinomial model estimates the effects of explanatory variables on a dependent variable with unordered response categories. The equation

$$\text{Prob}(y = j) = \left(e^{\sum_k \beta_k x_k}\right) \Big/ \left(1 + \sum_j e^{\sum_k \beta_k x_k}\right) \qquad [2.6]$$

is referred to as the multinomial logit model. In this model, the choice probabilities are dependent on individual characteristics only. The model estimates relative probabilities, defined relative to the base group (the full-time farmers in my analysis). The number of parameters to be estimated is equal to the number of individual characteristics multiplied by the number of possible choices minus one. Each of our adults will fall into one of the 4 categories with probabilities given by [2.6]. The subscript j indicates that there are J-1 sets of β estimates.

3.3. Lee-Heckman Correction for Selectivity

At the time of a survey, many people are not engaged in paid labour. With 'paid work' I mean an activity for which the labouring person receives an amount of money or an amount in kind. The majority of the rural working population does not participate in paid work. They are full-time farmers or domestic workers. Because it is very difficult to value domestic work and farmers' output, rates of return on education are typically only measured for persons doing paid work. In this case, we have a sample-selection problem, some people are 'selected' into the paid labour force and other people not.

In a wage-equation, sample-selectivity can in fact be seen as an omitted variable problem. The researcher believes that his estimated returns are biased because something is missing in the equation. It is the same story as we had before. In section 3.1, we wondered if parental education had an influence on earnings. If this is the case, returns on education are overestimated when parental education is left out of the equation.

The sample-selectivity problem is a problem of omitted variables: something affects the earnings of a person, and this is not captured by the variables already in the equation. This problem can be solved by first explaining the reason why some people are 'selected' into the paid labour force. This information is then used to eliminate the potential bias in the estimation of the private returns to schooling. When participation is positively related to human capital variables, the coefficients on the human capital variables in the OLS wage equations - not corrected for selectivity - are likely to be biased.

The conventional sample selection model has the following form. [3.1]

$y_i^* = x_i\beta + \varepsilon_i$, with i from 1 to n, with n the number of cases in the sample

$d_i^* = z_i\gamma + v_i$, with i from 1 to n

$d_i = 1 if\ d_i^* > 0;\ d_i = 0$ otherwise

$y_i = y_i^* \cdot d_i;$

where y_i^* is a latent endogenous variable and y_i the observed variable; d_i^* is a latent variable with associated indicator function di reflecting the selection equation. ε_i and v_i are zero mean terms with $E(\varepsilon_i / v_i) \neq 0$. We make the assumption (assumption 1) that ε_i and v_i are independently and identically distributed N(0,Σ),

where $\Sigma = \begin{pmatrix} \sigma_\varepsilon^2 & \sigma_{\varepsilon v} \\ \sigma_{\varepsilon v} & \sigma_v^2 \end{pmatrix}$

OLS estimation of β over the subsample n corresponding to $d_i = 1$ will lead to inconsistent estimates due to the correlation between x_i and ε_i.

Different procedures are used in empirical work, but two-step estimation is the most common approach. I will use the parametric two-step estimation like Heckman did (1976, 1979).[9]

Our primary equation of interest is

$y_i = x_i\beta + \varepsilon_i,$ with i from 1 to n [3.2]

Knowing that $E(\varepsilon_i / x_i, d_i = 1) \neq 0$, the method proposed by Heckman (1976) is to overcome this misspecification through the inclusion of a correction term which accounts for $E(\varepsilon_i / z_i, d_i = 1)$.

To employ this approach, we take the conditional expectation of [3.2] in order to get

$E(y_i / z_i, d_i = 1) = x_i\beta + E(\varepsilon_i / z_i, d_i = 1)$; i from 1 to n. From bivariate normality it follows that $E(\varepsilon_i / z_i, d_i = 1) = E(\varepsilon_i / v_i) = (\sigma_{ev} / \sigma_v^2) / v_i$. This can be proved.

Using assumption 1 and the formula for the conditional expectation of a truncated random variable we note that

$$E(\varepsilon_i / z_i d_i = 1) = (\sigma_{ev}/\sigma_v^2)\left[\phi(-z_i\gamma)/(1-\Phi(-z_i\gamma))\right] \qquad [3.3]$$

where Φ denotes the cumulative distribution function of the standard normal distribution. Lee (1983) has shown that this also works in case of a logistic distribution. This is what I need, because I am using a (multinomial) logit model.
In [3.3] we replace ϕ by l and Φ by L, L being the cumulative distribution function of the logistic distribution. The second term on the right hand side of the equation in [3.3] is known as the inverse Mills ratio.

Thus, the two-step procedure suggested by Heckmann first estimates γ over the entire N observations and then constructs an estimate of the inverse Mills ratio. One can then consistently estimate the parameters by OLS over the n observations reporting values for y_i by including

$$E(\varepsilon_i / z_i, d_i = 1) = (\sigma_{ev}/\sigma_v^2)\lambda_i$$
$$= (\sigma_{ev}/\sigma_v^2)\int v_i \, l(v_i)\, dv$$

as an additional regressor in [3.2].

We estimate

$$y_i = x_i\beta + \mu\lambda_i + \eta_i \qquad [3.4]$$

by OLS. The t-test on the null hypothesis $\mu=0$ is a test of $\sigma_{ev} = 0$ and represents a test of sample selectivity bias. In equation [3.4], one clearly views the problem as a problem of omitted variables. Least squares regressions of y on x and λ would produce consistent estimates, but if λ is omitted, the specification error of an omitted variable is committed. If λ is observed, OLS estimates are consistent but inefficient. The disturbance η is heteroscedastic.[10]

4. DESCRIPTION OF THE DATA

In the beginning of the nineties, Ethiopia entered a process of profound transformation. The Centre for the Study of African Economies at Oxford University and the Department of Economics at Addis Ababa University decided to do a large scale rural household survey as a follow up of a survey done by the International Food

Policy Research Institute in 1989. The sample consists of 1477 rural households in 15 areas of Ethiopia. No attempt has been made to have a representative sample of rural Ethiopia. According to Dercon and Krishnan (1995), the geographical spread however is likely to provide a very relevant picture of rural Ethiopia. Random sampling is applied in each site and the number of households interviewed in each site was proportional to the population of the region relative to the national population.

This paper uses data from the first round of this survey, concentrating on the parts in the survey where questions on off-farm activities were asked. Information on education was taken from the second round, conducted a few months later, since it was more detailed than the education part in the first round. In the survey, enumerators asked how many days the respondent had worked for pay in the last four months. We do not have information on hours worked per day or on hourly earnings. This could cause biases in estimation because not all people work for pay the same number of hours per day. This may not be important in a regulated, industrialised country, but it is important in rural Ethiopia, where much of the employment is informal and highly variable in hours worked. Individuals who work many hours a day will - ceteris paribus - have higher daily earnings.

A comparison of the earnings per day between men and women shows that men earn much more than women. It is however risky to attribute this to discrimination in the labour market, since we only have information on days worked. We know, that women do a lot of household work on a daily basis and it is therefore very likely that they work less hours a day for pay than men do. This is not observable from the data on earnings since we only asked for daily earnings. Of course, it is possible that there is a high degree of variance in the hours worked between men too. To avoid possible distortion we will conduct separate wage equations for men and women after correcting for selectivity.

We also asked what pay the respondent received for his/her labour. This pay could be expressed in kind or in cash. The pay in kind was converted to kilograms and valued at the local price (also expressed per kg of course) for that commodity. In case of payment both in cash or in kind, both were added up. In case of more than one off-farm activity, the earnings of all activities were summed. Then, all earnings were divided by the numbers of days worked, which gave average earnings per day. Since prices and crops differ substantially according to villages, this calculation was performed separately for all villages.[11]

For the dependent variable, the log of earnings per month is used. One cannot take total earnings in these four months as dependent variable, because in that case earnings are also determined by the number of days worked. It may be that earnings per day and number of days worked for pay are determined by the same variables.

Table 1 shows an example of this problem: more educated people seem to supply more labour. If they earn more in these four months, this can be due to their education, but also because they have worked more.

Table 1. Days Worked for Pay (averages) during Last Four Months by Level of Education

	Level of Education			
	No education	Max. primary school	Max. high school	Max. university
Days worked	40.23	37.86	48.48	96.50

In order to control for days worked, it is necessary to take earnings per day as a basic variable. I assume daily earnings to be independent of number of days worked[12]. There are 1224 individuals in the sample who reported to do off-farm work. 912 also gave us the pay they got for their work. I will use these 912 persons to do the regressions.

I first discuss descriptive statistics of participation in paid work in rural Ethiopia. One can distinguish four groups in rural Ethiopia when it comes down to paid work. We have 3097 individuals (>14 years) who are either farmers or domestic workers and who are not engaged in any kind of off-farm activity. These people are full-time working at home or on their farm. They do not participate in paid work. A second group consists of 802 individuals whose main activity is also farming or doing domestic work, but next to that, they participate in off-farm activities. These people are part-timers, viz. they devote some of their working time at home or on their own farm and other time working for pay. These paid activities can be very diverse: working on someone else's farm, food-for-work, domestic servant, unskilled labour, collecting and selling firewood, trading grain or other crops, trade in livestock.

Because of the diversity of the economic activities and the theoretical explanation of Dercon and Krisnan (page 7), the group of 802 people is split into two groups: a group of 294 people working on the farm (or at home) and doing part-time wage labour and another group of 508 people doing part-time farm work and part-time income earning activities. Table 2 shows that people in wage-labour have lesser land endowments and livestock than people in income earning activities. They also live further away from town. From Bevan and Pankhurst (1996) we also know that in the rural areas wage-labour is looked down on.

Table 2. Second and Third Group Compared

	Farmer and wage-labourer	Farmer and Income earning activities
Size of the household	6.31	6.20
Age in years	37.00	36.00
Land endowment	1.00	3.06
Value of livestock	906.70	2818.80
No. of years at school (excluding nursery)	4.02	3.55
Distance to town in km	11.97	8.65

Table 3. Part-time Farmers/Part-time Wage Workers are Involved in:

	Frequency	Percent
Farm worker	65	22.1
Labour sharing	11	3.7
Labourer (skilled)	16	5.4
Unskilled worker	39	13.3
Domestic servant	8	2.7
Food-for-work	137	46.6
Other	17	6.1
Total	294	100.0

Table 4. Part-time Farmers/Part-time Income Earning Activities are Involved in:

	Frequency	Percent
Weaving/Spinning	71	14.0
Handicraft	49	9.6
Trade in grain, Sales	92	18.1
Trade in livestock	27	5.3
Transport	7	1.4
Collecting and selling wood,	237	46.7
Other	15	2.4
Total	508	100.0

The main activity of the fourth group of people is not farming, nor working at home. They are full-time engaged in paid work. They are teachers, factory workers, mechanics, administrators, traders, ...etc.

Table 5. Full time Off-farm Workers are involved in:

	Frequency	Percent
Manual worker	39	9.2
Weaver	12	2.8
Craftworker/potter	39	9.2
Foodseller (Tella)	37	8.8
Driver/Mechanic	10	2.4
Skilled (factory) worker	17	4.0
Teacher	18	4.3
Party official/Administrator	17	4.0
Soldier	30	7.1
Trader	125	29.6
Other	78	18.1
Total	422	100.0

Table 6. Earnings in Birr, Males and Females

		Per Month	
		M	F
Farmer and Wage-earners	Min	7.61	10.69
	Max	1139.00	416.00
	Mean	108.60	82.53
Farmer and Income earning activities	Min	1.83	1.67
	Max	2083	1000.00
	Mean	177.80	98.53
Non-Farmer	Min	15.63	8.33
	Max	2075.00	958.30
	Mean	234.40	77.04

Table 6 shows the earnings-profile of people doing off-farming activities in rural areas of Ethiopia. From these three groups, part-time wage-earners have the lowest incomes and non-farmers the highest. Men earn more than women, especially when they are full-time non-farmers.

5. ECONOMETRIC SPECIFICATION

5.1. Estimating Mincer's Model

I will first estimate the model as specified by equations [1.8], [1.9] and [1.10] for the entire sample, not corrected for sample selectivity in one of the off-farm groups. This estimation allows us to get a first look at the effects and to compare later with more advanced estimations. I repeat the regression, but this time, I use dummy variables for education.

5.2. Specification of the Occupational Choice Model

The decision to participate in wage labour or to exercise another non-farming economic activity is influenced by a number of factors. The land endowment of the head of the household, to start with, has an important influence on the labour decisions of all household members. If your household head owns a farm in rural Ethiopia, it is likely that you work on the farm. In order to avoid an endogeneity problem, I left out all heads of households from the estimation. Labour has a different shadow price for every household depending on the land endowments and the number of household members. When cultivated land is large compared to household members, the likelihood of working off-farm is expected to decrease because the labour is needed on the own farm, and members of the household have a higher reservation wage. When cultivated land is small compared to household members, the shadow price of labour is lower and the probability to do off-farm work is likely to increase. In this case, farming may not yield enough output for the household to survive in which case off-farm work gives a supplementary income.[13]

The independent variables in the multinomial logit model determine the relative probability of ending up in one of the three mentioned groups: part-time farmers and wage-labourers, part-time farmers and income generating activities and non-farmers. The group of full-time farmers or domestic workers is the baseline group.

I used the size of the household, the occupation of the household head, the level of education of the household member, the value of the livestock of the household, the area of cultivated land per capita, the presence of an all-weather road and the distance to the nearest town as independent variables in the multinomial logit estimation. The parameters in this model are estimated using maximum likelihood.

I expect a positive relation between schooling and the chance to do off-farm work. It is often said that educated persons don't want to be a farmer anymore. But one can wonder if educated persons have parents that are farmers. What I mean is that I also expect a positive relation between the head of the household being a non-farmer and the probability of household members of being in the fourth group, namely the non-farmers. Children from non-farming households have a comparative disadvantage in farming.

The value of the livestock is introduced as a proxy for wealth in rural Ethiopia. Wealthier households are expected to be well-represented in income generating activities (group 3). Most of these activities namely demand collateral or assets. The proximity of roads and towns is expected to increase the probability of choosing wage labour because they reduce transportation costs and increase the demand for wage labour.

I will estimate the returns on investment in education for the three groups doing off-farm work separately. Moreover, as we noticed before, women work fewer hours for pay than men do and since we only have data on daily earnings, I estimate wage regressions for women and men separately to avoid potential bias.

5.3. Lee-Heckman Specification

If one wants to estimate returns to education, one has to take account of the selection bias in paid labour. The idea is that if people in the labour force, be it part-time or full-time workers, are non-random samples of the population, the observed earnings distribution gives a non-random picture of the real distribution, thereby causing biased OLS estimates of the Mincerian log-earnings function. The purpose therefore is to estimate returns on education corrected for the selectivity bias in paid labour.

We estimate equation [3.4]

$$y_i = x_i\beta + \mu\,\lambda_i + \eta_i$$

by OLS. The t-test on the null hypothesis $\mu=0$ is a test of $\sigma_{\varepsilon v} = 0$ and represents a test of sample selectivity bias.

6. ESTIMATION RESULTS

6.1. First Estimation

Regression 1 shows the results of four specifications. One has to be careful with the interpretation of the results. Since the sample is not corrected for selectivity into the paid labour force, returns to education will be biased.

Every year of schooling seems to give an additional income of 4.7%. The coefficient of the schooling variable is significant at the 1% level. When returns are this high, households have a strong incentive to send children to school and to keep them in school. We nevertheless observe a very low enrolment rate, which means that either the Mincerian specification overestimates the returns on schooling or that households are constrained. In the latter case, households cannot send children to school, even if they wanted to.

The two age variables, measuring labour market experience have the expected sign but are not significant. Other things being equal, your monthly earnings drop by 20% when you are female. In the specification with dummies, only the dummy for primary education is significant. Completion of primary school gives a return of 27%.

In the third specification, father's education is added based on the arguments of Lam and Schoeni. Father's education does not prove to be significant and the coefficients of our schooling variable does not lower because of the introduction of this new variable. This could be an important result, since several papers (e.g. Lam and Schoeni (1993)) report strong effects of parental education on earnings of children. However, making use of father's education in the regression is difficult because there is very few variation across the sample. 87 percent of the fathers have no education and 8 percent of the data are missing which leaves only 5 percent of the data set to provide variation. The researcher therefore refrains to use this variable in the following regressions. Moreover, the adjusted R^2 shows an extremely small value, which further weakens the regression.

Regression 1

Comparisons of Rates of Return to Education Across Different Specifications of the wage Function

Variables used	Basic Mincerian method		Basic Mincerian method		Lam and Schoeni		Lam and Schoeni	
Intercept	4.07	(10.5)	4.242	(11.12)	4.07	(10.52)	4.24	(11.1)
Number of years in school	0.047	(3.86)			0.047	(4.04)		
Primary ed.			0.27	(1.7)			0.26	(1.6)
Junior ed.			0.33	(1.53)			0.34	(1.57)
Secondary ed.			0.082	(0.25)			0.08	(0.25)
age in years	0.015	(0.73)	0.009	(0.47)	0.015	0.073)	0.009	(0.47)
age square	-0.0009	(-0.36)	-0.0002	(0.91)	-0.0003	(-1.6)	-0.0002	(-0.99)
sex dummy	-0.23	(-2.07)	-0.212	(-1.882)	-0.215	(-1.9)	-0.21	(-1.86)
Father's ed.					-0.0002	(-0.4)	-0.0002	(-0.37)
Adjusted R^2	0.05		0.05		0.048		0.05	
F-stat	6.09	(0.00)	4.5	(0.00)	4.9	(0.00)	3.88	(0.00)

Note: These regressions are not corrected for selectivity into the paid labour force. Monthly earnings used as dependent variable.

Up to here, the variable measuring the numbers of years in school has shown to be significant in our wage-regressions. From the dummy-variables used, only the primary school dummy was significant (at the 10% level). The two other education dummies are not significant. These results however, are not conclusive enough to favour the human capital interpretation of schooling (knowledge learned in school enhances one's productivity which is rewarded with higher wages) against the screening hypotheses. In the latter case we would expect a diploma-effect: employers use diploma's as screens for unobservable abilities. Schooling as such would not have a productivity-increasing effect. Our results indicate that the return on completed primary education is not very different from the return per year over six years. Moreover, since the dummy for primary education also is significant, we cannot opt for one of the two theories. The test is performing well for the primary education variables, but we have to keep in mind that the test is not corrected for sample selectivity and that it remains a rather weak test. In order to falsify one of the theories, the researcher has to have firm level data indicating the way employers hire and reward people.

6.2. Estimation of Labour Market Participation

6.2.1. Results of the Multinomial Logit

	Regression 2a		
	For Men		For Women
Dependent Variable(KEUS)	Occupational Choice		Occupational Choice
Number of Observations	2044		2277
Iterations Completed	9		14
Log Likelihood Function	-1784.04		-1442.62
Restricted Log Likelihood	-2108.13		-1707.94
Chi-squared	648.19		530.62
Degrees of Freedom	27		27
Significance Level	0.00		0.00
Variable	Coefficient	Sig.	Coefficient	Sig.
Part-time Wage Workers				
Constant	-2.04	0.00	-5.47	0.00
HHSIZE	-0.06	0.03	-0.10	0.05
DUMFARM	-0.17	0.65	-0.71	0.08
PRIMC	0.28	0.38	-10.86	0.97
JUNC	-0.54	0.30	0.69	0.10
HIGHC	0.77	0.39	-0.62	0.10
LIVVAL	-0.00	0.00	-0.00	0.04
CULTCP	-1.03	0.01	-5.54	0.00
ALLWROAD	0.88	0.00	2.32	0.00
TOWNKM	0.12	0.00	0.28	0.00
Part-time Income Generating Activities				
Constant	-1.47	0.00	-2.53	0.00
HHSIZE	-0.07	0.00	-0.10	0.00
DUMFARM	0.30	0.49	0.23	0.45
PRIMC	0.44	0.11	0.37	0.43
JUNC	0.26	0.49	-0.87	0.27
HIGHC	-0.54	0.50	-11.88	0.98
LIVVAL	0.00	0.17	0.00	0.11
CULTCP	0.90	0.00	1.35	0.00
ALLWROAD	-0.45	0.00	0.663	0.00
TOWNKM	-0.03	0.12	0.02	0.17
Full-time Non-farmers				
Constant	-0.09	0.82	-0.33	0.34
HHSIZE	0.05	0.04	0.02	0.38
DUMFARM	-3.08	0.00	-1.81	0.00
PRIMC	0.53	0.09	-0.36	0.53
JUNC	0.36	0.38	0.49	0.52
HIGHC	2.36	0.00	0.49	0.52
LIVVAL	-0.00	0.04	-0.00	0.01
CULTCP	-2.21	0.00	-1.65	0.01
ALLWROAD	0.93	0.00	0.53	0.01
TOWNKM	-0.05	0.01	-0.07	0.00

VARIABLES USED

HHSIZE is the size of the household, DUMFARM head of the household is farmer or not, PRIMC completed primary education or not (same for JUNC and HIGHC), LIVVAL value of livestock, CULTCP cultivated land per capita, ALLWROAD presence of an all-weather road or not, TOWNKM distance to nearest town.

The results in Regression 2a show the effect the independent variables have on the relative probability of being in one of the three groups. The results presented are not the marginal effects of each variable on this probability. I will only look at the sign and the size of the effect of each variable. Both men and women from larger households have a smaller chance of doing off-farm work than men and women from smaller households. This effect, however, only holds in the case of part-time work. If your head of the household is a farmer, it is very unlikely that you will be a full-time non-farmer. The dummy, which can be interpreted as a family background variable, namely shows a negative and very significant effect, both for males and females. The relative probability for females to be engaged in off-farm wage work for part of their time also decreases when the head is a farmer[14]. The author did not include father's education as a family background variable in the estimation because of the lack of variation of this variable in each of the subgroups and especially in one of the subgroups. Given the importance of agriculture, the occupation of the head of the household is probably a better family background variable.

The dummy variables for the educational level of the individuals are significant for entry in a full-time non-farming occupation. This is a strong result. One does not have to be educated in rural Ethiopia to do off-farm work for a part of one's time, but one does need to complete school if one wants to enter a non-farming economic activity as main occupation. This is clearly indicated by the significance of the dummies for education. However, the results on the education variables only hold for men. For females, the dummies for education are not significant. These effects indicate that men without schooling (especially without a degree) experience severe entry constraints in these full-time non-farming occupations.

The variable used as a proxy for wealth in the regression, the value of livestock is significant for male wage earners and non-farmers and for female wage-earners. This means that the relative probability of being in these jobs decreases when the value of livestock increases. In the case of wage-work, one can say that well-off people will not hire out their labour, they get higher returns in other activities. People with a lot of livestock, mostly also have a farm, which in turn reduces the relative probability of engagement in full-time off-farm work.

The variable measuring the opportunity cost of labour, cultivated land per capita, performs very well in the regression. From the theory, we expect a negative effect of

this variable on the relative probabilities: the larger the area cultivated relative to household members, the lower the relative probability of doing off-farm work. If labour is scarce on the farm, it has a high shadow price, which keeps the household members on the farm. In the regression, this proves to be true for both men and women in case of part-time wage work and full-time off-farm work. The relative probability of entering income generating activities however, increases when cultivated land per capita increases. One way to interpret this is that these people are relatively well-off, which means that they can hire in labour or rent out land and choose for themselves an activity with a higher return than the return they would get in farming.

In almost all cases, the presence of an all-weather road has a positive effect on the relative probability of off-farm work. Only once, in the case of males in income earning activities, does the presence of an all-weather road decreases the relative probability. In general however, accessible roads will enlarge one's opportunities to work outside the farm. In the case of wage labour for example, one can see the ease in which employees can be mobilised. Roads decrease transport costs both for goods and for persons. The effect of the distance to town is puzzling, since the sign of the coefficient differs according to sex and activity. Only in the case of females, the proximity of a town has a positive effect on the relative probability of doing full-time off-farm work. In all other cases proximity of a town has a negative impact.

6.2.2. Returns Not Corrected for Selectivity

Regression 2b: Mincerian wage regressions with monthly wage as dependent variable and years of schooling and years of experience as regressors for the three groups of people active in the paid labour force and for both sexes. Not corrected for selectivity.

For the men, schooling is significant in explaining wages of non-farmers and farmers who engage in income-generating activities and almost significant for part-time wage earners. With an extra year of education, the earnings of a non-farmer rises by 15 percent. For income generating activities, this is 4.5 percent and for wage earners 5%.

Referring to the outline of Mincer's original model on page four, we notice different values of r depending on the category one belongs to. It is thus not correct to interpret this r as a discount rate that applies to all people in rural Ethiopia in the same way. It is better to understand this r as the internal rate of return for investment in education depending on the kind of labour that one is involved in[15]. The results in Regression 2b, which are not yet corrected for selectivity, indicate that an extra year of education is more rewarding if you have a full-time non-farming job than when you are part-time farming, part-time non-farming. If these results are maintained in the regression which does correct for selectivity, this would be a clear indication of the

segmentation of labour markets in rural Ethiopia. A typical example would be the profession of teachers in Ethiopia. Teachers are paid according to standards set by the government. If you go 1 year to Teachers College after high school, you earn less than a person who went two or three years to Teachers College or who obtained an M.A.

	Part-time farmers part time wage	Part-time farmers part-time income	Full-time non-farmers	
	man*	man	women	man*
Variables in Constant	6.092	3.764	4.35	3.49
	(7.776)	(5.76)	(11.46)	(1.89)
number of	0.053	0.045	0.016	0.15
	(1.701)	(2.669)	(0.33)	(3.74)
Age	-0.114	0.041	0.008	0.0017
	(-2.571)	(1.19)	(0.035)	(0.144)
age	-0.0016	-0.0005	0.0001	-0.00018
	(2.847)	(-1.199)	(0.32)	(-0.102)
Adj. R Square	0.085	0.034	0.02	0.254
F-stat	3.617	2.75		4.972

* not enough observations for regression for women

The age variables (used as proxies for experience) are significant in explaining the wages of men working part-time as wage labourers. The same variable is insignificant in explaining the earnings of a non-farmer and a person in an income generating activity. The sign of the age variable in the regression for wage-labour however, is negative. This unexpected result might be explained as follows in this kind of activities, productivity is not explained by experience (human capital accumulation on the job) but by physical strength (or physical ability). Since physical strength decreases with age, the coefficient on the age variable is negative.[16] Although progressively improving, the R^2 is very low.

6.3. Returns Corrected for Selectivity

Regression 3

Mincerian wage regressions with monthly wage as dependent variable and years of schooling years of experience and father's education as regressors for the three groups of people active in the paid labour force and for both sexes. Corrected for selectivity.

	Part-time farmers part time wage labour	Part-time farmers part-time income generating activities		Full-time non-farmers
Variables in the equation	man*	man	women	man
Lambda	0.73 (2.59)	0.84 (2.64)	-0.10 (-0.31)	0.52 (1.74)
number of years in school	0.05 (1.30)	0.06 (3.25)	0.10 (2.12)	0.18 (4.02)
age	0.15 (5.26)	0.17 (6.58)	0.23 (9.02)	0.18 (4.21)
age squared	-0.00 (-4.03)	-0.00 (-6.03)	-0.00 (-7.11)	-0.00 (-2.65)
Adj. R Square	0.47	0.12	0.47	0.24

Not enough observations for regression for women. T-values in bracket.

Lambda, the inverse Mill's ratio is positive and significant for the men in all three groups. The null hypothesis of μ being zero has to be rejected, which means that we have a sample selectivity bias. Since Limdep software actually estimates $-\lambda$ there is a positive correlation between the unobserved variables in the wage equation and in the selection equation. People entering paid economic activities in rural Ethiopia are non-randomly selected in these activities. The direct returns are 5% per year in part-time wage work, 6% per year in part-time income generating activities and 18% per year in full-time non-farming economic activities.[17]

The age and age squared variables are very significant and with the expected sign. This is an improvement in comparison with Regression 2b (not corrected for selectivity) where the age variables are estimated insignificantly and with a non-expected sign. One can say that in the regression corrected for selectivity, the age variables are correctly estimated and the direct effect of the coefficient of age and age square on earnings immediately is the full effect since these variables do not turn up in the selection equation. With human capital theory, we can interpret these effects as the return to experience. Experience increases one's skill and productivity which is rewarded with higher earnings. At higher ages, when one grows older and becomes less productive, the effect of age on earnings decreases (coefficient of age square is negative).[18] Depending on the group you are into, an extra year of experience increases your monthly earnings by 15, 17 or 18 percent.

For the women in income earning activities, there is no selectivity bias since lambda is not significant. The direct return on education for these women is 10% per year. The age variables for women are also significant and have the expected sign.

7. CONCLUSION

In this paper, I tried to look at education in rural Ethiopia from the economist's point of view. I wanted to know if education is a worthwhile investment. Does education have an economic return in rural Ethiopia? If returns are substantial, parents have incentives to send children to school. For reasons outlined above, I limited the study to those persons working in off-farming economic activities.

From survey data and rural appraisals, we know that parents want to send their children to school, and parents have positive attitudes towards schooling. Only a small minority of parents is afraid that schooling will change the identity of a child. I did not study the curriculum of schools in rural Ethiopia. It is indeed quite likely that a number of factors situated at the level of the school influence enrolment. One could think of tuition, availability of books, quality of teaching staff, sizes of classes, etc. However, parents will judge all these factors and weigh them with the return they expect from education. I did not use expected return as a variable in my enrolment regression, since we have no data on the monetary expectations concerning child schooling in rural Ethiopia. I did calculate realised returns from off-farm activities. In order to do so, I estimated a multinomial logit model using several variables which determine the probability of entering a part-time or full-time non-farming economic activity. I applied the Lee-Heckman correction for sample selectivity in off-farm activities and found that the individuals working off-farm are a non-random sample of the adult population in our data-set. The probability of an individual entering a non-farming occupation as full-time economic activity increases when this person completed primary school and increases strongly when this person completed higher secondary education. The returns on education in these activities are 18% per year, but this percentage is an overestimation, since one still has to subtract the partial derivative of lambda derived to schooling. It is sure however that education determines entry in these jobs and that the return on education is substantial. The return in part-time off-farm work is about 5%. From these results, one can conclude that there are strong economic incentives to invest in education. This means that the reasons for underinvestment in education (low rates of enrolment, not analysed in this paper, but substantiated in other research) are to be found at the household level, namely lack of resources to send children to school and at the market level, namely imperfectly working credit and labour markets. Households have difficulties to hire in labour to replace children on the farm and have difficulty or no access to credit to pay for child education (direct and opportunity costs). The segmentation of the labour market is also demonstrated by the different internal rates of return on education depending on the type of labour that one is doing.

Notes

[1] Collier, P., Dercon, S. and Mackinnon, J., Ethiopian Social Sector Review (PER III), Oxford University, 1996.

[2] Verwimp, Ph., Enrolment in rural Ethiopia, Center for Economic Studies, Catholic University of Leuven, mimeo, 1996.

[3] Becker, G.S., Human Capital, third edition, 1993, p.59.

[4] If we equalise present values, we can find the ratio K, of annual earnings after s years of schooling compared to earnings after (s-d) years of schooling.

[5] This model, in its discrete form, can also be derived directly from

$Y_s = (1 + r)^s \; Yo \qquad \ln Y_s = \ln Y_o + s\ln (1+r) \approx \qquad \ln Y_s = \ln Y_o + rs$

[6] Meaning that r_i is likely to differ from r_j

[7] We will follow the approach taken in Liao, T.F, Interpreting probability models, Quantitative applications in the social sciences series, Sage publications, 1994.

[8] An important issue in the use of multinomial logit models is the assumption of independence from irrelevant alternatives. This means that the ratio of choice probabilities of any two alternatives (in response categories) for a particular observation is not influenced systematically by any other alternatives.

[9] This presentation is based on Vella, F., Estimating Models with Sample Selection Bias : A Survey, *The Journal of Human Resources*, vol 33, nr 1, Winter 1998, p.129

[10] The proof for this can be found in Greene, 1993, p.707.

[11] To avoid very small numbers and to present nice-looking descriptive statistics, daily earnings were multiplied by 25, which gave the earnings per month. This does not mean that all individuals work 25 days a month. Here, one assumes that earnings per day are independent of number of days worked.

[12] If one would do a tobit analysis in order to explain the number of days a person worked for pay, number of days worked would of course be an essential variable.

[13] In a paper on child labour (Addisson, Bhalotra, Coulter and Heady, 1997) the authors found some empirical evidence that supports this theory. Landless households make less use of the labour of their children than households with land. Households with land use the labour of their children to work on the farm. This gives rise to the apparent paradox that child labour is greater in relatively better-off rural households. (Cain 1977, Stekes et al 1984, Fure 1983 and Vlassoff 1979).

[14] This is different from our data on children (see enrolment estimation in Verwimp, Ph., C.E.S., mimeo) where we do have a lot of fathers who went to school and which reported this. About 400 children have educated fathers. Since in our present estimation, where we are dealing with adults, we need data on the educational level of their parents, where it is very likely that they did not go to school. However, if father's education is significantly determining enrolment and if one needs a degree to enter a full-time economic activity outside farming, father's education indirectly determines entry as well.

[15] See our discussion on the discount rate, page four.

[16] A possible way to test this hypothesis is to add a proxy for physical strength in the regression, for example the Quetelet Index (Body Mass Index (BMI)).

[17] this β corresponds to the β in formula (a.2) in the appendix. I refer to the appendix for the discussion on the marginal effects.

[18] The estimation, however, is not corrected for heteroscedasticity, which means that standard errors are biased.

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APPENDIX

There is a lot of discussion between scholars on the marginal effect of schooling. There are three ways to calculate marginal effects. The first way is the unconditional return on investment in education

$$\frac{\vartheta E(y_i^*)}{\vartheta x_i} = \beta . \qquad [a.1]$$

It gives you the marginal return on 1 year of education without correcting for sample selectivity.

The second way corrects for this. The marginal effect on y in the observed sample consists of two components. There is the direct effect on the mean of y, which is β. In addition, if education variables appear in the selection equation, they will influence y through their presence in λ. The full effect of changes in schooling on y is

$$\frac{\vartheta E(y_i / y_i > 0)}{\vartheta x_i} = \beta + \mu \frac{\vartheta \lambda}{\vartheta z_i} \frac{\vartheta z_i}{\vartheta x_i} \qquad [a.2]$$

because $z_i = f(x_i, t_i)$.

This gives the effect of schooling on earnings corrected for the fact that only members of a particular group are observed[1].

Since I use dummy variables for education in the selection equation, I should multiply the formula in (a.2) by approximately 1/6 for primary education, ⅓ for junior secondary education and ¼ for higher secondary education.

The third way to calculate the marginal effect of schooling takes account of the probability to be a member of one of the three groups. β gives you the marginal effect of schooling on earnings for a person belonging to (= working in) one of three groups, but this effect must be multiplied with the probability of belonging to this group. Moreover, this probability changes itself with an extra year of education. The result is then the marginal return on investment in education, conditional upon entry in one of the three groups.

$$\frac{\partial E(y_i)}{\partial x_i} = \frac{\partial}{\partial x_i}\left[prob(g=a)E(y_i/g=a)\right], \qquad \text{for a is 1 to 4}$$

$$= \left[\frac{\partial}{\partial x_i}(prob(g=a))E(y_i/g)\right] + \left[prob(g=a)\left(\beta + \mu\frac{\partial\lambda\partial z_i}{\partial z_i \partial x_i}\right)\right]$$

This formula gives the actual incentive to invest (or not) in education, since an individual does not know in which occupation he/she will work.

DETERMINANTS AND CONSTRAINTS OF PRIVATE INVESTMENT IN ETHIOPIA

WORKIE MITIKU

ABSTRACT

This paper attempts to identify the macro-economic determinants of private investment. Using investor level information some of the constraints to entry, operation and expansion of private investment in Ethiopia were also identified. Private investment during the period 1975-1989 declined sharply and started to increase slightly during 1990 and 1991 as the previous government started "reform" in 1989. The rate of private investment continued substantially from 1992. These trends of private investment are analyzed using both econometric and survey methods. The econometric analysis, using time series data for the period 1975-1994, shows that private investment in Ethiopia is determined by the availability of finance, the real exchange rate, policy and external debt. The real interest rate, growth of per capita GDP, public investment and change in terms of trade did not affect private investment during the period of the study. The survey of investors/enterprises which have acquired investment certificates from 1992-1995 in the two regions (Region 14 and Region 1) shows that bureaucratic procedures, lack of infrastructure particularly power and access to finance are the leading constraints for entry, operation and expansion. In addition to the above constraints access to and cost of land are the specific leading entry constraints in Region 14. The other areas of business environment such as political/policy uncertainty and labor regulations are relatively of lesser importance. Hence both the econometric analysis and the survey have confirmed that the availability of finance rather than interest rate is a crucial determinant of private investment in Ethiopia which support the hypothesis of credit rationing. Whereas both the domestic inflation rate, a proxy for macro-economic instability in the econometric analysis, and political/policy uncertainty in the survey are not significant determinants of private investment.

1. INTRODUCTION

1.1. Background

In many developing countries the reduction in aggregate demand is often borne disproportionately by investment, especially in the public sector, rather than by

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consumption, which may be at already low levels. The recovery of private investment, particularly in the tradable goods sector, is critical for restoring overall capital formation and economic growth.

Recognizing the importance of private investment for economic growth, recent attention is focusing on its determinants taking into consideration the specific situation of developing countries i.e., lack of data for certain variables such as capital stock, real wages, real financing rates for debt and equity and imperfect capital markets.

The level of private investment in the country during the last two decades (1975-1994) was fluctuating. During the period of 1975-1989 the share of private investment to total domestic investment has declined in comparison to the share during the pre-1975 and post-1990 periods. In 1974, the share of private investment to total investment was 39.5 and it dropped to 11.7 percent in 1989. Private investment increased slightly in 1990 and 1991 as the 'Derg' Regime started "reform" early in 1989 and proclaimed a mixed economy in March 1990. The rate of private investment continued to increase substantially since 1992. This has been influenced by a substantial change in economic policy by the then 'Transitional Government' and the present government of Ethiopia which emphasized market principles and the encouragement of private sector investment through investment proclamation No. 15/1992 and recently proclamation No. 37/1996.

Specifically the rise in the level of private investment since the change of government in 1991 can be revealed based on the number of projects approved by the Ethiopian Investment Office and Regional investment offices. Following the issuance of proclamation No. 15/1992, starting from July 1992 to July 1998, 4398 projects have been awarded investment certificates with estimated investment capital of Birr 36,575.49 million. Of these projects only 1,184 projects with a capital of Birr 8731.66 million started production/service and 706 projects with a capital of Birr 6189.59 million are in their implementation phase. The remaining 2508 projects with a capital of 21654.24 million remain unimplemented as of 7 July 1998, which is 57% of the total approved projects. The case is severe when we look at the number of projects which have not yet started in Addis Ababa. In Addis Ababa, out of 1774 approved projects with a capital of Birr 19,093.75 million, only 208 projects with a capital of Birr 2950.97 million have started production/service and 278 projects with a capital of Birr 2718.17 million are in their implementation phase as of 7 July 1998. The remaining 1288 projects (73%) with a capital of Birr 13,414.61 million did not start operation after they had received their investment certificate.

During the past 4-5 years the ratio of actually fully implemented projects to approved has been very low. This low achievement rate is despite considerable effort to remove macroeconomic imbalances, the introduction of new investment legislation with far reaching incentives and an attempt to remove some of the restrictions imposed on

private investment in past legislations.

Despite the relative increase in private investment during the early phase of the structural adjustment program (1992-1996), private investment performance has been low in comparison with other developing countries (Dailami and Walton 1992). The ratio of private investment to GDP averaged 3.3 percent per annum for the period 1975-1994. This is much lower than the average for Sub-Saharan African countries which is 12.5, 8.8 and 9 percent for the periods 1970-1979, 1980-1989, and 1990-1994, respectively (Jasperson *et al.*, 1995). The rate of private investment growth for Ethiopia is even lower than the above estimate if account is taken of the "investment" transfers from the public to the private sector following the introduction of the privatization program under Structural Adjustment Program (SAP). Thus, the low level and rate of growth of private investment has been a major problem confronting policy makers in the past two decades.

The present study is an attempt to learn more about the macro-economic determinants of private investment activity in Ethiopia during the 1975-1994 period and to identify entry, operational and expansion constraints encountered by private investors during 1992-1996. Specifically the objectives of the study are:

1. To identify macroeconomic variables that explain the low and fluctuating private investment growth;
2. To analyze the effect of policy reform on private investment growth over the long period since 1974;
3. To test for structural breaks;
4. To identify the major entry, operational and expansion constraints to private investment growth; and
5. To draw policy conclusions.

2. MACROECONOMIC DETERMINANTS OF PRIVATE INVESTMENT

The theory of investment behavior goes back to Keynes'(1936) "General Theory," who first called attention to the existence of an independent investment decision function in the economy. He observed that investment depends on the prospective marginal efficiency of capital relative to some interest rate that is reflective of the opportunity cost of the invested funds. He further pointed that because the rational assessment of the return on investment is bound to be uncertain, the "animal sprits" of private investors would be the main driving force in investment decisions.

After Keynes, the accelerator principle was the dominant theory of investment behavior especially during the 1950s and early 1960s. The accelerator theory postulated a linear relationship between investment and output. According to the

theory, given an incremental capital/output ratio, it is easy to compute the investment requirements associated with a given target for output growth. Hence there is a constant ratio of desired capital stock to output. The theory has several limitations as it disregards expectations, profitability and the cost of capital as determinants of investment. Some of the limitations are not removed by the modified version of the theory, i.e. the flexible accelerator model.

The flexible accelerator model based on the optimal accumulation of capital, associated with Jorgenson (1967) and Hall and Jorgenson (1971), assumes investment is a function of the level of output and the user cost of capital (which in turn depends on the price of capital goods, the real interest rate, and the depreciation rate). The theory has limitations with regard to its assumptions of perfect competition and exogeneously determined output. The theory also disregards dynamic expectations with regard to future prices, interest rates and output.

Tobin (1969) postulated that investment decisions are a function of the ratio of the addition to the value of the firm due to an extra unit of capital installed to its replacement cost. If this ratio, called Tobin's q, is greater (less) than unity firms would want to increase (decrease) their capital stock.

As a result of the poor empirical performance of the flexible accelerator models and later Tobin's Q-theory, recent work on investment broadly falls into two categories: (1) studies on "investment, irreversibility, and uncertainty" and (2) work that has attempted to relate investment to measure of political and country risk. The latter branch of the literature is especially relevant to the determinants of investment in developing countries, since it tends to emphasize those macroeconomic or institutional features that are specific to developing countries such as vulnerability to external shocks, large external debt positions, credit rationing, complementarities between public and private investment, and shifts in income distribution (Jaspersen *et al.*, 1995).

As stated above neoclassicals argue that investment depends on the rate of interest and the level of income. Thus the theory that investment depends on the rate of interest focuses heavily on the cost of finance as the key variable; all other costs (including the availability of finance, economic infrastructure, source of capital, policy, etc.) being assumed given. However, private investment behavior in developing countries cannot be directly explained by using the standard approach based on the theory of the firm (Jansen 1992). This is because, it has been generally hard to test this model in developing countries like Ethiopia, as key assumptions (such as perfect capital markets and little or no government investment) are not applicable and data for certain variables (capital stock, real wages and real financing rates for debt and equity) are normally either unavailable or inadequate. Hence the empirical literature on private investment behavior in developing countries focuses instead on testing

several hypotheses advanced to explain variations in private investment. Accordingly, in order to overcome the limitations of the neoclassical flexible accelerator model, research has proceeded in several directions, in the process, identifying a number of variables that might be expected to affect the private investment. Such variables are expected to reflect the institutional and structural characteristics of developing countries such as lack of infrastructure, finance, as well as political factors. This may be referred to as a modified version of the basic accelerator model. The inclusion of such variables has often resulted in eclectic and ad-hoc equations, constructed for econometric convenience, without a strong and convincing theoretical basis. All these shows the attempts made by researchers to improve the theoretical basis of the macroeconomic determinants of private investment in developing countries.

Theoretical models of the determinants of private investment have been applied to developed countries with a fair degree of success. Nevertheless, empirical studies have not yet clarified which of these models is a more accurate representation of the way in which capital formation occurs in developed countries. This is more true of developing countries because of the absence of well functioning financial markets, the presence of imperfect markets, lack of data and resource constraints (see, for example, Matin and Wasow, (1992)).

Empirical studies of the determinants of private investment in developing countries have used a much more eclectic modeling approach of private investment designed to capture the distinctive institutional and structural features of those economies. They have combined the features of flexible accelerator, neo-classical and structural models in an effort to emphasize the effects of resource constraint faced by private investors in developing countries. As stated above, because of the difficulty of identifying the theoretically correct specification, this paper does not attempt to build and estimate a full scale structural model of private investment in Ethiopia. Rather it is more of an exploratory data analysis. The study used the model which takes into consideration the above problems, particularly the models used by Green and Villanuera (1991) and Oshikoya (1994). Nevertheless, the results of this study may be useful in identifying the more fundamental relationships between private sector investment and macroeconomic variables in the country, which can then be used to develop an appropriate model of investment behavior for the country. Private investment in developing countries, as reviewed by Greene and Villanueva (1991) and others like Oshikoya (1994), is determined by the real interest rate, availability of finance, economic growth, public investment, macroeconomic stability (as proxied by the rate of inflation), income per capita, the size of debt service burdens, availability of foreign exchange, changes in the exchange rate (devaluation), change in terms of trade, and uncertainty.

The following variables are treated in the regression:

where P/GDP	=	the ratio of of private investment to GDP
Pub/GDP	=	the ratio of public sector investment to GDP
GRt-1	=	the lagged percentage change in real GDP per capital
(DS/XGS)t-1	=	the lagged ratio of external debt-service payments to exports of gooda and services
CPI	=	the percentage change in the Addis ababa consumer price index
CR/GDP	=	the proportion of credit disbursed to the private sector to GDP
(DEBT/GDP)t-1	=	the lagged ratioof the country's stock of external debt to its nominal GDP
Int	=	real interest rate
Rex	=	real exchange rate
ToT	=	change in terms of trade
D	=	dummy variable, with the value of 1 after the policy change 1991-1994 and 0 before the policy change, i.e., 1975-1990

The percentage change in the Addis Ababa consumer price index change in terms of trade, debt-service ratio and external-debt measure macroeconomic instability/uncertainty. Except for the consumer price index, the other three variables also measure foreign exchange constraints. Real exchange rate measures the impact of devaluation on private investment.

Univariate analysis, or the study of variables one at a time, is a foundation upon which multivariate analysis rests. Before moving to the regression of variables, analysis of each variable about its distribution (normal or skewed) and its trend (stationary or non-stationary) is important.

Using the methods of Box-plot and Histograms influenced by normal curve, the distribution of each variable was identified. It was found that: CR/GDP, P/GDP, (DS/XGS), (DEBT/GDP), Rex, Pub/GDP, ToT are positively skewed and CPI negatively skewed. GR and Int on the other hand are found to be almost normally distributed.

Power transformation was applied to each of the variable until they became normally distributed. Applying rule of power transformation, all of the positively skewed variables were transformed using logarithm i.e. ($\log_{10}X$) and became normally distributed. CPI was transformed by squaring it and it is found normally distributed.

After the variables were transformed to normal distribution, each of the variables were tested for stationary using the autocorrelation function coefficient. All of them are found to be stationary. This is because, occasionally, transformations are useful in reducing a non-stationary time series to a stationary one. Therefore taking the logarithm of the original series will be useful in achieving stationary (Montomery and Cliff 1976). Therefore, the regression is free of spurious regression problem. However, it is worth while to mention that the sample size is small (twenty years data).

2.2. Preliminary Evidence

As a first look at the evidence regarding the various factors affecting private investment, it is interesting to compare the values of independent variables with the values of the dependent variable, i.e., the ratio of private investment to GDP.

Table 1, which reports the respective values of the relevant variables during the 1975-94 period, provides support for many of the hypotheses outlined earlier. The data suggests that public investment may affect private investment through the crowding out effect as the ratio of public investment to GDP is increasing through out the period when the private investment to GDP ratio is decreasing. The data also suggests the rate of real GDP growth per capita is decreasing as the ratio of private investment to GDP decreases. The ratio of external debt-service payments to exports of goods and services is also increasing as the ratio of private investment to GDP is decreasing. Similarly the ratio of the country's stock of external debt to its nominal GDP is increasing when the ratio of private investment to GDP is decreasing which means both external debt-service payments and stock of external debt have a negative impact on private investment. The proportion of credit given to the private sector has decreased during the period of 1975-1989 when private investment was decreasing and it started to increase from 1990 onwards as private investment starts to increase in the same period (1990-1994), which means it had a positive impact through partly overcoming the financial constraints faced by private investors.

The inflation rate in the period is up and down and it is difficult to associate a specific trend, either increasing or decreasing. The real interest rate has been, for half of the period of study, negative which is usually associated with severe credit rationing, which lends itself to rent seeking and corruption in the allocation of credit. Negative real interest rates represent the presence of financial repression. The relation between real interest rates and private investment is difficult to associate with a specific trend. For example when real interest is declining during the period of 1975-1980 private investment has also declined, where it should have been increasing. This leads to the presumption that interest rate must have played a secondary role in the determination of private investment. If the interest rate has not played a major role in the behavior of private investment, it is likely that credit rationing and other factors have. Therefore, the availability of financing seems to be an important factor in explaining private investment. The terms of trade are deteriorating, and this is in line with theoretical understanding. As the terms of trade is deteriorating the availability of foreign exchange also declines which has a negative impact by limiting the capacity to import machinery and inputs. The Real Effective Exchange rate index has increased significantly since 1992 as a result of the devaluation of the domestic currency. The relation with private investment seems positive as private investment has increased since devaluation. Generally, the variables included in the analysis are appropriate; they have shown the hypothesized trends in relation to the private investment rate.

2.3. Estimation and Results

Six equations for the private investment rate were estimated for the country, using a time series data for the period 1975-1994. Because the current values of the per capita GDP and the debt-service ratio may be affected by the private investment rate, lagged values of these variables were used. In addition, the lagged value of the ratio of external debt to GDP was employed, because the information is usually available only for the end of the year and is, therefore, generally known retrospectively. A test of structural break was made. The null hypothesis of no structural break is tested using the methods of cumulative sum of recursive residual squares (CUSUMQ). It is found that there is structural break between the period 1975 and 1994. When a dummy variable is introduced in the regression, to catch the policy change, the problem of structural break is avoided. Hence the dummy variable catches the problem of structural break and represents the policy change. This tests the difference in intercepts between the two periods.

The results of the estimated six equations using OLS are presented in Table 2. From this table we realize that credit to the private sector to GDP, real exchange rate, debt service payments ratio, the country's external debt to GDP ratio and the dummy variables are variables that significantly affect private investment. All other variables– Int, ToT, CPI, Pub/GDP and GR-are insignificant. The results yield evidence in favor of the hypothesis of credit rationing since in the specifications of private investment equation the credit variable turned out to be strongly positive and significant. On the other hand, the real interest rate was not a significant variable in any of the private investment equations. The estimated elasticities imply that a 10% increase in credit to the private sector to GDP ratio will be associated with a 2.5% increase in the ratio of private investment to GDP.

Private investment appears to be positively influenced by the real exchange rate index. This implies that the devaluation of the domestic currency has favored private investment. However, it is difficult at this point to conclude that devaluation has increased the profitability of tradables which can off-set the increase in the cost of imported capital goods, inputs and materials in the country.

The significance of the dummy variable with a positive coefficient shows the positive impact of the policy change in private investment as it increases the intercept on average by 0.19 for the 1991-1994 period. This result is consistent with the preliminary evidence of increased private investment during the period 1991-1994. The existence of permissive polices (e.g. lifting of the capital limit, permission of engaging in more than one business by an individual, etc.) has contributed to the increment in the private investment rate. The magnitude of the coefficient suggests that private investment during the 1991-1994 period has increased on average by about 19 percent greater than in the period 1975-1990.

The ratio of external debt-service payments to exports of goods and services has confirmed its negative and significant impact as the preliminary evidence suggested. Similarly, the country's stock of external debt to its nominal GDP has a negative and significant impact on private sector investment as it was increasing during the period. The negative impact of both these variables could be either because of the shortage of the foreign exchange they created or the debt overhang.

3. MICROECOMONIC DETERMINANTS OF PRIVATE INVESTMENT

3. 1. Private Investment and the Business Environment

Programs of reform that eliminate macro-economic imbalances are necessary to ease the constraints on development. The investment recovery in intensive adjustment lending countries is partly a consequence of the success of adjustment policies in improving macro-economic stability and efficiency. Higher private investment responses occurred in countries with lower fiscal deficits, lower inflation, and more liberal trade regime and, for the low-income countries, lower parallel market premia in the late 1980s (Brain 1991).

While relative price reforms and macro-economic stabilization are necessary, these are not sufficient for the recovery and expansion of private investment. There are micro-economic and institutional constraints which do not lend themselves to the familiar analytical technique and policy remedies of their macro-economic counterparts (The World Bank 1992).

Private investment response among the low income (and Sub-Saharan African) countries, in addition to macro-economic stability is surely also constrained by long-term factors– a weaker human capital base, inadequate and often deteriorating infrastructure, less diversified economies, and poorly functioning institutions and factor markets. Much of the problem of the recovery and expansion of private investment in low-income countries is therefore a long-term problem of developing the private sector.

The recovery of private investments particularly during adjustment depends on four elements that might be labeled the business environment: the degree of certainty about government policies, the legal and regulatory framework, the state of physical infrastructure, and the efficiency of labor and financial markets. World Bank (1992a) Country case studies support the view that macro economic and structural reforms are necessary for the recovery and expansion of private investment, but are not necessarily sufficient. Among the findings of recent work, the experience of Ghana and Bolivia clearly points out that establishing market oriented rules alone may be insufficient to convince the private sector that it is worth committing resources to investment. Improvements in the business environment are also necessary.

The importance of Ethiopia's laws, regulations and procedures that govern business entry and business operations for the development of the private sector is also emphasized in a recent study of the Foreign Investment Advisory Service (FIAS, 1997). Hence it is hightime to identify laws, regulations and procedures which impede private investment in the country at present.

It is also argued that one of the reasons for the success of East Asian countries is the creation of a business friendly environment, particularly a hospitable legal and regulatory structure to private investment World Bank (1992b). Hence, along with macroeconomic stability, a business friendly environment is one of the factors, to be considered for the recovery and expansion of private investment.

The constraints faced by private investors differs from country to country although countries share common elements of the business environment. This is because the specific institutional situation of each economy affects the extent to which firms are constrained by any specific factor. The following table (Table 3) shows the different constraints faced by the respective country investors.

Because of the difference between countries of constraints affecting the development of the private sector, specific country study on the elements of business environment is vital. Thus, this study attempts to identify the major constraints to private sector development in Ethiopia in the area of business environment.

3.2. Methodology of the Survey

Interviews were conducted to learn from investors themselves what entry, operational and expansion constraints they faced. A printed questionnaire, highlighting obstacles in the area of business environment was verbally administered by the author directly to the owner or an officer of each project.

Rather than interviews in a specific sector, the survey focused on a broad group of sectors. This different sectoral approach enables us to have a general understanding of the entry, operational and expansion constraints faced by investors. The risk is that generalization of constraints in entry operation and expansion might fail to provide specific sectoral constraints where there is sharp difference from sector to sector in the character of the constraints. This is so when the sample of that specific sector is relatively small. Here an attempt of specificity is made only on the specific constraints faced by investors to entry, operational and expansion irrespective of sector. Constraints associated with bureaucratic procedures, financing, and uncertainty are common to entry, operation and expansion stages. By contrast access to and cost of land, access to and cost of raw materials, lack of skilled worker and market constraints are specific either to entry or operation or expansion stages.

The survey was originally planned to be undertaken only in Region 14/ Addis Ababa, but when the author got the opportunity to attend the Tigray Investment Conference (held from April 5-8, 1997) through the good offices of the Ethiopian Investment Authority, the survey also included investors in Region 1. The inclusion of the Region 1 permitted the identification of constraints faced by investors investing in this region and a comparison of these constraints with those in Region 14 and as well as the identification of constraints common to the two regions.

In the case of Region 14, a sample of 100 investors were selected to be interviewed out of a total number of projects of 1,117 which have been granted investment certificate from July 1992 to end of 1995. Out of the total number of projects, 898 projects have not started yet, 122 are in the implementation phase, and the remaining 87 projects are at the production/service stage. Those projects which have been granted investment licenses for the year 1996 are not included in the population to allow for the time needed for implementation of a project. This is because we can not expect a project to be in implementation phase as soon as it is granted an investment certificate. Time is needed to acquire land, capital (bank loan), etc. That is why the population is one year back from date.

In order to identify the sample from the population a stratified sampling method was used. The population was stratified into eleven strata/sector as: Agriculture, Construction, Education, Health, Hotel and Tourism, Industry, Mining, Real Estate, Social Service, Trade and Transport services. The author decided to have a Sample of 50 out of those projects which have not started yet and 50 from those projects which are in implementation and production/service stages. Adopting proportional allocation (depending on the population in each sector/strata), the sample size was determined for each sector. Simple random sampling method was used to select the samples from the respective strata/sector using random numbers.

After identifying the location of each investor through a telephone call, questionnaires were dispatched to the selected 100 investors by the author in person. A lot of problems have been encountered in identifying the location of each investor as it was impossible to get some by telephone. Most addresses of investors are different from the addresses given in their files in the Ethiopian Investment Authority. Further, when they were identified, it was difficult to get the investor or an officer to fill-in the questionnaire. And when found, they did not want to fill the questionnaire on the spot. They usually give an appointment and are not around at the appointment time. Generally, most investors were not willing to fill the questionnaire though they were told the purpose of the questionnaire (and that it will remain confidential). It proved very hard to collect the questionnaire in spite of the fact that I had all the access, their addresses, and am working at the Ethiopian Investment Authority.

After all efforts, it was only possible to collect 34 samples. Of the 34 samples, 11 are projects which have not yet started and the remaining 23 are either in their implementation or operational phase.

3.3. Results

3.3.1. An Overview of the Constraints

The survey in regions 14 and 1 elicited from the investors their assessment of the relative magnitude of obstacles inhibiting their efforts to entry, operation and expansion. The interview yielded a list of constraints to entry, operation and expansion. Investors were presented with the relevant list and asked to rank each constraint on a scale of 1 to 5 according to its degree of severity. Tables 4, 5 and 6 summarize entry and operational constraints in Region 14 (Tables 5 and 6), and common constraints to entry and operation in both regions (Table 6). Scores provided by individual investors were converted to a scale of zero (least severe) to one (most severe),[1] and averaged across investors. The resulting statistics provide cardinal measures of the relative severity in each stage of operation i.e., entry and operation.

As Table 4 reveals, access to and cost of land, bureaucratic procedures and lack of infrastructure are the leading constraints; access to and cost of finance are second and political/policy uncertainty, labor regulation, access to and cost of equipment are found to be the third or relatively minor constraints to entry in Region 14.

From Table 5, we realize that, again, bureaucratic procedures, lack of infrastructure, access to finance and cost of raw material are the leading constraints, whereas cost of finance, lack of market are secondary and the others such as political/policy uncertainty, labor regulation, lack of skilled workers, access to raw material and foreign exchange constraints are the third constraint to operation in Region 14.

Table 6 combines the common constraints for both entry and operation in Region 14, Region 1 and the two regions together. Bureaucratic procedures, infrastructure and access to finance are the leading constraints, cost of finance is secondary, political/policy uncertainty and labor regulations are the third constraints in Region 14. Whereas, in Region 1 access to and cost of finance are the leading constraints, infrastructure and bureaucratic procedures are secondary and political/policy uncertainty and labor regulations are the third constraints (Note that as the sample size for Region 1 is small it was only possible to identify the common constraints for both entry and operation). When the two regions are taken together, bureaucratic procedures, infrastructure and access to finance are the leading, cost of finance is secondary and political/policy uncertainty and labor regulations are the third constraints to both entry and operation in the two regions.

Generally, from the above three tables it appears that bureaucratic procedures, access to finance, and infrastructure are common leading constraints to both entry and operation in both regions and access to and cost of land are the specific leading constraints to entry in Region 14. The next sub-sections review and interpret in depth the results obtained for the leading constraints identified.

3.3.2. Common Constraints to both Entry and Operation

3.3.2.1. Constraints on Access to Finance

As Table 7 summarizes, the financing mechanism of private investment in both Region 14 and Region 1 exhibits some similarities. One feature common to both regions is the dominant role of own savings. This is seen as a poor strategy in a country where the average private marginal propensity to save is low (Teshome Mulat 1994). And the second most important source of finance is formal financial institution (Bank) in both Regions.

Generally problems with banks are common between the two region: long time, high collateral requirement and in some cases lack of genuine assessment of assets by bank officials. In order to further activate private investment in the two regions in particular and in the country in general these regulatory (high collateral requirement and unacceptability of machinery as collateral) and administrative (longer time and lack of genuine assessment by Bank officials) problems should be addressed.

3.3.2.2. Regulatory Constraints

1. Bureaucratic Procedures

Table 8 summarizes the relations between investors and the different service-giving public institutions in both Region 1 and Region 14. From the table it is clear that there is problem of bureaucratic procedures in Region 1, with about 19% of the investors having a difficult relationship with each institution. Bureaucratic procedure is much more severe in Region 14 where 71% of the investors are having a difficult relationship with Region 14 administration.

The main reasons explained, among others, by the investors are:

1. It is almost impossible to transfer ownership in an acceptable period of time and this prevents investors from obtaining a loan from the Bank. Banks require that the asset be in the name of the borrower before taking it as collateral. The overall effect is a shortage of finance.

2. As there are not enough competent workers in the administration, it is impossible to start operating quickly, even it takes a lot of time to know what kinds of activities can be performed in an identified site according to the

master plan of the city.

3. Most importantly it is difficult to acquire land; in recent days the investor is required to find the land himself and then negotiate the rate he/she will have to pay. Getting land is a difficult procedure. Identification and negotiation are not easy.

With regard to Custom Authority, it takes a very long time to clear items and one cannot see the item while it is with the Custom Authority. It is only possible through the transitors but the transitors cannot explain the items to the officers as they do not know the items well. Specially when there is damage, the problem is aggravated as the Custom Authority does not permit the owners to show their items to insurance officers.

In addition to the above institutions, some investors, particularly in Region 14, have cited Health Bureau, the Inland Revenue and the Bank as difficult institutions. In the case of the Health Bureau, its requirement for a permit for permanent/operational license is cumbersome. In this regard, it is reported:

> ...unable to meet the requirements for "permanent license" (because of failure to show "real" financial and other commitments toward establishing an enterprise or due to stringent health codes, municipality regulations, etc.) only a few succeed to obtain permanent licenses, and most applicants either stay on temporary license for another period (could not start production as a result), with draw completely, or go underground and operate as an informal business (Teshome 1996).

With regard to the Inland Revenue, investors, particularly those that are in the operational phase are complaining of double taxation of sales tax. When inputs are imported they are taxed at a rate of 12% when they are cleared from custom and the product using these inputs is taxed again at 12%, which means in actual fact that the sales tax is 24% in these industries. The regulation says the sales tax paid on inputs should be refunded but it is actually difficult to get it back. As a result, capital, particularly working capital, is being depleted. In addition partly because many investors do not have the financial documents, the income tax levied by the Inland Revenue is based on estimation (personal judgment) and this has been the ground for corruption.

As noted above the severe bureaucratic procedures particularly in Region 14, i.e., the time spent to deal with the bureaucracy and in some cases side payments (in Banks) represent deterring costs to entry and operation, comprising both financial elements and the opportunity cost of the fixed resource of the investor's time.

2. Infrastructure

Table 8 also reveals the problem with regard to the availability of infrastructural services. The availability of infrastructure (power, telephone and water) is generally poor with the supply of power and telephone being particularly limited. Hence public investments in the area of power and telecommunications are crucial for the development of the private sector.

3. Access to and Cost of Land

As noted from the ranking of the severity of constraints, lack of access to land is one of the leading constraints. In fact all of the investors in Region 14 that have not yet started operation labeled access to land as a serious constraint for entry (all of them have given the highest scale, 5). When we take all of the investors, those that have not yet started and those that are in the operational phase in Region 14, 25 have said there is a problem of access to land, 5 have responded that there is no problem of access to land (as it be obtained by lease) and 4 have not commented on it as they are working in rented houses or on sites which they have owned before. Whereas in Region 1, of the 16 investors only 5 have responded that there is problem of access to land and the remaining 11 have said there is no problem.

The reasons for the lack of access to land in Region 14 are mostly associated with the high rate of lease cost which they did not take into account as a project cost at the inception of the project. Secondly, one cannot get the type and size of land that one needs and the present experience of identification of the land by the investor himself is difficult (in one case the agreed rate was changed for unknown reasons and followed by a threat that the investor would be denied the site unless he pays the new higher rate). Third, it takes long-time to get land (one respondent has said it is a life-time process). In Region 1 lack of access to land is associated with the longer time it takes to get (one respondent has said, there was no reply for about 2 years and another that it took 3 years to get the land); temporary provision of land which does not enable the investor to get a plan and hence hinders investment activities and does not guarantee the implementation of the project.

Generally, the cost component and the administration of land provision are not conducive for private sector development, in particularly in Region 14. On the strategy of collecting unaffordable fees from the value of land by the Region 14 administration, one respondent has commented, that it is better to provide land at reasonable rate to those industries which can create employment opportunities, increase domestic production and increase the tax base of the government than trying to get the whole sum of revenue only from land. And the benefit of this will exceed that obtained by collecting revenue only from the price of land.

4.3. Expansion Constraints

Almost all the projects which are in operational phase are not working to their full capacity in both Regions. On the average all the enterprises are working at 50 percent of their capacity. A variety of reasons are given for operating at below capacities. In Region 14, lack of finance, high cost of raw materials and lack of a market are the major reasons. Whereas in Region 1 lack of finance, power and access to raw materials are the major reasons. In Region 1 all the enterprises have a plan to expand and also in Region 14 all the enterprises except two have plans for expansion. The reasons forwarded by the two enterprises are high cost of land, lack of market and high cost of raw materials. In sum, lack of access to finance, the cost of land and infrastructure (power) are problems to entry, operation and expansion in both regions although the severity between the two regions differs.

5. CONCLUSION AND IMPLICATIONS

This paper identified some of the macro-economic determinants of private investment. Using investor level information some of the constraints to entry, operation and expansion of private investment in Ethiopia were also identified. Private investment during the period of 1975-1989 declined sharply and increased slightly during 1990 and 1991 as the previous government started "reform" in 1989. The rate of private investment continued to increase substantially from 1992 as a result of a substantial change in economic policy by the then Transitional Government and the present Federal Government of Ethiopia. However, a portion of the additional investment is a result of transfers from the public sector following the implementation of the privatization program. The number of projects completing the project cycle is low. Although many project applications are received for investment certificates, the number of projects that make the transition to permanent license (to operation) are very few indeed. The trends of private investment were analyzed using both econometric and survey methods. The empirical results of the study leads to the following conclusions and implications:-

1. Using time series data for the period 1975-1994, the econometric result has shown that private investment is determined by the availability of finance, the real exchange rate, investment policy (private investment policy), debt-service payments and debt-overhang . The real interest rate, growth of per capita GDP, public investment and changes in terms of trade did not affect private investment during the period of study.

2. The survey results of investors/enterprises which have acquired investment certificates from 1992-1995 in the two regions (Region 14 and Region 1) show that Bureaucratic procedures, lack of infrastructure (particularly power) and access to finance are the leading constraints for entry, operation and expansion. Access to and cost of land are the specific leading entry constraints in Region 14 in addition to the above. The other areas of business environment such as political/policy uncertainty and labor regulations are relatively less important. Hence both the econometric analysis and the survey confirmed that the availability of finance rather than the interest rate is a crucial determinant of private investment in Ethiopia which support the hypothesis of credit rationing. Both domestic inflation rate, a proxy for macro-economic instability in the econometric analysis, and political/policy uncertainty in the survey are not significant determinants of private investment.

3. In addition investigation of the sectoral distribution of projects which are granted investment certificates since 1992 revealed that the share of projects in non-productive sectors is 30%. This shows the need for a change to the structure of private investment i.e. to shift to productive investment areas using incentive mechanisms .

In all, a rapid expansion in private investment is dependent upon improvements in infrastructure, particularly, power, in the proper functioning of institutions and markets. The implications of the study are that the encouragement of private investment is not only a question of relatively liberal investment laws (which permits the participation of the private sector in almost all areas, provide incentives, etc.), establishment of investment institutions which facilitate investor needs, but also is a question of making resources available particularly land, finance and infrastructure. As the survey and econometric results have shown these resources are lacking. Bureaucratic procedures in these institutions (in the provision of land and finance) have to be improved in order to activate private investment. Therefore, promotion of private investment needs cooperation of all relevant institutions; it is not only a question of one institution (investment office) and/or one policy (investment policy). These constraints and their implications are also equally important to those regions which the survey of the study did not include.

Notes

1. This paper is based on the Thesis of the author presented to the School of Graduate Studies, Department of Economics, of Addis Ababa University in June 1997.
2. Calibration of each investor's assessment of the severity of the obstacles on a scale of 0 to 1 controls for differences among entrepreneurs in their subjective perceptions of absolute level of difficulty posed by the obstacles they confront.

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Table 1 Empirical Values of Relevant Variables

	GR***	DS/ XGS	CPI	DEBT/ GDP	TOT	REX *	Int**	Pub/ Gdp****	P/ Gdp****	CR/ GDP
1975	-2.40	11.80	4.66	14.87	8.5	130	4.63	10.40	6.80	0.09
1976	-0.30	9.80	18.93	16.29	9.3	124	-9.57	8.50	3.60	0.09
1977	-21.0	8.60	21.85	16.19	197	110	-12.57	8.20	3.10	0.09
1978	-3.40	9.30	18.57	16.84	126	96	-9.27	7.50	3.10	0.10
1979	2.90	6.30	12.53	18.60	144	95	-3.57	8.70	2.90	0.12
1980	2.50	8.10	12.53	19.52	100	95	-3.17	10.00	2.70	0.06
1981	3.90	10.70	1.93	23.88	83	98	7.43	10.40	2.50	0.03
1982	-1.10	13.80	7.28	29.48	86	98	2.03	11.80	2.60	0.04
1983	5.80	18.30	3.84	31.29	88	87	5.53	11.20	2.50	0.04
1984	-8.30	19.30	-0.25	34.50	87	93	9.53	12.80	2.70	0.03
1985	-9.20	38.60	18.36	38.19	82	82	-9.07	14.00	2.20	0.02
1986	3.40	38.00	4.63	33.60	123	96	3.62	12.70	2.00	0.02
1987	6.20	51.40	-9.45	32.80	69	105	17.72	14.60	2.00	0.02
1988	-1.10	62.90	2.16	34.70	77	96	6.02	15.60	2.00	0.02
1989	-1.60	67.50	9.59	38.60	89	98	1.38	14.40	1.90	0.02
1990	-3.40	55.17	5.16	38.50	75	100	3.02	9.90	2.40	0.02
1991	-9.00	74.72	20.90	40.60	76	84	12.68	7.60	2.80	0.02
1992	0.20	76.90	20.99	37.80	80	202	-12.78	2.90	6.00	0.02
1993	20.60	48.60	9.99	32.10	70	149	2.75	14.40	6.40	0.05
1994	0.60	44.00	1.17	72.10	75	201	11.55	20.60	5.80	0.08

* Source: Deresse Degefu(1996)

** calculated by the Author

*** Percentage change in real GDP percapita.

**** Source: Pefferman and Madarussy 1993

Table 2. Determinants of Private Investment in Ethiopia: 1975-1994

Explanatory Variables	Equations					
	1	2	3	4	5	6
LPub/GDP	.018 (.13)	-.01 (-.07)	.008 (.05)	.19 (1.59)	.12 (.80)	-.008 (-.06)
Int	-.004 (-.1.2)	-.002 (-.52)	-.008 (-.28)	-.002 (-1.08)	-.001 (-.33)	-.002 (-.71)
GR(t-1)	-.002 (-.95)	-.002 (-.71)	-.002 (-.80)	-.003 (-1.25)	-.003 (-1.09)	-.002 (-.86)
D	.13* (1.80)	.19* (3.25)	.18* (3.24)	.26* (4.90)	.21* (3.05)	.14* (2.57)
LReX	.83* (3.28)	.63* (2.73)	.63* (.01)	.90* (.003)	.77* (3.40)	.63* (3.04)
(LDS/XGS)t-1	-.18* (-2.14)			-.19* (-5.22)		
$(LDEBT/GDP)_{t-1}$	.45 (1.43)				-.34* (-2.10)	
CPI*CPI	-.0006 (-.06)	-.001 (-.49)				
LToT	-.3 (-1.67)					-.28 (-1.47)
LCR/GDP	.27* (2.05)	.19* (3.02)	.18* (2.92)			.24* (3.34)
constant	-.67 (-.93)	-.54 (-.94)	-.60 -1.08)	-1.34* (-3.45)	-.77 -1.25)	.05 (.07)
ADJ. R-Squ	.88	.81	.80	.92	.73	.81

Notes: t-ratios in parenthesis,
L stands for logarithm in base ten,
* significant variables at different levels of significance (1%, 5%,and 10%).

Table 3.Recent Studies of Constraints to Enterprise Growth and Operation in the Private Sector

Country, Sector, and Study	Leading Constraint	Second Constraint	Third Constraint	Fourth Constraint
Brazil-Garments (stone levy, and Paredes 1992)	Political and Policy Uncertainty	Inflation and Price Instability	High Taxes	Tax Bureaucracy
Chile-Garments (Stone, Levy,and Paredes 1992)	Lack of Competent Workers	Political Uncertainty	Inflation and Price Instability	Lack of Technicians
Kenya-Multiple Sectors(schankerman & stone 1992)	Inflation	Access to Finance	Political and Policy Uncertainty	Infrastructure
Tanzania-SMEs in Furniture, Construction, Horticulture (Levy 1991b)	Lack of Access to Finance	Bureaucratic Procedures of Regulation	Lack of Acess to Industrial Sites	-
Egypt-Food, Textiles, Engineering (Galal 1991)	Political Uncertainty	Tax structure	Tax Adminstration	Acess to and Cost of Finance
Cote d'Ivoire-SMEs in Multiple Sectors (Rueda-Sabater and Stone 1991)	Tax and Fee Administration and Cost.	Policy Uncertainly	Acess to Finance	-
Ghana-Multiple Sectors (Steel and Webster 1991)	Lack of Access to Finance	Taxes	Lack of Demand	Economic Uncertainty

Source: The World Bank (1992), Adjustment Lending and Mobilization of Private and Public Resources for growth. Policy and Research series (22), p.39.

Table 4. Entry Constraints Ratingin Region 14

	SCORES
Regulatory Constraints	
Bureaucratic Procedures*	1
Political/Policy Uncertainty	0.49
Labour Regulation	0.40
Access to Land*	1
Financing	
Access to finance	0.64
Cost Constraint	
Cost of Land*	1
Cost of Finance	0.60
cost of equipment	0.31
Access to equipment	0.36
Infrastructure*	1
Number of Investors	11

*Note: Leading Constraints in each Table

Table 5. Operational Constraints in Region 14

REGULATORY CONSTRAINTS	SCORES
Bureaucratic procedure	0.72
Political/policy uncertainty	0.52
Labor regulation	0.35
FINANCING	
Access to finance*	0.84
COST CONSTRAINT	
Cost of finance	0.63
Cost of raw material*	0.80
INFRASTRUCTURE*	0.78
LACK OF SKILLED WORKER	0.50
ACCESS TO RAW MATERIAL	0.55
LACK OF MARKET	0.60
FOREIGN EXCHANGE	0.25
NO. OF INVESTORS	23

Table 6. Common Constraints to Both Entry and Operation

	SCORES		
REGULATORY CONSTRAINTS	Region 14	Tigray	Both Regions[†]
bureaucratic procedure*	0.86	0.56	0.76
political/policy uncertainty	0.51	0.23	0.42
labor regulation	0.38	0.20	0.32
Access to finance*	0.74	0.67	0.71
cost of finance	0.62	0.64	0.62
INFRASTRUCTURE*	0.84	0.56	0.75
NO. OF INVESTORS	34	16	50

Table 7. Main Source of Finance for 50 Region 14 and Tigray Region Investors (Number of Investors that obtained Finance from each source)

		Region 14	Tigray
1	Own Saving	18	9
2	Family or Friends	1	-
3	Partners	5	-
4	Formal Financial Institutional (Bank)	10	7
5	Information Financial Institution	-	-
Number of Investors		34	16

Table 8. No. of Investors and the Percentage which have difficult relationships with each institution

	Region 14	Tigray
Region 14 Administration/Tigray (Concerning Provision of Land)	24 (71%)	3 (19%)
Custom Authority	14 (41%)	3 (19%)
Power Authority	12 (35%)	3 (19%)
Telecommunications	16 (47%)	2 (13%)
Water Authority	7 (21%)	3 (19%)
No. of Investors	34	16

† Computed taking into consideration the number of respondents in each region.

USUFRUCT RIGHTS IN LAND IN GRAIN SUPPLY RESPONSE ANALYSIS: THE CASE OF ETHIOPIA

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ABSTRACT

Change in the production of a crop at household levels has to date been directly associated with increase in the size of cultivated land. Given that land size can not be augmented by way of land transfer because of the existing land policy and also given that there is low level of technological application, efforts targeting increase in the production of a crop require land transfer from other crops, making aggregate changes in crop production both at the household and at the national level following incentive changes to be small.

A vector autoregression model was fitted, using macro data, to investigate interrelationships between producer prices and size of cultivated land under grains. The findings from the impulse response functions suggested that perturbations in cultivated land do cause chain reactions in producer prices but the reverse was found to be true only for area under cereals. Variance decomposition also attributed higher percentage of variation in areas to come as a result of own innovations. But sizable proportion of variations in producer prices will partly be explained by variations in areas and the remaining higher proportion by their own past. Forecast values were also computed for areas and producer prices. The results showed that both continue to decline in the same direction in the years to come as they have already attained their turning points in the year 1995/96.

INTRODUCTION

Agriculture is the mainstay of the Ethiopian Economy. It accounts for not less than 50 percent of national output, provides raw materials and labor to the industrial sector and makes substantial contribution to foreign exchange earnings.

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economic planning. For example, the shift away from "industry-first argument" towards agricultural development, in the late 1960s, was caused by food shortages. Later the "Ten-year perspective Plan" following the drought of 1984, the "Mixed economic policy" in 1990, and the "Adjustment program" in 1992 planned increase in food production.

The economic policies introduced since 1990 have created favorable environment for an increase in grain production. For example, the 1990 policy reform abolished the privileges that were given to state and cooperative farms. It lifted quota delivery systems and restrictions on inter-regional grain flows and allowed trading of farm produce at free market prices. This was further strengthened by the 1992 political and economic reform with additional policy instruments targeting, among other things, the reduction of macro economic distortions and lowering of real effective exchange rate. These policy changes targeted directly or indirectly the setting of prices right.

Different studies have, however, discovered insignificant price elasticities of supply for food crops and ascribed this to non-price factor such as the non-existence of conducive land policy. Currently farmers have only a right of use but not to sell land. This is a remnant from the previous socialist regime.

Usufruct rights in land constrain farmers' response to market based incentive changes because the level of grain production has to date been affected more by size of cultivated land. For example, during the study period two distinct policy measures having opposite repercussions on farmers' response were witnessed. The time before 1990 was characterized by unfavorable policy environment. For example, fixed pricing and fixed quota delivery systems were introduced and in some areas farmers who were unable to comply to grain quota used to be compelled to fulfill the shortfall by purchasing from open markets. This was said to have forced many farmers to change their production mix of cropping pattern to evade grain quota (Alemayehu, 1990).

Between 1987 and 1990 prices of all crops under review were increased as a result of pressure from the International Monetary Fund, the World Bank, and the African Development Bank, because officially established prices were found to be unrmunerative. As evidenced by Table 1, following adjustment of floor prices, increases in production, area, and yield (production per hectare) were registered for cereals. The response was strengthened in the subsequent years except that there was a decline in yields i.e. price changes increased grain production and increase in grain production was in turn caused by increase in cultivated land but not yield. This is because as could be seen from Table 1, the figure for yield declined during the third period. This could be ascribed to many factors of which mentionable is the 140 percent devaluation of the domestic currency in October 1992, which increased domestic price of fertilizer, and to the gradual lifting of subsidy on fertilizer.

This can further be supported by analyzing changes in total grain production in the major cropping season of the past three consecutive years (1994/95 - 1996/97). In

1995/96 a 31.77% increase in total crop production was registered. But in the following year it rose only by 1.77%. This fluctuation in the percentage increase of production was the result of notable change in area than yield. This is because, in 1995/96, increase in cultivated land was registered to be 988.35 thousands hectares but increase in area fell to 123.83 thousand hectares in 1996/97. But increases in yield were 1.55 quintal per hectare in 1995/96 and 0.28 quintal per hectare in 1996/97.

Table 1: Response of Food Production to Area (Prices are at 1994\95 base year)

	Cereals				Pulses			
Year	AVG Price Index	AVG Prod. '000 Quintals	AVG Area '000 Hectares	AVG Yield	AVG Price Index	AVG Prod. '000 Quintals	AVG Area '000 Hectares	AVG Yield
1981/82-87/88	44.84	54959.76	4860.29	11.31	39.55	6435.41	716.24	8.98
1988/89-89/90	48.66	59423.43	4928.06	12.06	51.55	5683	572.5	9.93
Since 1990/91	91.70	63238.11	5490.14	11.52	80.41	7375.63	928.63	7.94

AVG stands for Average.
Source of Original Data: Central Statistical Authority, National Bank of Ethiopia and author's computation.

The reasons for low yield could be the fact that chemical fertilizer is used by less than 14% of farmers (Dejene, 1994). Improved seeds are available for only 2 percent of peasants and 15-20 percent of crop loss occurs due to very limited use of pesticides (Ramanujam). Only 0.3 percent of agricultural lands are irrigated (WB, 1993) and agricultural research activities have brought little progress in agriculture as it has not for long been target oriented (Goshu, 1994).

Therefore, given that

1. Farmers are too poor to afford application of high input package
2. Extensive farming is not possible by way of reclamation of uncultivated land, as production has long encroached upon marginal lands in some areas because of human and livestock population,
3. Little fallow land is at farmers' disposal, and that
4. Change in area under crops is primary source of production change

It is hypothesized in this paper that increase in the production of a crop following incentive changes is possible by decreasing land allocated to other crops, making over all changes in grain production following incentive changes to be small.

Therefore, this study takes as its major objective the establishment of interrelationships between area under grains and their respective producer prices. To

achieve this, vector autoregression model is fitted. The contribution of this paper may also be seen as methodological as most studies on supply response use Nerlovian Partial or Adaptive Expectation models which Nerlove himself was no longer so sure in their power as a tool for understanding the dynamics of agricultural supply in developing countries (Ramanujam). In addition, the model provides information regarding for how long, say, a change in land policy (or a change in producer prices) will continue affecting producer prices (or grain supply). It also serves as a measure of the nature of linkages between producer prices and grain supply.

The paper is organized into four sections. In section one, an attempt to highlight the current land tenure conditions in Ethiopia and their possible impact on grain production, in particular, and overall agricultural growth in general is made. Sources of data and measurement of variables are discussed in section two. In section three, discussion is made as to how investigation could proceed regarding interrelationships between size of cultivated land and price changes using a Vector Autoregression system. Finally, results are discussed and conclusions are given.

1. LAND POLICIES IN ETHIOPIA: *EFFECTS ON AGRICULTURE, AN OVERVIEW*

Different kinds of land tenure conditions were practiced prior to the 1974 political and economic reform. For example, Rist[2] system in the northern highlands, Gebbar[3] land in parts of Wollo and Northern Shoa, Schama[4] village tenure in parts of Eriteria and Tigray, Church land and State tenure both in the northern and southern parts, and Gult[5] system in the remaining parts of Ethiopian highlands (Sutcliffe, 1995; Desalegn, 1984). Following political and economic reform, which occurred in 1974, however, land fell into state hands with individual farmers possessing mere rights of use and occupancy; and sharecropping institutions were outlawed. The reason for not allowing marketing transactions on land currently is fear on the part of the government that it would intensify rural urban migration.

There are different views regarding the adverse impacts of state ownership on growth of agriculture. To mention a few, its effect on investment in land conservation, on the expansion of rural credit markets, and social tension between the "haves" and the "have nots". With regards to the latter, the tension, according to Aklilu and Tadesse (1994), created both inter-generational conflict (i.e. between fathers and sons) and intra-generational competition (between youngsters who compete for megazo[8] lands). Though implicit, conflicts are also apparent between the landless who favor another round of land redistribution and those who in one way or another obtained more than the average land size and feel that land redistribution makes them end up with little plots (Teferi, 1995).

Land distribution, which was conducted following the 1975 reform based on family size, could not satisfy new claims for land by newly formed households. Peasant associations across the country had, therefore, to deal with this by redistributing land until government in 1989 officially banned it. Land redistribution has, however,

continued even after 1989 within households in the form of *miraazaa baass or gulema* lands[7]. This contributed to an increase in land diminution, dislocations, and tenure insecurity. As a result farmers whose holding is below 0.25 hectare are currently excluded from the use of the high input package, extended by the Ministry of Agriculture and Sasakawa Global 2000, since the conditions attached to the use do not permit them (ICRA, 1997). Currently a household is assumed to hold on average less than one hectare making adoption of modern yield increasing technology difficult. High intensity of crop production in most parts of the country has become a strategy to cope with the small farm sizes i.e. double cropping of small cereals is a common practice.

Tenure insecurity, which occurs owing to uncertainty regarding continuous use of a plot, is assumed, in economic literature, to cause reduction in farmers' incentives in investing in soil conservation and soil management measures. Too small land size to use legume-based crop rotation and fallowing is one reason why farmers fail to counter declining soil fertility and cultivation of high valued but less nitrogen-fixing crops in order to avoid the risk of losing plots in redistribution before earning the maximum possible was another (Teferi, 1995). Thirdly, government support in the supply of high input package is biased towards land requiring relatively less investment in land conservation i.e. majority of farmers in the hills whose lands are greater than 5% slope are not eligible to benefit from government package.

The paucity of credit channeled to small farmers by formal lending institutions, which is ascribed among other things to the sanctioning of farmers to use land as collateral, is another factor cited as responsible for impeding farmers' access to technology. For example, of the total credit disbursed by the Development Bank of Ethiopia and the Commercial Bank of Ethiopia between 1983\84 to 1992\93, only 22.2% and 2.4%, respectively, went to peasant agriculture (NBE, 1996).

The introduction of an "Adjustment Program" in 1992 provided management autonomy to credit institutions and allowed free entry of private banks into credit markets. Because of this a further decline in credit to farmers is anticipated owing to the fact that the majority of Ethiopian farmers are too poor to supply collateral required by formal credit sources. Land becomes attractive collateral provided that the owner or borrower can guarantee to the lender that his land can be transferred. As a result farmers' sole source of fund has remained to be informal. For example, an estimate by the National Bank of Ethiopia in 1996 indicated that in 1995, credit from informal sources to small enterprises, farmers included, amounted to 10% of Gross Domestic Product.

2. DATA AND MEASUREMENT OF VARIABLES

The study covers only cereals and pulses. This is because, in terms of area coverage more than 95% of the total cultivable land is on average used for cultivation of these crops. As shown in Table 2, a larger percentage of land under crops goes to cereals

and pulses. Cereals include teff, barley, wheat, maize, sorghum, millet, and oats, while pulses include horse beans, field peas, haricotbeans, chickpeas, lentils, and vetch.

Table 2: Area Under Grain

Year	Cereals		Pulses	
	Million Hectare	%	Million Hectare	%
1994\1995	6.45	83	0.92	12
1995\1996	7.67	85	1.01	11
1996\1997*	6.67	83	0.91	11

Sources: Central Statistical Authority, National Bank of Ethiopia and author's own computation.
* Data is available only for main cropping season.

Because area is used in place of production as a proxy for supply, weather is excluded from the model. The use of area in place of production in supply response analysis is suggested as production figures are more susceptible to weather fluctuations. In addition, a proxy for technology in not included in the model. Small land size, at farm household level, has caused full utilization of land resource leaving almost no fallow land at farmers' disposal. Therefore, availability of technology is assumed to bring no change in land size under a crop. This is because with land falling in state hands and with a peasant having little access to additional land purchase, he or she is assumed to be dictated more by price to expand area under a crop since such a decision requires a farm household to reduce area devoted to other crops.

The time series data on output, area, and prices for the period 1981/82-1996/97 were collected from various periodic reports published by the Ethiopian Central Statistical Authority and National Bank of Ethiopia. Price indices for cereals and pulses are not readily available in Ethiopia. With this fact in mind, rural consumer price indices indexed at 1995/96 prices were used and deflated by similarly indexed price of competitive crops (price index of pulses were used to deflate price of cereals and price index of cereals were used to deflate price of pulses). Price indices were available for 1981/82 to 1995/96 at 1981/82 base year price and since 1995/96 at 1995/96 prices. The index for earlier years was converted to index with 1995/96 as the base year.

3. THE MODEL

Vector Autoregression (VAR) is used in this study to analyze the interrelationships between producer prices "P_t" and Area "A_t". It is a multiple time-series generalization of the Autoregressive model.

$$A_t = \beta_{11}A_{t-1}+\beta_{12}P_{t-1}+\varepsilon_{1t} \quad \text{.....} \quad [1]$$

$$P_t = \beta_{21}A_{t-1} + \beta_{22}P_{t-1}+\varepsilon_{2t} \quad \text{.....} \quad [2]$$

Where, A_{t-1} and P_{t-1} are area and producer prices at time t-1, and ε_{1t} and ε_{2t} are error terms.

τ The system in terms of the lag operator L is

$$\begin{bmatrix} A_t \\ P_t \end{bmatrix} = \begin{bmatrix} 1-\beta_1 L & -\beta_{12} L \\ -\beta_{21} L & -\beta_{22} L \end{bmatrix}^{-1} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

$$= 1/\tau \begin{bmatrix} 1-\beta_{22} L & \beta_{12} L \\ \beta_{21} L & 1-\beta_{11} L \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad [3]$$

Where

$\tau = (1-ß_{11}L)(1-ß_{22})-(ß_{21}L)(ß_{12}L)$

$= 1-(ß_{11}+ß_{22})L + (ß_{11}ß_{22}-ß_{12}ß_{21})L^2$

$= (1-\lambda_1 L)(1-\lambda_2 L)$ say)

where λ_1 and λ_2 are eigenvalues of the equation

$$\lambda^2 - (ß_{11} + ß_{22})\lambda + (ß_{11}ß_{22}-ß_{12}ß_{21}) \quad [4]$$

For the satisfaction of stationarity condition, absolute values of?eigenvalues should be less than???? otherwise there is little point in studying impulse response functions for nonstationary systems. As the condition for stationarity is satisfied for grains under study, it is found unnecessary to estimate cointegrating equations since linear combination of the variables is stationary.

4. RESULTS AND DISCUSSION

All data are transformed to logarithms. The data were examined by visual inspection of the correlograms and by Augmented Dickey-Fuller tests to determine whether they are stationary in levels or possess a stochastic trend. As shown in Appendix 1, autocorrelations die out as the lag becomes large for all the variables. But according to tests done for unit root using (summarized in Table 3 below) Augmented Dickey-Fuller, the null hypothesis for the presence of unit root was rejected only for price variables. Since linear combinations of these I(0) and I(1) variables in the VAR give a stationary series, it was concluded that the variables should appear in levels. Stationarity of these linear combinations of the variables was later proved by the eigenvalues, the absolute values of which turned out to be less than one.

Table 3: Unit Root Test

Variables	Cereals				Pulses			
	ΔA		ΔP		ΔA		ΔP	
	Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio
Constant	0.9483	1.1222	2.1628	2.0398	0.9208	1.1553	2.0854	2.1515
Trend	0.0090	1.0868	0.6483E-3	0.0811	0.0122	1.6053	0.7698E-3	0.0960
X(-1)	-0.2418	-1.1657	-0.4646	-2.1002	-0.2381	-1.2599	-0.4582	-2.0828

X(-1) stands for one-year lag of the dependent variable
Δ stands for first difference of the dependent variable
Source: Author's calculations

Lag lengths were determined by estimating the models with one and two lags and employing a likelihood ratio test. Based on the result of these tests the order of the VARs was determined to be one. Regression results of the equations with two lag orders, before a step by step deletion of non-significant variables was applied, and variance covariance matrix of their respective residuals are given in Appendix 2.

Tests for structural stability was conducted on selected models using CUSUM and CUSUM-SQUARES. The CUSUM test is used to detect systematic changes in regression coefficients, while the CUSUM-SQUARES test is used in situations where the departure from consistency of the coefficients is arbitrary and hidden. According to these tests the hypothesis for the absence of systematic and sudden or haphazard changes could not be rejected. The parameters according to these tests are constant and no departure from consistency of parameters in a sudden way exists. This means that there are no changes in the trend because of a major structural break witnessed in 1990/91. As a result data before 1990 is included to increase sample size.

4.1. Impulse Response Functions

After deleting insignificant constant terms from the model for pulses, considering the 1993/94 observation for area of pulses as an outlier based on analysis of residuals, correcting first order serial correlation using cochrane-orcutt from the equation for area of cereals, and finally making sure that the absolute values of eigenvalues computed from the two VARs are less than one; impulse response functions were computed as summarized in Table 4 (see Appendix 2 for original regression results and diagnostic tests). Impulse response functions calculate chain reactions overtime in all variables as a result of perturbation in an innovation.

Table 4 above shows a one standard deviation perturbations in the first and second orthogonalized innovations in cereals and pulses. It takes less period for reactions in producer price to die out as compared to cultivated land. One standard deviation perturbation in the first orthogonalized innovations does cause chain reactions in producer prices implying that changes in cultivated land triggered by changes in policies affecting use of land cause change in producer prices. But perturbation in the

second orthogonalized innovations (producer prices) causes chain reactions only in cereals. This may be due to the supplimentariness of pulses to cereals in the dietary makeup of Ethiopian dish. This is because as evidenced by Table 2 and Table 5 greater proportion of the available arable land goes to the production of cereals despite the relatively higher price fetched by pulses.

Table 4: Impulse Response Functions

Cereals						Pulses					
$U_1 = [1\ 0]'$			$U_1 = [0\ 1]'$			$U_1 = [1\ 0]'$			$U_1 = [0\ 1]'$		
Period	Area	Price	Period	Area	Price	Period	Area	Price	Period	Area	Price
1	0.11	-0.04	1	0	0.01	1	0.12	-0.01	1	0	0.11
2	0.05	-0.05	2	0.03	0.04	2	0.11	0.02	2	0	0.08
3	0.01	-0.04	3	0.03	0.01	3	0.10	0.04	3	0	0.06
4	-0.01	-0.02	4	0.02	0	4	0.09	0.05	4	0	0.05

Source: Author's calculation

Table 5. Per kilogram Retail Prices of Cereals and Pulses in Rural Areas in Randomly Selected Years

	Cereals				Pulses			
Year	Teff mixed	Wheat mixed	maize	Sorghum mixed	Horse beans	Haricot beans	Chick peas	Lentils
1981/82	0.61	0.62	0.52	0.70	0.43	0.72	0.52	0.58
1984/85	1.18	1.08	0.85	1.02	1.05	0.96	1.37	1.53
1988/89	0.78	0.71	0.54	0.61	0.91	1.94	0.98	1.39
1992/93	1.53	1.39	0.97	1.13	1.35	2.29	1.73	2.18

Source: Central Statistical Authority, Rural National Consumer' Price index

Therefore, one may conclude from Table 4 that perturbations in producer prices do cause little impact on cultivated land and thereby grain supply. This may partly be attributable to the prevailing land holding system, as it has restricted land acquisition of any form and made capable farmers operate on *fixed plots with almost no fallow land at their disposal*. And partly to the risk averse and subsistence natures of agricultural production, which allow little room for specialization in the production of specific crops.

4.2. Variance Decomposition

Evidence on the nature of the linkages between producer prices and area is provided by the variance decomposition, which measure the proportion of forecast error variance in one variable explained by innovations in itself and the other variable. As reported in table 6 below, a larger proportion of variations in area is explained by its own past, accounting between 62%-100% for cereals and 100% for pulses. The same is true for variations in producer prices accounting for between 90%-99% for pulses and between 71%-96% for cereals.

Table 6. Variance Decomposition of Area and Producer Price

	Cereals				Pulses			
	Var. decomposition of Area		Var. Decomposition of Price		Var. Decomposition of Area		Var. Decomposition of Price	
	Area	Price	Area	Price	Area	Price	Area	Price
1st	100	0	16.7	83.30	100	0	1	99.00
2nd	97.5	2.50	29	71.00	100	0	5	95.00
3rd	62	38	4	96.00	100	0	9.7	90.30

Source: Author's calculations

*Confidence intervals are not included because of the difficulties inherent in computing standard errors for structural VARs.

Variations in producer prices are to a certain degree explained by variations in area accounting for between 4%-29% to cereals and between 1%-10% to pulses. This means that variations in supply (measured in terms of area) do affect producer prices but little will be the impact of producer price variation on supply. This may imply the continuation of the impact of the aforementioned constrains in shaping future relations between the variables given that the current policy environment continue to influence production in the future .

4.3. Forecasting

To see weather the trends in areas and producer prices experienced since 1992/93 will continue beyond the sample period, forecasting was made.

Sample period prediction performance of the VARs was measured using mean squared error (MSE), mean of forecast errors (μ_ε), standard deviation of forecast errors (σ_ε),and correlation between prediction errors and prediction values (γ) in order to check the power of the VARs in making forecasts within the sample period.

As shown in Table 7 below, the statistics obtained are small, except for area under pulses[8], suggesting that the prediction bias may be characterized as being minor and the usefulness of the model in making forecasts for future values of area and price with little prediction bias. Forecast values within and beyond the sample periods for each variable are summarized in Figure 1.

Table 7. Summary Statistics for Sample Period Prediction Errors

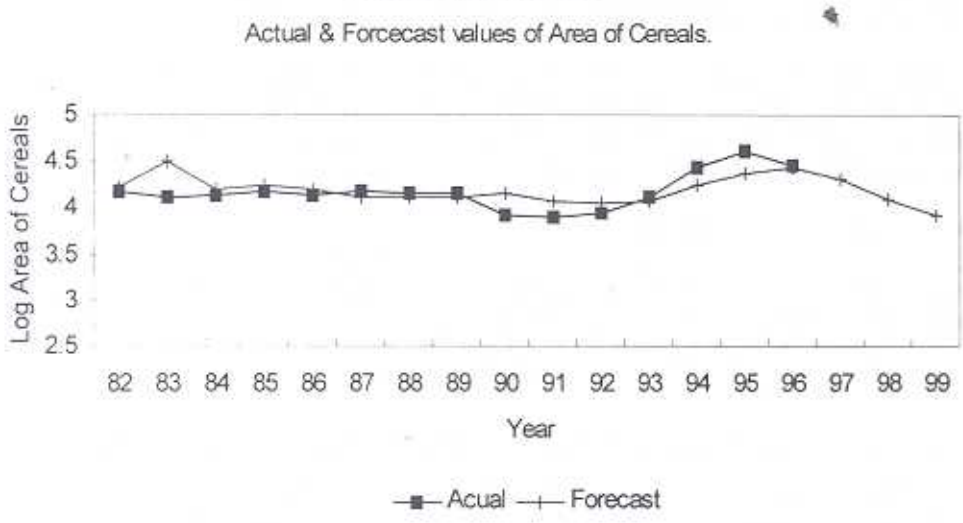
		Cereals				Pulses		
Variables	MSE	μ_ε	σ_ε	γ	MSE	μ_ε	σ_ε	γ
Area	0.14	-0.01	0.12	0.44	0.11	0.31	0.11	-0.16
Price	0.03	0	0.10	0	0.02	0	0.10	-0.20

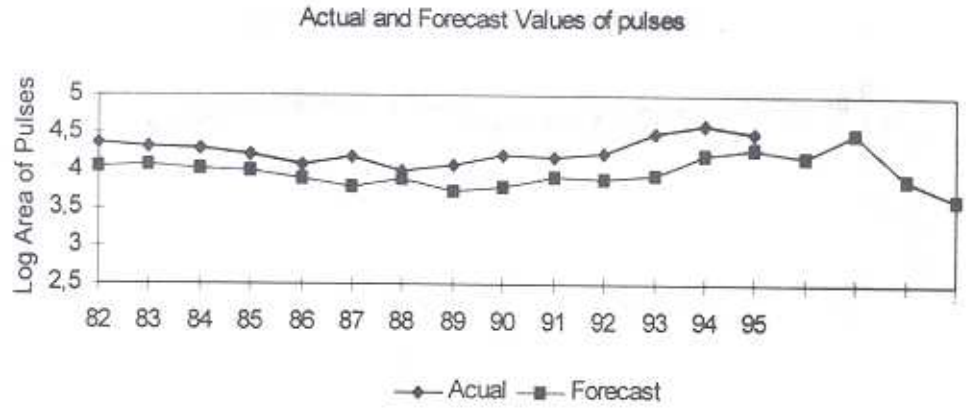
Source: Author's calculations

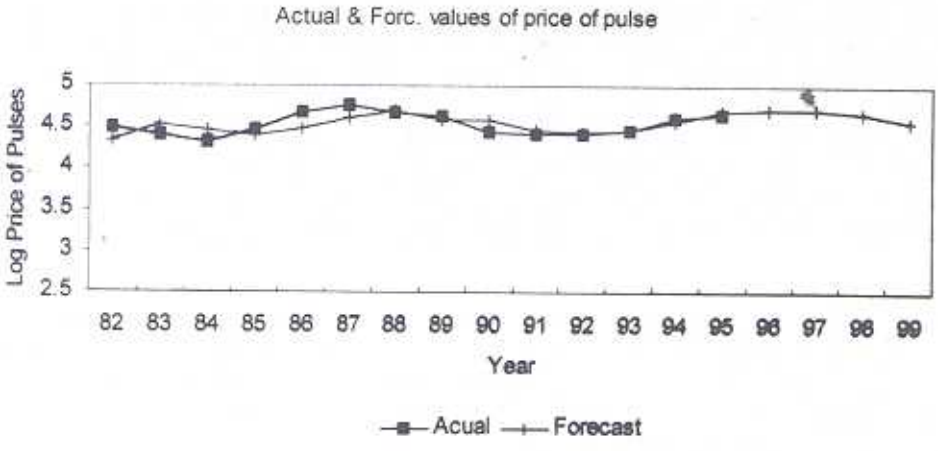
Increase in actual values occurred for the variables (Figure 1) between the years 1991 and 1994/95. This as explained earlier resulted from deregulation of marketing constraints, which were experienced prior to 1990. Since 1994/95, however, actual values have declined. One possible reason for this could be that the IMF-World Bank orchestrated restructuring, initiated in 1991/92 and being strengthened by a series of accompanying policies to date, began to achieve its target of shifting resources from the non tradable to the tradable sectors of the economy.

According to the forecasts made for values of the variables beyond the sample period (see values after 1996/97) decline continues to occur in the years to come. This decline in areas may be attributed, as explained earlier, to the increasing competition for scarce arable land coming in recent years from cash crops. This may be because of the fact that production of cash crops is becoming rewarding due to continuous adjustment of the exchange rate, which in turn is causing a rise in domestic price of these crops. It is however the author's belief that further investigation should be made to identify factors responsible for this phenomenon. These declines in areas under grain are accompanied by similar reaction in producer prices. This is in line with a priory expectation regarding direction of movements of area and producer prices.

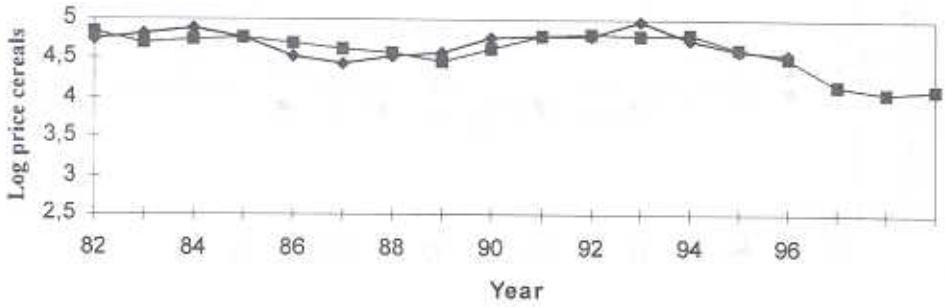
Figure 1: Actual and Forecast Values of Areas and Producer Prices for Pulses and Cereals




Actual and Forecast Values of pulses
Log Area of Pulses
5
4,5
4
3,5
3
2,5
82 83 84 85 86 87 88 89 90 91 92 93 94 95
Acual
Forecast


Actual & Forc. values of price of pulse
Log Price of Pulses
5
4.5
4
3.5
3
2.5
82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99
Year
Acual
Forecast

Actual and Forecast Values of price of Cereals



SUMMARY AND CONCLUSION

Increase in production of individual food crops is directly associated with an increase in cultivated land. This is because the majority of Ethiopian farmers can not afford to apply high-powered inputs. Increase in cultivated land by way of reclamation of uncultivated land has become difficult as cultivation has long encroached upon marginal lands in most areas. Increase in the cultivated land by way of consolidation is also constrained by the current system of land holding which does not allow selling and lease of land. The system has reduced average holding to less than one hectare due to continuous redistribution and increase in human and livestock population. These have made possible only intra crop and/or inter crop transfer of cultivated land and made changes in over all grain production following incentive changes to be small.

Tenure insecurity as a cause for the reduction in the long term investment in soil conservation, the inability of farmers to use land as collateral as a cause for reduction in the use of agricultural inputs, and possible conflicts between those having land and those without are also among the consequences of state ownership of land, calling for a change in the existing rural land policy.

A system of vector autoregression was fitted to investigate interrelationships between producer prices and cultivated land. Findings from impulse response functions suggest that perturbations in cultivated land do cause chain reaction in producer prices. But perturbations in producer price cause chain reactions only in cereals. Attempts to decompose variations in the variables under consideration suggest that greater proportions of variations in cultivated land be explained by their own past. But variations in producer prices will be attributable partly to cultivated land, and partly to their own innovations. Forecast for future values of areas and producer prices were also made to see weather the trend experienced in recent years in cultivated land and producer prices will continue to occur in the future. Results indicate that they will have

decreasing values as they have already attained their turning points in the year 1995/96.

The findings are in line with a priori expectation i.e. in situations where farmers operate under fixed plots and where there exist little fallow lands, both resulting from the granting of user rights on land, little change in grain production occurs following incentive changes. This could also be justifiable by risk averse behavior of farmers, subsistent production, and little market orientation.

Therefore, if an increase in grain production is to be achieved, in addition to the incentives provided, two alternatives may be considered. First, devising farmers' access to additional land by allowing land transferability. Second, reducing farmers' dependence on land size as primary means for increasing production.

VII. NOTES

[2] Rist is hereditary use rights, both matrilineal and patrilinieal. Allocation and reallocation of plots could and often did occur as new claims were made.

[3] Tenants on Gebbar land had little or no security of tenure with tenancies usually renewed annually. Tenants were unable to claim compensation for any improvements made to the land.

[4] Periodic redistribution of plots to accommodate changing population pressures.

[5] Tribute was collected by Gult holders (nobility, the clergy, and military) or by the landowner in the form of rents.

[6] Megazo lands are share cropped lands. Although share cropping is not allowed it is still being practiced between kins in some parts of the country.

[7] Except for the wording both are to mean arrangements between sons and parents when sons marry or start to plough independently. The name Gulema is used by farmers in the central highlands while miraazaa baass is used among Oromo inhabitants in eastern highlands.

[8] This could be attributed to factors not explainable by the model.

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IX. APPENDIX

Appendix 1

Autocorrelation Coefficients

	Area Under Crops		Price Deflated by Price of Competitive Crop	
Order	Cereals	Pulses	Cereals	Pulses
1	0.67496	0.43706	0.48740	0.48740
2	0.13994	0.34449	0.89527	0.89527
3	-0.30246	0.18315	-0.16827	-0.16827
4	-0.43658	-0.16411	-0.39085	-0.39085

Appendix 2

VAR Results of First and Second Orders

2.1. First Order

2.1.1. Cereals

Numbers in brackets are standard errors.

$$A_t = 0.6212A_{t-1} + 0.34084P_{t-1} + \varepsilon_{1t}$$
$$(0.26492) \quad (0.24073)$$

$$P_t = 4.1257 - 0.3378A_{t-1} + 0.4183P_{t-1} + \varepsilon_{2t}$$
$$(1.4050) \; (0.18510) \quad (0.20340)$$

First line of the equation initially showed serial correlation problem of order one. This problem was corrected using Cochrane-Orcutt. Other tests for Heteroscedasticity, Functional form, and Normality were also conducted for the two equations using microfit program. Results showed that OLS assumptions are satisfied.

2.1.2. Pulses

$$A_t = 0.93196A_{t-1} + 0.0666\,P_{t-1} + \varepsilon_{1t}$$

$$P_t = 0.25831A_{t-1} + 0.76213\,P_{t-1} + \varepsilon_{2t}$$

** All coefficients in the above two equations are significant at 5% significance level except the coefficient for P_{t-1} on line one. Diagnostic tests for serial correlation, Hetroscedasticity, Functional form, Normality were done and no problem was detected. These results were obtained after an outlier in observation 1993\94 was excluded based on analysis of residuals.

2.2. Second Order

Below are shown coefficients obtained before a step by step deletion of insignificant variables was made. Numbers in brackets are standard errors. No specification problem except that the null hypothesis for joint explanation of variations in area are rejected at 13% and 14% significance levels for cereals and pulses, respectively.

2.2.1. Cereals

$A_t = 0.78675 + 1.352\ A_{t-1} - 0.81466\ A_{t-2} + 0.36258\ P_{t-1} - 0.12247\ P_{t-2} + \varepsilon_{1t}$

(2.0135) (0.29178) (0.39937) (0.28811) (0.27577)

$P_t = 3.8046 - 0.26235\ A_{t-1} - 0.045904\ A_{t-2} + 0.58160\ P_{t-1} - 0.11952\ P_{t-2} + \varepsilon_{2t}$

(2.3754) (0.34423) (0.47117) (0.3399) (0.32534)

2.2.2. Pulses

$A_t = 3.0183 + 0.95217\ A_{t-1} - 0.39959\ A_{t-2} - 0.12273\ P_{t-1} - 0.12439\ P_{t-2} + \varepsilon_{1t}$
(2.9488) (0.34161) (0.47084) (0.37683) (0.39981)

$P_t = 1.3396 - 0.026855\ A_{t-1} + 0.11616\ A_{t-2} + 0.90982\ P_{t-1} - 0.28859\ P_{t-2} + \varepsilon_{2t}$
(2.4542) (0.28431) (0.39187) (0.31363) (0.33276)

2. 3. Variance Covariance Matrices of Residuals

Stepwise elimination of insignificant variables from the VARs was done and the following variance covariance matrices of residuals were computed for cereals with one and two lag orders. Variance covariance matrices of residuals for pulses are not presented here. This is because elimination of insignificant variables from the models resulted in equivalent models.

$$\Omega_1 = \begin{bmatrix} 0.015 & -0.003 \\ -0.003 & 0.012 \end{bmatrix}$$

$$\Omega_2 = \begin{bmatrix} 0.865 & -0.003 \\ -0.003 & 0.012 \end{bmatrix}$$

Ω_1 is variance covariance matrix of errors from the VAR with one lag order and Ω_2 is variance covariance matrix of residuals from the VAR with two orders. Testing the

hypothesis that the order is $p_0 < p_1$ made selection for the order of the VAR. The null hypothesis is nested within the alternative hypothesis and it was tested by a likelihood ratio test statistic given by:

$LR = n [\ln \Omega_1 - \ln \Omega_2] \sim$ Chi square with q degree for freedom

Where q is given by $q = k^2 (p_1 - p_0)$

Appendix 3

Production, Area, and Rural Consumer Price Index for Cereals and Pulses

	Cereals			Pulses		
Year	Production	Area	Rural CPI	Production	Area	Rural CPI
1981/82	53935.04	4629.43	34.8	8203.3	793.7	23.6
1982/83	67182.83	5029.23	35	9654.6	798.8	30.5
1983/84	55268.17	4715.59	35.6	7117	761.2	29.1
1984/85	42398.47	4814.68	67.8	5017	739	51.2
1985/86	48199.87	4991.63	57.4	4673	670	49.4
1986/87	56364.29	4786.31	42.23	5316	590	45
1987/88	61369.68	5055.19	41.3	5067	661	48.2
1988/89	57335.73	4890.79	48.8	5245	557	52.8
1989/90	61511.13	4965.32	48.8	6121	588	50.5
1990/91	53201.71	3898.63	66.3	9587	678	56
1991/92	45671.3	3835.16	81	6241	664	67
1992/93	51550	3974.43	92.1	5778.5	706	76.8
1993/94	4740.1	4714.24	97.5	5091.3	1610	67.42
1994/95	65890	6450.0	106	7922.17	918.3	91.8
1995/96	92660	7670.0	100	8662.1	1008.8	100
1996/97	86293.32	6688.55	99.01	8347.33	914.39	103.8

Sources of Original data: Central Statistical Authority, and National Bank of Ethiopia

Book Review

[Chandan Mukherjee, Howard White and Marc Wuyts (1998). **Econometrics and Data Analysis for Developing Countries**. Routledge, London and New York; ISBN 0-415-09399-6 (hbk), ISBN 0-415-09400-3 (pbk) 496pp. With Diskette]

This is a new book on the use of econometrics and data analysis techniques in the context of developing countries. The book contains five sections with fourteen chapters, three of the chapters supported by appendices. It is also accompanied by a set of electronic data (on developing countries) that greatly facilitates computer-based application of concepts explored in the main text.

Part I of the book is informed by the authors' belief in the exploration and understanding of data before modeling presumed patterns that may emerge from the exploration. Thus, the first three chapters of the book are devoted to understanding of data centered analysis, averages and distributions. Once the data is explored in this manner, the next issue is to model the observed patterns. Thus, part II of the book is devoted to this issue, in particular, by focusing on regression (both simple and multiple) analysis. The strength of this part lies in its attempt to elucidate interpretation of regression results by explicitly taking real world developing countries' problems. This is forcefully demonstrated, for instance, using Griffin's aid versus saving model and the issue of model misspecification in econometrics.

Part III and part IV of the book seem to be informed by the desire to make the book not only theoretical but also an invaluable tool for practicing econometrics. In part III the emphasis shifts to cross-section data analysis while in part IV time series econometrics is introduced. As noted, although the introduction of these sections, in particular part IV, justified on practical ground, it demands the reader to jump into new area (except perhaps chapter seven on hetroschedascity) without providing adequate exposition on problems of classical regression assumptions that would have deepen the exposition in part II. Be that as it may, the introduction of the logit model in this part is quite an interesting addition for those researchers that deal with qualitative data.

Part IV on time series econometrics provides an excellent introduction. The authors could have strengthened that part by discussing the Johanson method and some developing country examples using this method. Adding such chapter would have undoubtedly qualified the book for post-graduate teaching in most LDCs. Part V, on simultaneous equation models, is not fundamentally different from the classical treatment of topics raised in this theme. The authors largely followed their creative approach in the book (i.e. data-centered analysis and its application in LDCs), however. This is in particular good in chapter 13 when they discussed misspecification bias. However, the analysis is not creatively linked with new time series econometrics, which only is discussed in the preceding section. Future work on

this part need to focus on the relationships between single equation vector autroregressive modeling (such as ECM and its in/capacity to deal with simultaneous equation bias) and simultaneous equation models by focusing on practicality of these models.

One major problem of this book is perhaps lack of clarity of the intended readers. The book treats topics at various levels so that it is pretty hard to pinpoint whether it is targeting graduate or undergraduate level students. This has both merits and demerits. It is advantageous to graduate universities which take quantitatively weak students from undergraduate level but could be limiting for others. Hope, in future editions, the authors will target particular class of students and build the material progressively (step by step).

All in all, Mukherjee *et al.* need to be congratulated for the excellent job that is well done. The authors, drawing on their wide experience on teaching developing countries' students, not only provided us a state of the art (but highly simplified) book in quantitative methods that is squarely focused on developing countries but also a book that goes beyond the traditional methodological confines of econometrics.

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