L A B O U R A B S O R P T I O N I N K E N Y A ' S M O D E R N S E C T O R A G R I C U L T U R E

BY

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A Thesis submitted in part fulfillment for the Degree of Master of Arts in the University of Nairobi.

March 1976.

This Thesis is my original work and has not been presented for a Degree in any other University.

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A C K N O W L E D G E M E N T S

This Thesis is indeed my original work as I have stated at the beginning. Nevertheless it could never have been written without the help, guidance and co-operation of many different people.

I take this opportunity to thank Prof. J.K. Maitha and Dr. P. Wyeth, my supervisors, who have read earlier drafts of this thesis and made many valuable comments.

I would also like to thank the German Academic Exchange Programme (DAAD) and the University of Nairobi for providing me with the funds to complete this study.

Mr. J. Kamau enabled me to get a typist Mrs. Catherine Kamau who has typed the manuscript with patience.

Gicunge, Kaibiria, Nyaga, Kimathi and his wife Grace, Karambu and Muthoni have given me encouragement when it was most needed.

Finally I thank the many Christian friends who have been praying for me.

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A B S T R A C T

This study is intended to provide some insight into the demand for labour in Kenya's Modern Sector Agriculture. Modern Sector Agriculture comprises the small farms which grow some cash crops and the large scale farms. The study focuses on the whole of Modern Sector Agriculture but lays emphasis on the large scale farms.

The employment problem facing the country at present is in part a result of a high rate of population growth. An examination of the problem from the supply side is discussed in Chapter I. Kenya's labour force has been growing at a rate in excess of 3 per cent per annum since 1964. The Modern Sector is small and absorbs relatively a small proportion of the labour force. Hence a majority of Kenyans are absorbed in the "traditional sector" as self - employed persons or family workers. However, Agricultural Modernization is taking place in many parts of the country as cash crops are introduced, and many subsistence farmers are brought into the cash economy. Modern Sector Agriculture is therefore expected to play an increasing role as a source of income and employment for many Kenyans.

Employment in Modern Sector Agriculture has not been growing fast enough particulary in the large scale farms. Infact employment in the large scale farms declined during the 1960 - 1970 decade. The break up of some of the large scale farms and the process of Agricultural Mechanization are suggested as the main causes of the decline in employment. Agricultural Mechanization need not result in a decline in the demand for labour, however, since a "Selective Mechanization" can lead to an increase in both output and employment.

I have used published data on output, employment and earnings to estimate the demand for labour equations derived in Chapter IV. From the results of these equations (given in Chapter V), I have an estimate of the elasticity of substitution between labour and capital. The elasticity of substitution is small (on the basis of total acreage), which would indicate a rather low capacity of substituting labour for non-labour inputs, but on per hectare basis, the elasticity of substitution turns out to be quite high indicating that there is some room for substituting labour for non-labour inputs, without sacrificing output.

The small farms tend to be more labour intensive than the large farms. Thus the author suggests that the Selective Mechanization package be accompanied by measures to break up the large scale farms into smaller units.

C H A P T E R I

INTRODUCTION

1.1 THE OUTLINE OF THE STUDY

In this thesis we examine the problem of labour absorption in Kenya's modern sector agriculture. Our attention is mainly on the demand side of the question Modern sector agriculture covers monetary agriculture, which includes small scale farming and large scale farming.

In Section 1.2 of this chapter, we shall present in broad terms the employment problem as it faces the country. The role of agriculture in the economy is the subject of Chapter II. Whereas the main emphasis in this chapter is on large scale farms, mention will be made of the part played by the Small Scale farm sector.

Labour and capital are important factors of production in the modern sector agriculture. Capital, mainly in form of tractors and harvestors, is used as a substitute for human labour. Thus in Chapter III we shall focus on agricultural mechanization in both the more developed countries and the less developed countries.

In Chapter IV we shall present a model of demand for labour in the modern sector agriculture. We shall make use of two commonly used families of production functions, (the Cobb-Douglas and the CES), to derive demand for labour functions. These demand for labour functions will be empirically estimated and tested in Chapter V with the use of available data. In the last Chapter (Chapter VI), we shall draw some conclusions and suggest some policy implications based on our study.

1.2 THE STATEMENT OF THE EMPLOYMENT PROBLEM

1.2.1 POPULATION GROWTH AND THE SUPPLY OF LABOUR

Kenya, with a population of about 13 million people, has one of the highest rates of growth of population in the world. Both the population and its rate of growth have been increasing over the years. Table 1.1 shows that from 1941-1974, the rate of growth of population increased by 75 per cent from 2.0 per cent per annum to 3.5 per cent per annum. Over the same period, the population increased by nearly 170 per cent.

The implications of such a high rate of population growth are quite obvious. At the 2 per cent annual rate of growth of population prevailing in 1941, the population could double in about 35 years' time. At the current rate of growth of population, the Kenya population is likely to double in about 20 years' time.

TABLE 1.1 POPULATION GROWTH IN KENYA 1931 - 1974

Year	Population	% Annual Rate of Growth
1931	3,981,000	n.a.
1941	4,843,000	2.0
1948	5,408,966 (Census)	n.a.
1951	6,211,000	2.5
1961	8,346,000	3.0
1962	8,636,263 (Census)	3.2
1969	10,942,705 (Census)	3.3
1971	11,524,000	3.4
1974	12,934,000	3.5
2000*	28 - 34 Million	

Source: Kenya Development Plan, 1974-78 pages 5 and 101

* Projection for the year 2000 A.D.

n.a. Not available

The high rate of population growth prevailing in the seventies is unprecendented in Kenya's history. This high rate of growth has resulted from great reductions in the death rate, with the birth rate remaining at high and stable levels. Higher incomes, accompanied by better health and living standards, mean that more of those who are born in Kenya survive than was the case in earlier years. Further declines in mortality are to be expected, and unless the fertility rate in Kenya is checked, still higher population growth rates[1] are possible, though it is likely that a fall in the fertility rate could result from increased incomes and higher levels of living; and this could provide people with incentives to desire small families.[2]

The rate of growth of a country's labour force depends on the rate of growth of the population of that past country. This is because of the lag involved before the newly born children mature into working adults. In Kenya

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(1) Thus if fertility remains at its present level Kenya's population will be growing at 3.9 per cent per annum during the 1995 - 2000 period. See (64) pp 100.

(2) Kocher (44 pp 76) notes that for Taiwan output in smallholder agriculture has increased rapidly and the resulting improvements in living conditions have had an antinatalist effect. Rural fertility has declined about as rapidly as urban fertility. From 1964-1969 total fertility rate declined by 20.4 per cent in cities and 17.4 per cent in rural areas. This is primarily because people's aspirations have risen as a consequence of modernization and improved living conditions.

we should expect the rate of growth of the labour force to be in excess of 3 per cent per annum.[3] The current high rate of population growth (3.5 per cent in 1974) will be projected into higher growth rates of the labour force in future (15 - 20 years). Hence any change in the fertility rate will have effect on the labour force only in the long run.

Kenya's population is relatively young with over 45 per cent of the total population comprising children under 14 years of age.[4] This implies that those who enter the labour force are more than those who leave it. Already the country is faced with a problem of labour under-utilization.[5] Thus there must be measures to stimulate the demand for and better utilization of human resources.

The unemployment problem prevailing in many less developed countries is essentially a modern phenomenon. Unemployment was non-existent in the traditional society since both men and women had their own social roles to perform. Nevertheless underemployment of labour existed even in the traditional society because of the low productivity of those who were fully employed. The introduction of cash economy and its educational demands has led to a change in social roles and values. This, coupled with high rates of

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(3) Ghai notes that the male labour force is growing upwards of 3 per cent per annum. See (26) .

(4) In 1970, of the stimated population of 11,247,000, 5,239,000 (46.6 per cent) were children under 14 years of age. The productive age group (15-59 years) had a total of 5,445,000 (48.4 per cent), while the potential labour force was estimated at 3,818,000 (39.9 per cent). See 64 pp 101 .

(5) See Edwards (18) pp 6-7, for a definition of labour under-utilization.

growth of the labour force, has resulted in an oversupply of the labour force, particularly to the modern urban based industrial sector. Streams of unemployed peasants and young school leavers are flocking into major urban centres in search of urban wage employment.

The lack of complimentary factors of production like land, capital, skilled manpower and foreign exchange, have also contributed to the problem of unemployment in the country. To some extent, inappropriate use of these resources has also contributed to the unemployment problem. The education system which is supposed to provide the country with skilled manpower might flood the labour market with young people having more formal qualifications but lacking the relevant skills suited to rural areas.

1.2.2 THE DEMAND FOR LABOUR

Labour is demanded for its contribution to production. The demand for labour therefore is influenced by the wage rate (the price of labour) and the prices of other factor inputs. Labour has a cost incurred in its maintainance since each person must eat regardless of whether he works or not. Idle human resources are therefore a waste and a cost to the society. Thus the society should aim at absorbing in productive activities all those who are willing and able to enter them.

Table 1.2 below shows the utilization of labour in the Kenyan economy for the period 1964 to 1978 - the period covered by the three development plans drawn up in independent Kenya. The modern sector includes monetary agriculture, private industry and commerce and the Public Sector. The

modern sector employs a small proportion of the total labour force in the country - about 14 per cent in 1972. (This proportion is expected to increase to 15.5 per cent by 1978). Wage employment in Kenya is less than a third of total labour force. Thus 2/3 of the total labour force is either self-employed or engaged as family workers. A large proportion of this residual labour could be unemployed or underemployed. One criterion for assessing economic performance would be the rapidity with which the excess labour force is absorbed. The Kenya Government aims at ensuring that "every one has access to means of livelihood in terms of either land or wage job by 1980".(6)

TABLE 1.2 LABOUR UTILIZATION IN KENYA 1964 - 1978

Figures in thousand

Sector	1964	1968	1972	1978*
Modern Sector**	n.a.	n.a.	762	995
Rural non-agricultural Activities	n.a.	n.a.	222	288
Other Wage employment	n.a.	n.a.	390	460
Informal Urban sector	n.a.	n.a.	108	166
TOTAL WAGE EMPLOYMENT	765	1,056.9	1,482	1,909
Self employed & family workers (Residual)	2,435	3,243.1	3,875	4,370
TOTAL LABOUR FORCE	3,200	4,300.0	5,357	6,479
Annual Percentage rate of growth of labour force		3.0	3.1	3.2

Source: Development Plans 1970-74 and 1974-78.

* Estimates for 1978.

(6) See (62) op. cit. pp 4

** The modern sector employment figure for 1972 differs from the one recorded in the Economic Survey (1974 p.147) and the Statistical Abstract (1972 p 210). These two publications do not include wage employment in small scale agriculture. We note that modern sector employment was 575,400, 606,400 and 719,800 for 1964, 1968 and 1969 respectively (see Economic Survey 1974 p. 147 and Statistical Abstract 1972 p. 210).

n.a. - not available. The figures for total wage employment for 1964 and 1968 are not broken up into their respective categories.

The demand for labour function can be theoretically derived from a production function. Such a production function gives a technical relationship between output and factor inputs, with labour as one of the factors. Economic planners have in the past assumed that both output and employment would grow at the same rate.(7) The problem would then be to set up a target rate of growth of output and then channel investments so as to achieve this target rate of growth. Thus development planning in Kenya in the past focused mainly on expanding GDP (and hence GDP per capita). For the period 1964-1972, Kenya achieved an average annual rate of growth of GDP of 6.8 per cent. Since the population was growing at 3 to 3.3 per cent per annum during this period, GDP per capita was growing at 3.5 to 3.8 per cent per annum. On the basis of the Harrod-Domar Model of growth, we would expect employment to have grown at the same rate as GDP. Nevertheless, in Kenya, output grew faster than employment, implying that labour had become more productive.(8)

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(7) This assumes a constant output-labour ratio. Hence if $\frac{Q}{L}$ is constant, it can be shown that $\frac{dQ}{dt} \cdot \frac{1}{Q} = \frac{dL}{dt} \cdot \frac{1}{L}$

Planners now acknowledge that the problem of unemployment in Kenya is not due to a low or inadequate growth of GDP since "there is no conceivable rate of economic growth that would produce full employment."(9) Increase in factor productivity was responsible for most of growth in GDP. Labour productivity as such is desirable if it is a result of increased labour efficiency. Nevertheless labour might also become more productive as a result of increased use of capital. New capital equipment could produce more even though it might require fewer people to operate it. The increase in Kenya's modern sector output could have been at least partly a result of an increased use of capital.

Factor price distortions in Kenya have made capital relatively cheaper than labour. In the past, capital has been imported free of duty and at over-valued exchange rates. The wage rate, on the other hand, exceeds the true scarcity value(10) of labour due to institutional minimum wages legislation and the desire to provide workers with a fair wage. Since producers in both industry and agriculture are rational decision makers whose primary motive is profit maximization, the prices of factors will be reflected in the production techniques chosen.

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(8) Modern sector employment for instance, grew at 3.4 per cent per annum while GDP for this sector grew at 8.2 per cent per annum during the period 1964-1972. Factor productivity was thus responsible for 4.8 per cent of growth rate of GDP (See 64 p. 4 op.cit)

(9) See (64) op.cit.

(10) In a labour surplus economy, the scarcity value of labour may be very low. A wage rate reflecting the true scarcity value of labour may be socially unacceptable.

Where capital is relatively cheaper , capital intensive methods of production are likely to be adopted. Such methods are essentially labour-saving (and/or labour displacing) and as such may be unsuitable in the Kenyan economy where we have a labour surplus situation.

The employment problem facing Kenya is a complex one,[11] but part of the long term solution to this problem will be the development of rural areas. Hence the agricultural sector has a crucial role to play in the overall development of the economy. For this study we shall focus mainly on modern sector agriculture with an aim of finding out what has happened to employment in this sector.

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(11) The ILO Report (37) notes that "three distinct types of problems underlying concern with the employment situation are:- the frustration of job seekers; the low level (poverty level) of incomes and the underutilization and low productivity of labour."

C H A P T E R II

THE ROLE OF AGRICULTURE IN THE KENYAN ECONOMY

Kenya has a land area of approximately 219,800 square miles, but 79 per cent of this is arid or semi-arid with less than 30 inches of rainfall a year. Thus it is approximately 47,740 square miles (about 13 per cent of total area) which receives rainfall consistently of over 30 inches a year. This constitutes the high potential land suitable for agricultural persuits. Excluding forest reserves, the high potential land has an estimated area of 41,630 square miles.

Kenya with an average population density of about 60 persons to the square mile is, by comparison with some other countries, sparsely populated. However since most of the country is arid or semi-arid, we would expect heavy concentrations of people on the high potential land. Thus if the entire population were to live on the high potential land (excluding forest reserves), we would have a population density of about 300 persons to the square mile. This yields an average acreage of 2 acres per person which implies a low capacity to support a large population. The marginal lands (medium and low potential areas) are used for agricultural persuits thus relieving the pressure of population on the high potential land. At present, about half of the Kenyan population lives on only 6 per cent of the country's total area. The marginal lands are expected to support increasing numbers of people in future inspite of the risks and uncertainties imposed by weather and climatic conditions.

Infact already over 80 per cent of the population live in rural areas and depend primarily on agriculture for their livelihood. Hence in 1962, at least 1 million of the estimated 1.2 million families derived a living from the land.(1) By 1985 an estimate of 2.8 million households will be living in the rural areas compared to 1.7 million in 1969.(2) Thus agriculture is expected to support a large and a growing population in Kenya.

2.1 AGRICULTURE IN THE ECONOMY

Kenya doesn't have abundant mineral resources. The country therefore relies heavily on agricultural exports and tourism for its supply of foreign exchange reserves. Agriculture inspite of its dependence on weather and climatic conditions provides a livelihood for majority of Kenyans. Agricultural exports earn foreign exchange which is used to finance imported capital, raw materials and skilled manpower.

A predominantly agricultural country has most of its manufacturing, trade, transport and financial activities directly dependent on agricultural production and processing of agricultural commodities. The overall growth of such an economy to a large extent, depends on the growth of the agricultural sector. For the Kenyan economy, agricultural development is vital to ensure successful economic development.

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(1) See (61) p.45. The revised 1966/70 Development Plan sets the estimates at 1.2 million out of 1.6 million families who derive a living from agriculture and animal husbandly See (62) p.124.

(2) See ILO Report (37 p.151).

Kenya's agriculture is dual in nature with small subsistence farmers on one end and large scale farmers on the other end. Modern Sector agriculture comprises the large scale farms and the small scale farms which grow some cash crops. The bulk of the Kenyan farmers are subsistence farmers. Agriculture contributed 39-40 per cent of GDP (including subsistence) and 20-22 per cent of monetary GDP during the period 1954-1964. In 1962, agriculture accounted for 39 per cent of GDP and 89 per cent of total exports. During the 1964-1974 period, agriculture still accounted for 35-40 per cent of GDP and approximately 75 per cent of total employment in Kenya.(3)

2.2 MODERN SECTOR AGRICULTURE IN THE ECONOMY

Appendix table 1 shows the value of gross marketed production from modern sector agriculture for the period 1954-1974. The marketed production from both the small farms and the large farms has increased substantially over the whole of this period. The small farms have made remarkable progress in expanding their marketed production. Thus since 1967 the proportion of gross marketed production from the small farms has exceeded that one from the large farms. From 1963-1974 marketed production from the small farms nearly quadrupled while the marketed production from the large farms almost doubled. Thus then, there has been a relative decline in the role of the large scale farms in the Kenyan economy. The small holder agriculture has become increasingly significant.

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(3) According to Mr. G. Mwicigi (Asst. Minister for Agriculture) agriculture accounts for 31 per cent of Kenya's GDP, 70 per cent of the country's foreign exchange and provides a livelihood to more than 80 per cent of the population. See the "Daily Nation" November 6th, 1975.

2.2.1 THE SMALL FARM SECTOR

The remarkably good performance of the small farms can be attributed to the success of the Swynnerton Plan, which enccuraged land consolidation and the introduction of cash crops. The removal of restrictions on growing certain commercial products by Africans in recent years has also contributed to the growing importance of the small farm sector. The transfer of land from the large farm sector to settlement schemes has boosted output from the small farm sector.

The small farm sector has emerged as the largest producer of clean coffee in the economy. Hence in 1974, the small farm sector produced 39,000 metric tons of clean coffee compared to 30,800 metric tons from the estates. The area under small holder tea has continued to expand since independence. Thus in 1973/74, 34,384 hectares were planted with tea in the small farm sector compared to 26,300 hectares for the large scale farms in 1974. Other commercial crops grown largely by the small farmers are pyrethrum, cotton and groundnuts. Maize is also grown as a commercial crop by the small farmers. (In fact 90 per cent of total maize is produced on small scale farms on holdings less than 5 hectares, but most of this is consumed and very little is sold to the Maize and Produce Board). Sisal is mainly grown on large estates, but in Machakos and Kitui districts it is grown by small farmers.

The small farm sector will continue to play an important role in Kenya's Modern Sector agriculture. As land consolidation proceeds, and more subsistence farmers

are brought into the cash economy, the small farm sector will continue to expand.

2.2.2 THE LARGE SCALE FARMS

Large Scale farming in Kenya began after the completion of the Kenya-Uganda Railway which opened the Kenya Highlands for European settlement. The high attitude of the highlands provided an ideal temperate climate for white settlers. The Government of Great Britain and the Colonial Government in Kenya encouraged European settlers to come to Kenya, take up residence, and with the capital they brought, establish and develop large scale farming on a commercial scale. The European Settlement was made possible through the alienation of land on the east and west of the Rift Valley. This land was set apart as an exclusive domain for non-African settlement. Thus through the ordinance of 1902, the "White Highlands" were established. Some 12,200 square miles of land were set apart for Asian and European Settlement mainly in the Rift Valley and the Coast Provinces. The alienated land included about 7,560 square miles (or about 20 per cent) of the high potential land and 3 per cent of arid or semi-arid areas. The alienated land formed what used to be the "Scheduled Areas".

Large Scale farming in Kenya is therefore a result of the measures taken during the Colonial period to develop commercial agriculture. The "Scheduled Areas" were not open to African settlement until the early 1960s when independence was imminent. The Colonial Government in Kenya pursued policies commensurate with the goal of making large scale farming a profitable venture.

Cheap labour was made available through the levying of hut and poll taxes on all adult males except those working for European Settlers. Agricultural Research and Extension Services were provided to settlers and so were price support programmes and Government supported co-operatives. These policies which aimed at making large scale farming profitable, placed the settlers at a relatively more favourable position in comparison to African peasants.

The large scale farms include farms whose acreage exceed 20 acres (8 hectares). Agricultural censuses for these farms have been conducted annually since 1956.(4) The large scale farms can be grouped into:- (1) The Mixed Farms located throughout the Rift Valley emphasise a single major crop (usually maize or wheat) coupled with dairying activities; (2) Estates and plantations found mainly in the Coastal strip, Central, Nyanza and the Rift Valley Provinces, which concentrate on a single crop like coffee, sisal or sugar; (3) Ranching operations mainly in East and Central Provinces. In 1960, the 'Scheduled Areas' comprised 7.5 million acres of land of which 4.1 million acres consisted of ranches and plantations while the remaining 3.4 million acres of land was devoted to mixed farming.

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(4) For the Small Scale Farms (within the monetary agriculture) censuses have been conducted since 1963.

Large Scale Farming in Kenya has undergone a lot of changes since the opening up of the "White Highlands" in the early 1960s. One of the major changes was the transfer of some of the large scale farms to small scale settlement schemes. This transfer had a negative effect on the total production of the large scale farms.

The large scale farms have continued to produce a large, even though declining proportion of the country's GDP. In 1960, the GDP from Modern Sector Agriculture (and forestry) was £33-43 million, most of which was from the large scale farms. By 1974, the GDP from the Modern Sector agriculture (and forestry) had increased to £120.01 million, an average annual increase of 7.8 per cent. The share of Modern Sector Agriculture of GDP is still the largest in Kenya's Monetary Economy. Nevertheless the contribution of the large scale farms has been declining relative to total value of agricultural output due to:- (1) Increase in production and productivity in the small holder agriculture; (2) Decrease in the area under large scale farming; (3) Probable negative effects of transfer of large units from Europeans (with more experience and capital) to African farmers (lacking both the capital and the management skills required for managing large farms).(5) The decline in investments on the large scale farms, due to political uncertainties in the early 1960s also had some repercussions on agricultural output.

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(5) See Posner (59).

2.3 EMPLOYMENT IN MODERN SECTOR AGRICULTURE

Modern Sector Agriculture has been the largest single employer of wage earners in the Kenyan Economy. Nevertheless recorded agricultural employment refers exclusively to the level of employment in the large scale farms. However, the small farm Sector is emerging as an important source of wage employment for many Kenyans. Thus in 1969 wage employment in the small farms was 350,000 of which 165,600 were casual workers. The figures for 1970 were 318,900 (including 147,000 casual workers).(6)

Hired labour is the basis of plantation and large scale farming enterprises in Kenya. For the period 1945-1960, there was a large increase in employment in the large scale farms, consequent on the development and intensification of these farms.(7) In fact the availability of cheap labour in the country was one of the factors that encouraged large scale farming in the former scheduled areas. Hence in 1940 wage employment in the large scale farms exceeded 130,000 (115,111 African males and 4,414 females were employed regularly and 11,040 casual workers were hired). By 1955 employment of Africans in the large scale farms was almost 245,000. Wage employment in the large scale farms reached an all time record figure of 271,800 in 1960. Since then wage employment in the large scale farms has been declining and by 1967 it was at its lowest level.

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(6) See Statistical Abstract 1974, tables 247(a), (b)and (c). The estimated number of those in wage employment in the small farms and Settlement Schemes was 476,200 (including 238,700 casual workers) for 1971/72. ibid.

(7) See Brown (9) page 41.

In Appendix table 2, we note that the share of Modern Sector Agriculture of total wage employment has been declining over time. Hence in 1946 Modern Sector Agriculture employed 48.5 per cent of total wage employment in the country. In 1960 Modern Sector Agriculture's share of total wage employment was 43.7 per cent. Marked decline in agriculture's share of wage employment has taken place since 1960. (In 1974 Modern Sector Agriculture employed 25.9 per cent of total wage employment). The large scale farms have ceased to be the largest single employer of wage earners in the country.

The following factors are suggested as the main causes of the decline in employment particularly on the large scale farms:-

(1) Political uncertainty experienced in the early 1960s;

(2) Rise in agricultural wages due to Minimum Wages Legislation;

(3) Changes in the size and structure of the large scale farms;

(4) Increased use of tractors (Agricultural Mechanization).

We shall discuss (1), (2) and (3) in the next subsections while (4) will be discussed under the heading "Agricultural Mechanization" in Chapter III.

2.3.1 EFFECT OF POLITICAL UNCERTAINTY ON EMPLOYMENT

Political uncertainty loomed prominently in the early 1960s and this could have had some repercussions on employment. This uncertainty halted investments on the large scale farms thereby leading to a decline in output and employment. Thus by 1962, it had become apparent that

investment by Europeans and Asians had virtually stopped and was not likely to be resumed until a stable independent Government emerged."(8) As a result of this the numbers employed (in large scale farms) fell following the reduction in development.

Wage employment in the country as a whole was affected by the political uncertainties of the early 1960s. Total Modern Sector employment fell from 622,000 in 1960 to 533,000 in 1963 with agricultural employment falling by 56,800 between 1960 and 1963. This decline was partly due to the political uncertainty.

2.3.2 THE WAGE RATE AND ITS EFFECT ON EMPLOYMENT

Prior to 1960, wage employment in the economy was growing quite rapidly and infact a situation persisted whereby labour shortages were experienced. After 1960, there was a halt on the growth of wage employment. A situation of labour surplus thus emerged with the supply of labour to the modern sector exceeding the demand. The wages in the modern sector, particularly, in the modern sector agriculture have continued to increase inspite of accumulated unemployment in the economy as a whole.

In the mid 1960s, the public sector emerged as the chief employer. The wages in the private sector therefore have been influenced a great deal by the wage structure in the Public Sector. Since the Government wage scales are high, the private sector wages are expected to be high.

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(8) See Due (18)

Table 2.1 shows employment and average earnings in the modern sector for some selected years.

TABLE 2.1 EMPLOYMENT AND AVERAGE EARNINGS IN THE MODERN SECTOR

	1956	1960	1966	1974
EMPLOYMENT: Agriculture	235,200	271,800	188,100	213,700
Public Sector	168,000	161,400	200,400	330,100
Total Modern Sector	576,700	622,200	596,400	826,300
AVERAGE ANNUAL EARNINGS (£) Agriculture	40.82	45.99	68.58	95.93
Public Sector	156.36	200.12	289.42	402.3
Total Modern Sector	115.47	135.5	219.99	332.7

Source: Statistical Abstracts 1964 and 1972

Economic Survey 1975.

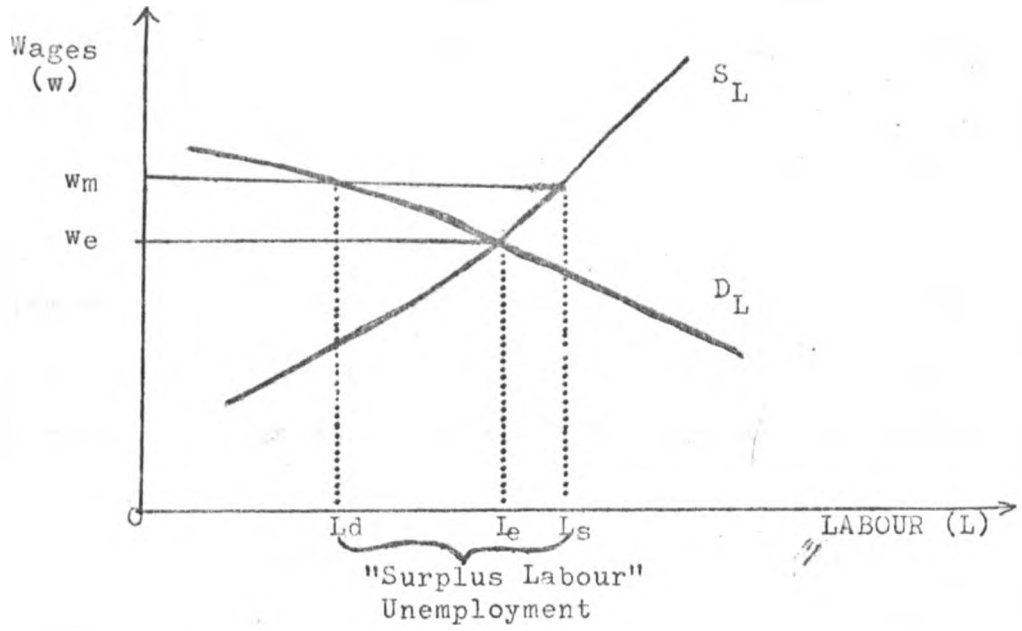
The wage rate in the modern sector agriculture continued to increase and was accompanied by a decline in employment in this sector. For the whole period (1956-1974) the wage rate in the agricultural sector more than doubled; (average wages for the modern sector as a whole nearly trebled over the same period).

The introduction of the minimum wages legislation in the Kenyan Economy played a big role in raising the wages. The minimum wages legislation is a Government tool for influencing the level and structure of wages. It aims at achieving a 'fair wage' and at the same time eliminating unfair competition among the employers which might lead to exploitation of some employees. The rational response by

the employers (in our case the farmers) is to reduce the numbers employed or to refuse to take additional workers. This substantially reduces the demand for labour while its supply is raised by higher wages, thus resulting in unemployment.

Figure 2.1 depicts the labour Market situation.

FIGURE 2.1 LABOUR MARKET



W_m is the minimum wage rate which is above the market wage rate (i.e. the equilibrium wage rate, w_e). At the minimum wage rate, W_m, labour supplied (L_s) exceeds labour demanded (L_d). The difference ($L_s - L_d$) is the surplus labour force. If the wage rate was flexible downwards, then unemployment would be eliminated by lowering wages to the equilibrium wage rate. The wage rate that clears the market, however may be too low and hence socially unacceptable.

The minimum wage was extended to cover the agricultural sector in 1965.[9] The wage rate was then set at Shs.60 per month per adult male. In July, 1970 the wage rate was raised to Shs.70 per month and by May Day in 1975 it was again raised to Shs.150 per month. Certainly, "if the major intent of the wage order was to see that a wage floor was established which minimised exploitation and provided workers with a living wage, results indicate success".[10] The minimum wages legislation therefore seems to be achieving some of its aims.

The minimum wages legislation probably had the effect of increasing unemployment in the economy. The rising wages might have encouraged substitution of capital for labour in the large scale farms. For those who are unemployed, a lower wage rate would be accepted, instead of the alternative of being unemployed. The wage rate in agriculture could decline if the factor price distortions were corrected. Nevertheless agricultural wages are the lowest in the modern sector.

2.3.3. LARGE SCALE FARM ACREAGE

The large scale farms were opened up to Africans in the early 1960's as the pressure of land shortage on the African reserves bordering these farms became more acute.

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(9) See Posner op.cit. page 191

(10) See Posner op.cit.

In fact land hunger among the Africans was the cause of political instability. "It was therefore necessary to embark on a broader scheme for the transfer of land ownership from Europeans to Africans which would incidentally, in the course of time help absorb many of the unemployed. This resulted in the "Million Acre Scheme ", allowing for an annual purchase of 200,000acres of European owned mixed farms, generally excluding plantations (which were too expensive) and the ranches (which were unsuitable for small holding).(11)

The Million Acre Scheme was financed by U.K. Loans. Some of the large scale farms were transferred on the basis of a willing buyer— willing seller. By June 1965, 24,000 small holders owned land in the former Scheduled Areas either as individuals or through co-operatives, while 750 large farms were owned by Africans individually or in companies and partnerships.(12) By 1972, 800,000 hectares (nearly 1,900,000 acres) of land formerly owned by expatriates had been transferred to African ownership.

The transfer of land led to a decline in the large scale farm acreage. Most of the transfer took place between 1962 and 1963 when a total of 355,000 hectares changed hands to African farmers, mainly small holders. The effect of land transfer on employment depends on the nature of land transferred. We have noted that the large

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(11) See Due ibid.

(12) See (62) op.cit. page 125.

scale farms consist of mixed farms, ranches and plantations. The ranches which are situated mainly in areas with less rainfall and therefore unsuitable for crop production bordered areas with relatively low densities of African population. The plantations (particularly sisal plantations) were unsuitable for small scale African Settlement. The mixed farming areas on the other hand bordered African reserves where the pressure of population and livestock was greatest. Political and economic considerations thus dictated that this massive land transfer should for the most part be initially confined to the mixed farming areas. Moreover, political uncertainty put greater pressure on European mixed farmers than on ranches and plantation managers. These mixed farmers wanted Government assistance to enable them pull out of the farms as soon as possible.

The transfer of farms to small holder agriculture led to a decrease in the number of holdings under large scale farming particularly during the 1960-1967 period. Since 1967 the number of large scale holdings has been increasing, probably as a result of breaking up of some "extra large" units into smaller units but still within the category of large scale farms. If this is the case, then we would expect the average size per large scale holding to decline. In Appendix table 3, we note that average size per holding ranges from 820 hectares in 1963 to 971.6 hectares in 1965. Since 1965, average size per holding has been declining, probably due to increase in the number of large scale holdings.

Table 2.2 shows the size distribution of the large scale farms for some selected years. The number of the large scale farms whose acreage is under 100 hectares increased from 842 (23.24 per cent of total number of holdings) in 1961 to 1065 (33.65 per cent of total) in 1973. Initially most of the transfer affected the farms whose acreage is 100-500 hectares which declined from 1494 (41.22 per cent of total) in 1961 to 1010 (36.72 per cent) in 1966. The decline in the number of farms exceeding 1000 hectares indicates that these farms also might have been transferred to small scale farming or sub-divided into smaller units. The sub-division affected mostly farms whose acreage is under 500 hectares. Hence from Appendix table 4(b) we note that 64.5 per cent of farms whose acreage was under 500 hectares comprised about 15 per cent of total large scale farm area in 1961. In 1972, 72.2 per cent of farms under 500 hectares comprised about 13.2 per cent of total large scale farm area.

The effect of transfer of land to small holder agriculture on employment depends very much on the nature and use of the land transferred. The categories of large scale farmland include: (1) Cultivated land - i.e. land under crops (temporary or permanent) and land under temporary meadows and temporary fallow; (2) Uncultivated meadows and pastures - the natural grazing land. Table 2.3 shows the utilization of land under large scale farming for some selected years.

TABLE 2.2 SIZE DISTRIBUTION OF LARGE SCALE FARMS

	1961		1963	
HECTARES	No. of Holdings	% Total	No. of Holdings	% Total
0 - 99	842	23.24	847	25.14
100 - 499	1494	41.22	1295	38.47
500 - 999	687	18.95	625	18.56
1000 and over	601	16.59	601	17.83
	3624	100.00	3368	100.00

Source: See Appendix Table 4(a).

TABLE 2.3 LAND UTILIZATION

	1961	1964	1966	1973	Change 1961-19
Cultivated land ('000 hect.)	629.2	603.1	581.7	591.1	- 8
Uncultivated meadows &pastures('000hect)	2204.3	1879.0	1783.4	1810.7	-20
Total land area[13] ('000 hect.)	3138.3	2751.0	2641.9	2651.7	-17
No. of Large Scale Farms (holdings)	3624	2959	2750	3165	-15
Livestock:-cattle, pigs &sheep ('000heads)	1563.4	1182.1	1196.0	1031.3	-13

Source: Statistical Abstracts, 1970 and 1974.

We have chosen the year 1961 because it had the largest number of large scale holdings, while 1966 had the lowest number of large scale farms and minimum acreage. All categories of land experienced some decline in acreage but the uncultivated meadows and pastures experienced the largest decline. The mixed farming areas included part of the uncultivated meadows and pastures while cultivated land includes the plantations which, as we have noted, were not initially affected by the transf of land. Land transfer thus mostly affected the land which was formerly used for livestock activities. Livesto activities are relatively less labour-intensive than crop production. A decline in acreage of land formerly

(13) Total land area also includes forest land as well as other land i.e. land reserved for buildings, roads and unusable land.

used for keeping livestock would have less of a negative impact on employment than the transfer of land used for crop production. It could even have a positive impact. We note that employment on large scale farms fell by 44 per cent during the 1966-1968 period. Thus there must have been some other factors responsible for this decline. In the next Chapter we shall examine Agricultural Mechanization and its effect on employment.

C H A P T E R III

AGRICULTURAL MECHANIZATION AND ITS EFFECT ON EMPLOYMENT

For many Third World Countries, agriculture forms the basis upon which overall economic development is built. In the early stages of economic growth, agriculture employs the bulk of the labour force, but as structural transformation takes place the proportion of population and labour force engaged in agriculture is reduced.(1) Posner(2) cites 5 reasons that make agricultural development necessary:-

(1) To provide increased food supplies to a growing population;

(2) To expand the agricultural export sector which would supply needed foreign exchange;

(3) To provide revenues, both private and public, to be used in the financing of further development particularly in the non-agricultural sectors;

(4) To provide increased incomes in the agricultural sector which would raise the level of welfare in the sector and concurrently provide an external market for expanding domestic industry;

(5) To release labour for the growing industrial demand.

As structural transformation takes place, the non agricultural sector absorbs labour released from the agricultural sector. According to the Lewis-Fei-Ranis Model,(3) which assumes zero marginal product of labour in

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(1) See Johnston (40) and Mellor (55)

(2) See Posner (59) p.2

(3) See Lewis (45) and Fei and Ranis (25).

agriculture, labour transfer takes place without any consequent decline in agricultural output, and not faster than the non-agriculture sector can absorb it. This model has limited application in the economies of the less developed countries where the marginal product of labour in agriculture might not be zero and there might be unemployment in Urban areas. In these cases, more investments should be encouraged in the rural sector thus enabling it to absorb more labour and allow migration to proceed more slowly.

3.1 MECHANIZATION IN AGRICULTURE

Mechanization is any form of power used to assist or replace hand labour.(4) In agriculture, it takes the form of tractors, combine harvestors and equipment for weeding and transplanting. Mechanical power can include huge tractors and small tractors and in a broad sense simple hand tools and ox-ploughs as well. Nevertheless it is the use of motor power in agriculture that we are mainly concerned with here because so far that is the form that mechanization has mainly taken in Modern Sector Agriculture in Kenya.

Farm Mechanization has taken place in both the More Developed Countries (MDCs) and also in the Less Developed Countries (LDCs). In the MDCs, Mechanization was introduced to solve a labour bottleneck problem created by the transfer of labour to the industrial sector. The MDCs' industrial sector provided the agricultural sector

(4) See Eicher and Gemmill (21).

with cheap capital needed for mechanization. Thus the two sectors complimented each other.

Mechanization in MDCs' agriculture was adopted so as to economize on labour which was becoming scarce and hence expensive relative to capital. Apparently, farm Mechanization led to a reduction of the producers' labour requirement. Thus the main reason for the adoption of farm Mechanization has been its ability to cut production costs by substituting machinery for increasing expensive labour.(5)

Mechanization leads to an increase in the productivity of those left employed in agriculture. This increase in productivity might result from an increase in farm output and consequently lead to an increase in the incomes of both the employees and their employers. Agricultural Mechanization is appropriate for a land-rich, labour-poor economy as more land can be brought into cultivation. Mechanization leads to an increase in output per worker as acreage per worker increases.(6)

3.2 FINANCIAL AND ECONOMIC ASPECTS OF MECHANIZATION

The transfer of an essentially capital intensive technology to the economies of LDCs may be inappropriate. Marsden observes that the introduction of advanced technologies in LDC economies might reduce both employment and

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(5) See Hall (35).

(6) In U.S. Agriculture, output per worker was first raised by increasing acreage per worker, while in Japan, acreage per farmer was expanded by the adoption of labour saving equipment only after the growth in output per acre had been slow and extremely costly. See Kaneda (43).

real earning in certain circumstances.(7) For the LDCs, we should maximise the productivity of capital and at the same time keep the social costs of production at a minimum. We should consider both costs and benefits of Mechanization not only to the individual farmer but to the country as a whole.

In some countries, there might exist a genuine shortage of labour even though labour in the country as a whole is not scarce. This is what was observed in Uganda as the following quotation states:-

> "Although in many ways labour is relatively abundant, there are some crucial tasks for which there is a scarcity of labour. This is because much of the crucial effort in agriculture must be concentrated into a relatively short period of the year. Therefore Mechanization of certain aspects of agriculture can provide very high returns. Mechanization has an important role of accelerating the rate of growth of agricultural output."(8)

Thus for countries experiencing labour bottlenecks during certain periods of the year agricultural mechanization can lead to an increase in the area under cultivation. For a labour-scarce, land-abundant economy, farm mechanization can increase farm output, but for a labour-abundant, land-scarce economy, it might lead to labour displacement. The high potential land as we have noted in Chapter II is limited in Kenya. Thus in a way Kenya is a land scarce economy because most of the population live on the high potential land.

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(7) See Marsden (51).

(8) Work for Progress - Uganda's Second Five Year Plan, 1966 - 1971 (81)

Farm Mechanization enables the individual farmer to save on the cost of administration and supervision of a huge labour force, thereby increasing his income. The land owner is enabled to bring more land under cultivation, thus increasing his output. The labour left employed in agriculture has more capital at its disposal and hence its productivity is increased. Farm Mechanization is thus labour augmenting since it increases the productivity of those workers left in agriculture. Nevertheless its main effect is labour displacement because it reduces the total demand for labour. Moreover, Mechanization benefits mainly the larger farmers and land owners who have the resources.(9) The problem is that the net private financial benefits of Mechanization differ from net social benefits.

For many MDCs, farm Mechanization is indigenous and therefore suits the country's own needs. The situation is quite different in the third world countries. These LDCs have populations growing at high rates and at the same time unemployment and underemployment are nearing chronic proportions. For LDCs, agricultural Mechanization is not undertaken to solve any labour bottleneck problem as such. Many of these countries do not have domestic industries for manufacturing farm machinery and therefore they have to rely

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(9) See for example Gotsch (29) and Kaneda op. cit. on Mechanization in Pakistan, and Raj (60) on Mechanization in India and Sri Lanka. In India and Sri Lanka the large scale farmers mechanized to reduce dependence on tenants or casual labour.

on imports of such from the industrial nations.[10] Farm machinery therefore should cost more in LDCs than in the MDCs where it is manufactured.

Nevertheless, some forces from within the LDCs themselves, and from without, have made agricultural Mechanization economical and there exist distortions in factor prices in favour of capital. In some countries, the Government has been active in encouraging Mechanization through foreign assistance.[11] Moreover, farm machinery may be imported at overvalued exchange rates. Tariff and tax concessions granted to farm machinery makes it cheaper to the farmers than it would have been. In the labour market, the expansion of minimum wages and social security provisions to the agricultural sector have raised the price of labour thus making it relatively more expensive than capital. In some countries, labour unrests have made labour less attractive thus encouraging farm mechanization even more. From a private point of view, the prestige of owning a tractor has hastened the pace of mechanization in some less developed countries.

On the other hand, for the economy as a whole, Bose and Clark point out that an indirect social cost is the

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(10) Some countries in Latin America have their own agricultural Machinery Industries. Argentina has the biggest agricultural machinery industry which supplies 94 per cent of the National Market. See Abercrombie (2).

(11) In the Philippines, the Government negotiated loans from the World Bank to finance farm mechanization. (see Baker et. al. (57). In Latin America, Mechanization has been advanced by foreign technicians and advisors. (See Abercrombie op. cit.)

resettlement of the displaced labours.[12] Thus"if tractors substitute for farm labour as seems quite certain, then the society is going to have to decide on what to do with these unemployed persons."[13] There is a need to appraise farm mechanization on broader terms. Such an economic appraisal should consider the impact of mechanization on national aggregates like real incomes, employment and foreign exchange balances. We should also consider the widening income differences which might result from Mechanization as a social cost. Private financial benefits are little indication of the contribution of agricultural mechanization.

There is a need to consider "how capital economises on labour, the opportunity cost of labour, and the value of output and the cost of Mechanization."[14] The valuation of labour may be different when viewed from the private and the social points of view. The society does not incur any cost by employing surplus labour at a subsistence wage rate in agriculture since this labour has to be sustained whether employed or not. The cost to the farmer of employing this surplus labour however is definite and positive. The society therefore should subsidise the labour employed in agriculture (instead of subsidising capital as is the case in many LDCs). An alternative would be to correct the factor price distortions in such a way as would lead to an increase in the initial cost of mechanization. This

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(12) See Bose et. al. (8)

(13) Bose et. al. op. cit.

(14) See Clayton (12)

would save the country from the wasteful forms assumed by Mechanization when factor prices are distorted.(15)

3.3 MECHANIZATION IN KENYA'S MODERN SECTOR AGRICULTURE

The Government of Kenya recognises the need to adapt the technological and economic knowledge available abroad to the needs and circumstances of Kenya.(16) Nevertheless there is the "possibility that farm machinery could be a substitute for the employment of labour."(17) In Kenya therefore, increased mechanization should be economically justified if the cost to the nation of the mechanized operation is covered by the value of increased output.(18)

The large scale farm sector of Kenya's Modern Sector Agriculture has a rather intensive level of mechanization as the number of tractors in operation and the number of tractors per 1000 hectares indicate.(19) The small scale farms due to their size have limited use of tractors. Hence in Kenya there are approximately 7500 tractors in the small scale farm sector compared with nearly 6,000 wheeled

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(15) Raj op.cit. argues that since capital and foreign exchange are scarce (in India and Sri Lanka), and underpriced, mechanization "..... assumes wasteful forms and takes place on a largerscale than it is consistent with either factor proportions or the objectives it is sought to reach through development."

(16) See (62) page 160.

(17) See Havelock Report (67).

(18) ibid.

(19) The number of tractors per 1000 hectares increased from 2.05 in 1961 to 2.70 in 1970, an annual increase of over 3 per cent. See appendix table 5, column 4.

and 700 crawler tractors in the large scale farm sector. In 1945 there were relatively few tractors, available, but by 1954 the number of tractors used in the large scale farms had risen to 4,799 of which 1,049 were crawlers.[20] In 1970 there was a record figure of 7,249 tractors (which included 645 crawlers). This increase in the number of tractors in the large scale farms has taken place inspite of a decrease in the acreage of these farms.

In column 4 of Appendix Table 5, we have the number of tractors per 1000 hectares, of total area of the large scale farms. This number increased from 1.85 in 1956 to 2.70 in 1970.[21] This number was highest for the sub-period 1962-1973, but during this period, employment in the large scale farms was at its lowest levels. This implies that mechanization on the large scale farms had intensified.

Capital expenditure on the large scale farms has increased since independence. Expenditure on mechanical equipment forms a large component of total capital expenditure. Expenditure on mechanical equipmen per 1000 hectares increased from £403.7 in 1963 to £908.1 in 1973 (See Appendix Table 5, column 5).

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(20) See Brown op. cit.

(21) We note that in column 8 of Appendix table 5 there wasn't much change in the area of cropland per tract even though column 4 shows an increase in the numbe tractors per 1000 hectares. This is because we have used different acreage figures. Cropland acreage increased during the 1956-1974 period while total acreage decreased.

This increase could partly be due to inflation. Nevertheless such substantial increase on mechanical equipment expenditure during a period when inflation was not as great as it is now, suggests that there has been an intensification of mechanization.

In column 7 of Appendix Table 5, we have the number of employees per 1000 hectares, which indicates labour requirements. Labour requirements per 1000 hectares declined from 87 employees in 1960 to 64 in 1967.(22) Such a decline in labour requirements implies that there might have been some substitution of labour for other factors during this period (i.e. 1960-1967). In column 6, the number of employees per tractor declined from 44 in 1957 to 25 in 1970. This we believe is a result of an essentially labour-displacing mechanization.

Agricultural mechanization depends very much on the type of crop that is grown, since some crops are relatively more labour intensive than others. Wheat for example is grown under highly mechanized operation (land preparation, planting and harvesting) Hence as Hall, (op. cit.) argues, mechanization in Kenya has been successful due to artificially high prices for wheat which give farmers an incentive to increase wheat acreage. Wheat acreage increased from 91,400 hectares in 1961 to 139,800 hectares in 1968 (See Appendix Table 6). Since 1968, wheat acreage has

(22) During 1960-67 period, large scale farm acreage declined by 17% while labour requirements (employe per 1000 hectares) decreased by 30%.

been declining probably due to a shift of land to maize and other crops, which are more labour intensive than wheat. Employment in the large scale farms increased from 173,000 in 1968 to 220,600 in 1973. This increase in employment could be a result of a shift to more labour intensive crops.

The increase in tea acreage for example, could have resulted in an increase in the demand for labour (labour for plucking tea leaves). The large scale farm coffee acreage has not changed very much since 1960, but acreage under sugar cane has increased tremendously since 1966. Sisal acreage on the other hand has been declining. Wheat and sisal are mainly grown on the small scale farms, so we cannot be sure exactly how the shifts took place.

In this section, we have argued so far that mechanization was partly responsible for low labour absorption particularly on the large scale farms. The use of tractors has been encouraged even on the small scale farms. The Ministry of Agriculture has been running tractor hire services in some small scale farms. This same Ministry has also been providing mechanization extension officers to advise and assist private tractor owners in small farming areas. The small scale farmers are encouraged to buy tractors for their own use by the Loan Scheme run by Agricultural Finance Corporation.[23] Mechanization therefore plays a big role throughout Kenya's Modern Sector Agriculture.

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[23] See Heyer and Inukai (39).

3.4 A SELECTIVE MECHANIZATION FOR KENYA'S MODERN SECTOR AGRICULTURE.

In LDCs agriculture, we cannot do away with all forms of mechanization without any serious consequence on output as well as employment. We are thus looking for a technological package that will maximize both output and employment by economizing on scarce resources (capital, skilled manpower and foreign exchange) and at the same time expanding the use of the more abundant factors of production like unskilled labour. Thus in considering the appropriateness of mechanization we should consider the efficiency with which tractors can be operated and the extent to which output can be increased either by increasing yield or the area under cultivation.

Kaneda (op. cit.) suggests that there is a need to distinguish between:- (1) Mechanization as applied to each specific operation and Mechanization as applied to several or all farm operations; (2) Mechanization as introduced to a socio-economic organization of agriculture and calling for minor adjustments, and "Mechanization" calling for a highly sophisticated organization and co-operation not easily introduced into a given situation. A "Selective Mechanization" will be directed mainly to some few aspects of agriculture. The Mechanization of selected processes of cultivation and post harvest operations might prove to be more beneficial. On the other hand, the introduction of larger equipment in agriculture requires large management units and output standardization and uniform cultural practices.

Sometimes the timing of planting is crucial in determining the output. In this case, mechanization would allow the farmer to prepare his land more quickly and more thoroughly so as to reduce the time interval between crops. The mechanization of soil preparation and planting activities might lead to a reduction in labour requirements, but if high yielding varieties are introduced then there is an increase in labour requirements for weeding, harvesting and threshing. Mechanization of some farm operations can thus lead to an increase in the demand for labour to perform others.(24)

The decision to Mechanize is ultimately made by the very many thousands of farmers. Such private decisions will benefit mainly the larger farmers who have the resources. Meanwhile, the hardships of unemployment and the displacement of labour would fall exclusively on the landless workers. A selective mechanization should aim at benefitting the majority of a country's farmers and farm workers.

The Government, through the policies at its disposal can determine the type of mechanization to be encouraged by influencing the profitability of mechanization to individual farmers. These policies could be short term,

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(24) For example in India and Sri Lanka, Mechanized irrigation has raised the intensity of cropping thus evening out the seasonal fluctuations of labour. See Raj. op. cit.

medium term or long term and can affect the prices of farm output as well as factor prices in agriculture.(25)

Selective Mechanization should be accompanied by some institutional changes on patterns of land ownership. A mere correction of factor price distortions is not enough since the profitability of Mechanization depends basically on the size of the farm. The Government should adopt an intermediate technology which aims at increasing land productivity (instead of labour productivity). We note that land productivity can be increased irrespective of the size of the farm.

Kenya's Modern Sector Agriculture can at present benefit from a mixed strategy which includes not only ordinary tractors but also the use of draught animals and smaller tractors. Small tractors may be more expensive to run per horse power unit, but this is not important if large horse power is not required.

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(25) Eicher and Gemmill (20) give the short term policies as:- (i) inclusion of mechanization in Government's agricultural projects; (ii) subsidising of tractor hire services; (iii) subsidising credit for machinery purchases; (iv) removing or imposing tariffs on imported machinery, spare parts and fuel; (v) taxing locally produced machinery and spare parts. The medium term policies which affect mechanization indirectly and are less immediate in their impact are:- (i) subsidies on prices of certain products; (ii) minimum wages legislation; (iii) encouraging domestic machinery industry through Government investments. The long term policies are a continuation of short term and medium term policies over a period of several decades. One such long term policy concerns the general importance attached to Mechanization.

Most of research on the development of farm implements has been conducted in the industrial countries. Kenya therefore needs to devote some research and development resources for setting up a local capital goods industry. This however might take quite a time. For the time being, some progress can be achieved by improving the strength of draught animals through better feeding, improving harness types and by using single animals instead of animals in pairs for light work. We note that animal techniques are quicker than hand techniques, cheaper than tractors and easily available in many areas. Thus the improvement of draught animal power could benefit largely the small farmers.

In some cases, the use of ordinary tractors could benefit the small farmers more. This could be achieved through group farming. In Kenya, tractors are used in both the settlement schemes and irrigation schemes. In the Irrigation Schemes (particularly Mwea), farm mechanization has contributed by allowing more thorough cultivation, stabilization of planting dates, timeliness of planting and concentration of extension effort.

With appropriate institutional changes, selective mechanization could be designed to suit the local needs. Such an appropriate technology would require a shift of emphasis in favour of smaller land holdings. It should be accompanied by the development of small instead of large tractors and an increased use of animal drawn ploughs.

There is a need also to change the product mix (by introducing more labour intensive crops). By introducing high yielding varieties and encouraging multiple cropping instead of single cropping, output per hectare could be increased. The introduction of an intermediate technology does not necessarily lead to a decrease in farm output.

Kenya at present is not faced with the serious problem of concentration of land ownership that is faced by some other developing countries (for example in Asia or in Latin America). The Government could thus break up the large farms that do exist without seriously affecting farm output. This is what has been happening as land has been transferred to small scale settlement schemes. Hence the average size of the large scale farms in Kenya has been declining. Eventually, most of the large scale farms may be replaced by small scale farms and thus improve employment prospects in agriculture.

C H A P T E R I V

A MODEL OF LABOUR ABSORPTION

The production function would describe the way in which alternative factor combinations are related to output. In Kenya's Modern Sector Agriculture, the production function would describe the way in which farmers combine the factors available (land, labour and capital) to produce a certain amount of output. If we take land as given, then we could define the production function in terms of two factors only (capital (K) and labour (L)).

In our analysis we use an aggregate production function because we are dealing with the whole of the modern sector agriculture. From the aggregate production function we derive a demand for labour function. Assume a general production function of the form:-

$$Q_t = (L_t, K_t, Z_t) \text{ ----------(1)}$$

where Q_t = level of output from Modern Sector Agriculture in year t,

L_t = Employment in Modern Sector Agriculture in year t,

K_t = Capital input used in Modern Sector Agriculture in year t,

Z_t = Land and other inputs used in Modern Sector Agriculture in year t.

The partial derivatives of (1) with respect to the factors L, K, and Z respectively are the marginal products of these factors.

The farmers are assumed to have profit maximization as their primary objective. We also assume perfect competition, or at least price taking, in both the product and

the factor markets. This assumption implies that the farmers have no influence on either the factor prices and the commodity prices. This applies not only because in Kenya's modern sector agriculture we have a large number of farmers (as the number of the large scale farms indicate) but also because many prices are set by the Government.(1)

The assumption of price taking in the factor market enables us to determine the level of utilization of these factors. As rational entrepreneurs, the farmers' optimum factor combination should satisfy the condition that the price of each factor equals the value of its marginal product. Thus for the labour input

$$\frac{\partial Q}{\partial L} = w$$

(where $\frac{\partial Q}{\partial L}$ = the marginal Product of Labour and w = the real wage rate).

For empirical work, two families of production functions have been used quite extensively. These are the Cobb-Douglas production function and the Constant Elasticity of Substitution (CES) production function. We shall use these two models to derive demand for labour functions.

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(1) For certain agricultural commodities (tea, coffee, pyrethrum and sisal), prices are determined in the international Market. The import duties on imported capital goods have significant effect on the prices of these capital goods. For labour, the minimum wages legislation has been extended to cover the agricultural sector.

4.1 THE DEMAND FOR LABOUR FUNCTIONS

The demand for labour depends among other things on the price of labour and the prices of other factors that can be substituted for it. Both labour and capital are used and can be substituted for one another in Kenya's Modern Sector Agriculture. The concept of the "elasticity of Substitution" therefore is quite relevant. The elasticity of substitution measures the rate at which substitution takes place between the factors of production. For two factors of production (capital K and labour L), the Elasticity of Substitution, (σ) between labour and capital is defined as follows:-

$$\sigma = \frac{d \log (K/L)}{d \log (MP_L/MP_K)}$$, where $MP_L = \frac{\partial Q}{\partial L}$ = The Maginal Product of Labour

$MP_K = \frac{\partial Q}{\partial K}$ = The Marginal Product of Capital.

4.1.1 THE DEMAND FOR LABOUR FUNCTION BASED ON THE COBB-DOUGLAS MODEL.

We shall give the general production function (1) a specific format, namely the Cobb-Douglas, as follows:-

$$Q_t = Ae^{\lambda t} L_t^{a_1} K_t^{a_2} Z_t^{a_3} \qquad \text{----------(2)}$$

where Q_t, L_t, K_t and Z_t are as in (1),

$e^{\lambda t}$ is a trend variable,

A is a positive parameter which, when it alters, indicates technical progress that is not embodied in K

a_1, a_2 and a_3 are partial Elastisities of response of output with respect to labour capital and other factors respectively.

The partial derivative of (2) with respect to any factor input is the marginal product of that factor. For the labour input, we have

$$\partial Q_t/\partial L_t = MP_{L_t} = a_1(Q_t/L_t) \quad \text{----------(3)}$$

Assuming price taking, labour will be hired up to the point where the wage rate is equal to the value of labour's Marginal Product.

Thus,

$$W_t = a_1(Q_t/L_t) \quad \text{----------(4)}$$

Rearranging (4) gives

(I) $(L_t/Q_t) = a_1(1/W_t)$.

This is the first demand for labour equation.[2] It assumes that capital remains fixed as labour varies. Equation (I) shows an inverse relationship between labour per unit of output and the real wage rate. Thus an increase in the wage rate will lead to a decline in the labour required to produce a unit of output.

Here we assume that the Cobb-Douglas Production Function must be homogeneous of degree 1, thus giving us constant returns to scale.[3] The labour coefficient a_1, measures the elasticity of response of output to the labour input. Thus an increase of 1 per cent in the labour employed would add a_1 per cent to total output. Under purely competitive

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(2) A similar equation has been used by Lianos (46)

(3) See Walters (75) pp. 275 - 281.

equilibrium, a_1 , indicates the share of output allocated to the labour input. A high value of a_1 would imply that the share of output allocated to labour is quite high.

The Cobb-Douglas production function has a unitary elasticity of substitution ($\sigma = 1$). Thus an elasticity of substitution which is very different from unity would imply that the Cobb-Douglas Model is inappropriate. A CES production function, of which the Cobb-Douglas production function is a special case with $\sigma = 1$, may be more appropriate.

4.1.2 A DEMAND FOR LABOUR FUNCTION BASED ON THE CES MODEL.

The CES production function assumes any constant elasticity of substitution (σ). The CES production function is defined as follows:-

$$Q_t = \gamma e^{\lambda t} \left[\delta K_t^{-\rho} + (1-\delta)L^{-\rho}\right]^{-(v/\rho)} \quad \text{-----(5)}$$

where Q_t, K_t, and L_t are as before.

$e^{\lambda t}$ is a multiplicative trend variable.

The four parameters γ, δ, ρ and v represents the four characteristics of an "abstract technology".[4]

γ is a scale parameter denoting the efficiency of a technology. It is analogous to the A - parameter of the Cobb-Douglas Model. δ indicates the degree to which the technology is Capital intensive and is defined in the interval $0 < \delta < 1$. ρ is a substitution parameter since

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[4] See Brown (10) pp.45-50.

$\sigma = \left(\frac{1}{1+\rho}\right)$ (where σ is the elasticity of substitution of labour for capital). v represents the degree of homogeneity of the production function or the degree of returns to scale.

The partial derivatives of (5) with respect to L and K, which give us the marginal productivities of labour and capital respectively can be worked out in the usual way. For the labour input, we have

$$MPL_t = \partial Q_t / \partial L_t = hQ^{1+(\rho/v)} L^{-\rho-1} e^{-\lambda(\rho/v)t} \quad \ldots\ldots\ldots (6)$$

where $h = v(1-\delta)\sigma^{-(\rho/v)}$

Under competitive equilibrium, the real wage rate would be equal to the marginal product of labour (i.e. $w_t = MPL_t$). Thus from (5) we have

$$w_t = hQ^{1+(\rho/v)} L^{-\rho-1} e^{-\lambda(\rho/v)t} \quad \ldots\ldots\ldots (7)$$

Transforming (7) into logarithms and rearranging gives us

(II) $\log L_t = a_o + a_1 \log(1/w_t) + a_2 \text{Log } Q_t + a_3 t$

where $a_o = \frac{1}{1+\rho} \log h$, $a_1 = \frac{1}{1+\rho} = \sigma$ - the elasticity of substitution

$$a_2 = \frac{1+(\rho/v)}{1+\rho} \text{ and } \quad a_3 = \frac{-\lambda(\rho/v)}{1+\rho}$$

(II) is the second demand for labour equation again assuming capital remains fixed. If we assume constant returns to scale, then $v = 1$ and from (7) we can derive a third demand for labour equation. Thus from (7) letting $v = 1$ by taking logarithms and rearranging, we get:-

(III) $\log (L_t / Q_t) = a_o + a_1 \log (1/w_t) + a_2 t$ (5)

where $a_o = \frac{1}{1+\rho} \log h$, $a_1 = \frac{1}{1+\rho}$ and $a_2 = \frac{\lambda \rho}{1+\rho}$

Now we have 3 demand for labour equations which will be used in our estimation.

4.2 THE DUMMY VARIABLE IN THE MODEL

Kenya's Modern Sector Agriculture underwent some fundamental changes during the period 1956-1974. In the early sixties, the "Million Acre Settlement Scheme" was initiated involving the transfer of land from large scale farming to small scale farming. This transfer did not take place completely in one single year but most of it was effected during the period 1962-1963 in which a total of 355,000 hectares of land formerly under large scale farming was transferred to small scale farming. Average area of land under large scale farming for the period 1956-1962 was 3,072,300 hectares, but for the period 1963-1974 the average acreage was 2,688,300 hectares. These two periods are therefore quite distinct.

We would expect the decrease in the large scale farm acreage to have some negative effect on employment. In our Model therefore, we use a dummy variable to estimate the effect of the Government policy of land transfer on employment. The dummy variable is specified as follows:-

x = o for the period 1956 - 1962

x = 1 for the period 1963 - 1974.

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(5) This equation with the trend term ommitted is a version of the Productivity equation $\log(Q/L) = a + b \log w_t$ derived by Arrow et.al. See (3)

The sign and significant of the coefficient of the dummy variable will help us determine the effect of Government policy on employment. A negative and significant coefficient of the dummy variable (x) would imply a negative effect on employment resulting from land transfer. A positive and significant coefficient would indicate the opposite effect. An insignificant coefficient would indicate that the Government policy had no significant effect on employment.

The use of a dummy variable may not be justified on the grounds that the transfer of land did not take place completely in one year. To deal with this problem we use per hectare measurements. Both output and labour are divided by total acreage (hectares, H_t), thus giving output per hectare and employment per hectare. On per hectare basis, the three equations are as follows:-

(I) (a) $(L_t/Q_tH_t) = a_1(\frac{1}{w_t})$ //

(II) (a) $\log(L_t/H_t) = a_o + a_1\log(1/w_t) + a_2\log(Q_t/H_t) + a_3t$

(III) (a) $\log(L_t/Q_tH_t) = a_o + a_1\log(1/w_t) + a_2t.$

where L_t and Q_t are as before, H_t is area (in hectares) of the large scale farms in year t. These three equations will also be estimated alongside the previous 3 equations.

4.3 THE USE OF TIME DERIVATIVES

We have included a trend term in each of the two production functions we have used in deriving the demand for labour equation. By considering the growth rates of the variables in the Model we could take account of the trend term. We shall use percentage changes from year to

year to estimate time derivatives.

Now if we differentiate (I) and (III) with respect to time, we obtain:-

$$\dot{l} = \dot{a}_1 - \dot{w} \quad \text{----------(7)}$$

$$\dot{l} = \dot{a}_o + a_1\dot{w} \quad \text{----------(8)}$$

where $\dot{l} = \frac{dl}{dt} \cdot \frac{1}{l}$ and $l = \frac{L}{Q}$; $\dot{a}_1 = \frac{da_1}{dt} \cdot \frac{1}{a_1}$; $\dot{a}_o = \frac{da_o}{dt} \cdot \frac{1}{a_o}$

and $\dot{w} = \frac{dw}{dt} \cdot \frac{1}{w}$

If a_1 in (7) is constant over time, then the rate of growth of labour per unit of output would be equal to the negative of the rate of growth of the wage rate. Since $l = \frac{L}{Q}$, then $\dot{l} = \dot{L} - \dot{Q}$. Thus a constant elasticity of output with respect to labour (a_1 = constant) gives us $\dot{L} = \dot{Q} - \dot{w}$, i.e. the rate of growth of employment is simply the difference between the rate of growth of output and the rate of growth of the wage rate. If the wage rate grows faster than output ($\dot{Q} < \dot{w}$), then we would expect employment to decline over time. Equation (8) assumes that a_1, the elasticity of substitution is constant. If a_o does not change over time, then $\dot{l} = a_1\dot{w}$. We shall use (8) to estimate the rate of growth of labour per unit of output.

C H A P T E R V

EMPIRICAL RESULTS.

In this chapter, the demand for labour equations which were derived in Chapter IV are empirically tested with the use of available data. We use time series data for the period 1956 - 1974.

5.1 THE DATA

The demand for labour equations require data on output, labour employed, and the wage rate. For this study we use published data. Since 1956 an agricultural census has been conducted annually particularly for the large scale farms. The information from the agricultural census is summarised in the Statistical Abstracts and the Economic Surveys.(1) The data cover mainly the Commercial Sector of agriculture and forestry.(2)

5.1.1 OUTPUT

In our case, we use value added data as a measure of output. The national accounts table of the gross domestic product by the industry of origin gives us the value added data for each sector. These tables are given in both the Statistical Abstract and the Economic Surveys.

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(1) These two Publications are compiled by the Ministry of Finance and Planning. Each devotes a chapter on agriculture, particularly Modern Sector Agriculture.

(2) Forestry contributes minimally to the GDP. In 1956, Modern Sector Agriculture GDP was £32.62 million. Forestry contributed only £0.81 million. Figures for 1964 were £55.08 million and £1.15 million respectively and those for 1972 were £88.94 million and £4.03 million respectively. See Statistical Abstracts 1965 and 1974.

Value added data for agriculture is given separately for the Subsistence (outside the Monetary Economy) and for Modern Sector agriculture (within the Monetary Economy).

5.1.2 LABOUR

The data on labour is also published in the Statistical Abstracts and the Economic Surveys. Annual enumeration of employees and self employed persons is conducted at the end of the month of June each year. Employment figures include all apprentices, casual employees, part time workers and directors and partners not serving on a basic salary. Self employed persons who do not receive regular wages or salaries are excluded.(3)

5.1.3 THE WAGE RATE

The Statistical Abstracts give data on earnings or wages which are cash payments including basic salary, cost of living allowances, profit bonuses, together with the value of rations and free board and an estimate of the employers' contribution towards housing.

The table of earnings by sector give data on total earnings for each sector. The annual wage bill is estimated from the monthly data (reported earnings for the month of June multiplied by 12). These are earnings from the large scale farm sector where most of the farm workers are full time employees. For our analysis we shall use average earnings per person (total wage bill divided by the total number of employees) as a proxy for the wage rate.

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(3) See Statistical Abstract 1974 pp. 241.

Average earnings are not really homogeneous among all employees, since they vary among races. Table 5.1 shows average earnings in the agricultural sector for some selected years.

TABLE 5.1 AVERAGE EARNINGS BY RACE (£ per Annum).

	1956	1960	1963	1964	1967	1972
AFRICANS	32.18	37.16	46.42	50.45	54.48	72.31
ASIANS	500.00	500.00	571.43	500.00	625.00	1666.67
EUROPEANS	882.35	1105.26	1143.85	1583.33	1500.00	2444.44
ALL EMPLOYEES	39.12	45.99	55.08	61.63	57.81	93.99

Source: This table is derived from the two tables on:- (1) Employment by sector and race, (2) Earning by sector and race given in the Statistical Abstracts 1965 and 1974.

Now we have the data we need for our analysis, which are presented in the Appendix table 7. The data on value added and average earnings are not deflated (since there is no suitable deflator available) and this might introduce some bias into the results. Appendix table 7 includes also the data on large scale farm area (in hectares) which will be used in estimating the demand for labour equations on per hectare basis.

5.2 REGRESSION RESULTS

We have used the ordinary least squares method to estimate the demand for labour equations derived in Chapter IV. For equation I the following results were obtained.

$$\text{I} \quad (L_t/Q_t) = 3.28 + 0.083\left(\frac{1}{w_t}\right) - 1.7998\ x$$

S.E. (0.299) (0.0193) (0.317)

t 5.76 4.30 5.67

R^2 = 0.978

Dw = 1.7108

The coefficients of this equation are all significant at the.005 level. This equation however has a constant term which makes it slightly different from the original equation derived from the Cobb-Douglas production function.

The Durbin Watson d statistic is greater than dw the upper limit, at 5 per cent level. (d = 1.7108 > 1.53=dw). This implies that there is the possibility of the existence of positive first order auto-correlation. Thus even though we might have unbiased estimators of the coefficients, the sampling variance of these estimaters are likely to be seriously understated, while their predictions might be having large sampling variances.(4)

If we drop out the constant term, then the dummy variable takes up an insignificant coefficient. The constant term also has a statistically insignificant coefficient if the dummy variable is ommitted. The dummy variable and the constant term give us statistically significant results, but the coefficient of the wage rate is drastically reduced. In appendix table 8(a) we have presented regression results of several versions of equation (I).

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(4) See Johnston (41) pp.246 - 248.

The regressions results for the second demand for labour are as follows:-

$$\text{(II)}\quad \log L_t = 8.079 - 0.504 \log\left(\frac{1}{w_t}\right) - 1.103 \log Q_t$$

S.E.	(0.522)	(0.175)	(0.285)
t	15.48	2.89	4.05

$\bar{R}^2 = 0.822$

Dw = 1.1000

The coefficient of log Q_t and the constant term are significant at .005 level. The coefficient of log $\left(\frac{1}{w_t}\right)$ is significant at .01 level. For the second demand for labour equation, we included a trend term but this trend term had an insignificant coefficient. We also included a dummy variable, which was statistically significant but it resulted in the coefficients of other terms becoming statistically insignificant. Results of versions of the second demand for labour equation are given in appendix table 8(b).

The third demand for labour equation has the following results:-

$$\text{(III)}\quad \log (L_t/Q_t) = 3.12 + 0.389 \log \left(\frac{1}{w_t}\right) - 0.473\ x$$

S.E.	(0.285)	(0.079)	(0.025)
t	10.95	4.90	6.27

$\bar{R}^2 = 0.972$

Dw = 1.2176

Both the constant term and the coefficients of $\log\left(\frac{1}{w_t}\right)$ and x are significant at .005 level. Regression results of versions of equation III are given in appendix table 8(c). The dummy variable in equation II is significant but

it reduces the coefficient of $\log(1/w_t)$ -the elasticity of substitution. A trend term included in this equation had a statistically insignificant coefficient

The Durbin-Watson d statistics of equations (II) and (III) are small and fall within the range in which the Durbin-Watson test for auto-correlation is inconclusive (i.e. $d_l < d < d_u$).(5)

In Chapter IV, it was suggested that we could estimate the demand for labour equations by using labour requirements on per hectare basis instead of using a dummy variable since the transfer of land to small scale farming did not take place in one single year. The regression results on per hectare basis for the three demand for labour equations are:-

I(a) $L_t/Q_t H_t) = 0.000936 + 0.145(1/w_t)$

S.E. (0.000132) (0.0075)

t 7.09 19.39 $\bar{R}^2 = 0.985$

II(a) $\log(L_t/H_t) = 1.808 + 0.748\log(1/w_t) + 0.335\log(Q_t$

S.E. (1.735) (0.279) (0.153)

t 1.04 2.68 2.70

$\bar{R}^2 = 0.643$, D-W = 0.8709

III(a) $\log(L_t/Q_t H_t) = 0.5066 + 1.728\log(1/w_t)$

S.E. (0.3198) (0.0776)

t 1.58 22.26 $\bar{R}^2 = 0.983$

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(5) See Johnstone (41).

The coeffients of I(a) are significant at the .005 level. For equation II(a) the coefficient of $\log(1/w_t)$ and $\log(Q_t)$ are significant at the .005 level. while the constant term is significant at the .025 level. The constant term in III(a) is significant at the .10 level but the coefficient of $\log(1/w_t)$ is significant at the .005 level.

The coefficients of the equations on per hectare basis have more meaningful results than the results on totals.

5.3 ANALYSIS OF THE RESULTS

The coefficient a_1 of $(1/w_t)$ in equation (I) measures the elasticity of response of output with respect to the labour input. Under purely competitive equilbrium, a_1 would measure the proportion of output paid to labour in form of wages ($a_1 = \frac{\text{Wage Bill}}{\text{Total output}}$ In our case $a_1 < .10$ implying that less than 10 per cent of value added (output) in the modern sector agriculture is paid out in form of wages.(6) Nevertheless $a_1 < .20$. On the average the wage bill in Kenya's modern

(6) The proportion of the wage bill to the value added in Kenya's Modern Sector Agriculture has been falling since 1961. In 1961 the wage bill was 22.1% of the value added while in 1970 it was 17.9%. By 1974 the wage bill was only 16.1% of value added

sector agriculture is about 24 per cent of this sector's value added for the period 1956-1974. a_1 therefore underestimates the proportion of the wage bill to the value added. a_1 is highly significant implying that the demand for labour is highly dependent on the wage rate.

The dummy variable in equation I is quite significant implying that the Government policy to transfer land to small scale farming had some negative effect on employment. The inclusion of the dummy variable in our results reduces the value of the coefficient of $1/w_t$, but if we drop it ,this coefficient increases to 0.2 (see Appendix table 8(a The adjusted coefficient of multiple determination ($\bar{R}^2$= 0.978), is quite high. Hence the wage rate and the dummy variable explain 98 per cent of the variation.

The results of equation (I) suggests that a fall in the wage of say 10% would result in an increase of less than 1% in employment if value adde does not increase. Value added in modern sector agriculture has been increasing. If a_1 were higher, then we could increase employment more by a given reduction in wage rate. We note that proportionate change in both the wage rate and the value added will leave employment virtually unaffected. If the wage is held constant. equation I suggests that both employment and value added could grow at the same rate. To increase the demand for labour we should ho the wages constant (since the wage rate is inflexile

downwards)
and then expand output as fast as possible. Equation (I) assumes that the capital used in modern sector agriculture is constant. Nevertheless an increase in the level of output might require increased use of other factors of production like fertilizers and better seeds.

The coefficient of $\log(1/w_t)$ in equation (II) is an estimate of the elasticity of substitution between labour and other inputs. For equation (II) this coefficient is negative. Since $\sigma = \frac{1}{1+\rho}$ and $\rho > -1$ then we conclude that equation(II) is not appropriate. Thus a CES production function assuming non-constant returns to scale fails to fit our data. The coefficient of $\log(Q_t)$ is also negative though statistically significant. This however could be interpreted to mean that output grew faster than employment. Equations II and III are derived from the same CES model, but III, which assumes constant returns to scale has better results.

The coefficient a_1 of $\log(1/w_t)$ in equation IIIis an estimate of the elasticity of substitution between labour and non- labour inputs. In equation III, this estimate is 0.4 but if we drop the dummy variable fromm the regression equation, the value of

a_1 increases to 0.8.[7] This implies that there is room for substitution of labour for non-labour inputs.

The regression results of the three equations on per hectare basis are better than the results on total. The coefficients of the equations have higher values and take up the right signs. Hence on per hectare basis the assmption of non-constant returns to scale is valid but we have an elasticity of substitution which is less than 1.

Equation (III) (a) on the other hand gives us an elasticity of substitution which is greater than 1. The results on per hectare basis imply that there is room for substitution. Thus labour can be substituted for non-labour inputs.

The trend term has a statistically insignificant coefficient and therefore we have dropped it from our results. In Chapter IV it was suggested that we could use time derivatives to take account of the trend term. The following results were obtained from the time derivative equation:-

$$\dot{i} = -3.95 - 0.634\dot{w}$$

S.E. (4.09) (0.51)

t 0.97 1.25 $\bar{R}^2 = 0.229$

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(7) Maitha (50) found that the elasticity of substitution in the Kenyan agriculture was greater than 1. He used time series data for the period 1956 - 1968. In our case we have a larger s sample (1956 - 1974)

This equation has statistically insignificant coefficients. Moreover, the coefficient of multiple determination is small (about 30% of variation is explained by the regression) Hence there are other factors which determine the growth of employment. The coefficient of $\dot{w}$ measures the elasticity of demand of labour per unit of value added. Thus a 10 % increase in the wage rate would be accompanied by 6.3% decrease in employment. The confidence interval however is very wide.

C H A P T E R VI

CONCLUSIONS AND POLICY IMPLICATIONS

This study was designed to provide some insight into the problem of employment in Kenya's modern sector agriculture. In this chapter we shall draw some conclusions and suggest some policy implications. The study is concerned with labour absorption in the modern sector agriculture with some emphasis on the large scale farms. In chapters II and III we analysed the role of the modern sector agriculture with respect to labour absorption. In chapter IV we derived some demand for labour equations which we estimated and tested in chapter V with the use of available data.

Capital does not appear explicity as one of the independent variables in the demand for labour equations we have used. Hence we cannot really determine the effect of mechanisation on labour absorption. This however could be deduced from the regression results. We have noted from the regression results presented in chapter V that the increase in the wage rate (average earnings) that occurred throughout the whole period had some negative effect on the demand for labour in the modern sector agriculture and in particular in the large scale farms. The increase in the wage rate was therefore partly responsible for the stagnation and decline in agricultural employment in Kenya. Throughout the whole period, output (value added) has been growing as a result of increase in factor productivity. Labour perhaps became more productive because more capital was at its disposal. Nevertheless the

increase in agricultural productivity could also result from an increased use of fertilizers and higher yielding seeds.

Our results suggest that there is a high degree of substitutability between labour and capital in the modern sector agriculture.

The dummy variable which represents the government policy on land transfer has a significant coefficient. Thus the Government policy on land transfer had some negative effect on employment particularly on the large scale farms. The transfer of land from large scale farming to settlement schemes could have boosted employment on the small farm sector of modern sector agriculture.

The trend term has a statistically insignificant coefficient. This implies that there was no significant technical change in agriculture. Moreover the quality of labour did not have any significant effect on employment in modern sector agriculture. Most of labour hired in the modern sector agriculture is unskilled and hence its quality doesn't have any significant effect on output. The new tractors introduced in agriculture could have some technical change embodied in them which

could have led to an increase in labour productivity, but this effect would probably not be large.

Agricultural output depends on other variables like rainfall and soil fertility which are not fixed. The effect of such variables is represented by the constant term which apparently is quite significant in our results.

From our results we can draw the following conclusions:-

(1) The increase in the wage rate (average earnings) that took place in Kenya's modern sector agriculture had some negative effect on employment.

(2) The estimates of the elasticity of substitution suggests that there was a high degree of substitution between labour and capital. The increased use of tractors particularly in the large scale farm sector of modern sector agricultre indicates that some substitution took place.

(3) The decrease in the large scale farm acreage had a negative effect on labour absorption.

6.2 POLICY IMPLICATIONS

Modern sector agriculture includes the large scale farms as well as the small holder agriculture within the monetory economy. We have however not fully covered the small holder agriculture which as we have noted is emerging as an important sector in the Kenya economy. This small holder agriculture has proved to be quite competitive with the large scale farms.

From this study we make some recommendations on the following:-

(1) A need for a restraint on wage increases;

(2) The possibility of adopting a selective mechanization that is appropriate to the country's needs,

(3) The possibility of a change in the land tenure system preferably in favour of smaller sized units.

6.2.1. THE WAGE POLICY

The increase in the wage rate in Kenya's modern sector agriculture, as we have noted, was partly responsible for the decline in the demand for labour. There is therefore a need for some restraint on wage increases. This is consistent with our results since as we have already noted in chapter V, employment in modern sector agriculture could be increased if the wage rate remained constant. What is required however is a correction of the factor price distortions in the modern sector agriculture particularly in the large scale farms. If the wages remained constant for a time, we would expect some increases in employment as

output increases.

Agricultural wages are not the highest in the Kenya economy. There have been increases in the wages throughout the whole country. A wage policy for the whole economy is therefore required, because wages increases in other sectors will force wages in modern sector agriculture to rise also.

The minimum wages legistation in Kenya has been quite effective in raising the wage level above what it could have been in a free labour market. Labour which is overpriced becomes relatively more expensive than capital (which is underpriced). These distortions in factor prices should be corrected, and where possible, distortions should be encouraged in the opposite direction (in favour of labour). This could be achieved by subsidising the labour employed in the large scale farms. A problem arises over the payment of the subsidy. The government could tax the wealthy (who include the large land owners) and then use these funds to subsidise agricultural employment. An alternative which probably is easier to administer is the taxing of the capital inputs (tractors, spare parts and fuel). The government could also reduce the advantage of capital imports by raising the tariffs and duties on imported capital. The objective in distorting prices in favour of labour is to effectively make labour cheaper relative to capital thereby stimulating its demand.

6.2.2. SELECTIVE MECHANIZATION

We have already pointed out in chapter III that agricultural Mechanization is indispensable in Kenya's modern sector agriculture. A selective mechanization that is adopted to the country's needs could benefit many Kenyans.

Our main concern is with labour absorption. Hence we should allow the use of capital to the extent that it supplements (rather than displaces) human labour. A selective Mechanization that is based on local manufacturing industries, will give the country a double benefit by providing the country with the required capital equipment as well as increasing industrial employment. Industries should be set up locally for the manufacture of small tractors and improved ox-ploughs. Research is therefore needed to develop such an intermediate technology. This selective mechanization might require some changes in the tenure system in favour of small scale farms.

6.2.3. A TENURE SYSTEM IN FAVOUR OF SMALL FARMS

The need to increase production and create more employment requires that land be more intensively utilized. The size of the large scale farms makes mechanization profitable, but a reduction in the size of farms would lead to more labour intensive units without necessarily a reduction in output.

Most of the cash crops grown in Kenya could be grown quite successfully and profitably by small farmers. For some other crops however there are substantial

economies of scale when such crops are grown on large scale farms. Wheat has some economies of scale when grown on the large scale farms but wheat acreage is less than 5 per cent of total large scale farm acreage. A redistribution of land towards more labour intensive units will lead to an increase in both output incomes, and employment.(2)

Kenya in the 1970's is facing a rather critical problem of unemployment. The urban industrial sector is not large enough to absorb all those who are added to the labour force each year. The bulk of the rise in wage employment must therefore come from improved agriculture. Agricultural productivity (particularly in the small farms), must be raised beyond the point where the family's labour supply is able to cope. This would raise the farmers income to a point high enough to enable him employ labour as a substitute for himself or his family.

The productivity of the small farmers could be improved by providing some basic education (both formal and informal) to these farmers. The institutions which serve these farmers, like Marketing and Credit Services need to be improved. Research and extension services also be provided to the small farmers. These measures to increase productivity will raise the farmers' incomes thereby enabling them to employ more labour.

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(2) See ILO Report (37) page 165

APPENDIX TABLES

APPENDIX TABLE 1 GROSS MARKETED PRODUCTION FROM THE MODERN SECTOR AGRICULTURE

YEAR	LARGE FARMS £ MILLION	SMALL FARMS £ MILLION	TOTAL £ MILLION	% SHARE OF LARGE FARMS
1954	27.3	6.0	33.3	82.0
1955	32.8	5.1	37.9	86.5
1956	32.6	5.9	38.5	84.7
1957	32.4	6.9	39.3	82.4
1958	33.4	7.6	41.0	81.5
1959	33.9	8.4	42.3	80.2
1960	37.7	9.5	47.2	79.9
1961	35.7	10.4	46.1	77.5
1962	37.1	10.6	47.7	77.8
1963	40.7	11.3(19.3)	52.0(60.0)	78.3(62.9)
1964	35.8	24.6	60.4	59.3
1965	33.3	23.8	57.2	58.4
1966	36.0	32.7	68.8	52.5
1967	32.9	34.1	66.9	49.0
1968	34.4	35.8	70.2	49.0
1969	37.9	38.3	76.2	49.7
1970	41.2	44.2	85.4	48.3
1971	42.1	44.6	86.7	48.6
1972	50.3	55.6	105.9	47.5
1973	60.0	63.3	123.3	48.8
1974	72.0	74.6	146.7	49.1

Source: Republic of Kenya: Statistical Abstracts, series 1 and 2. Economic Surveys 1970 and 1975.

* The figures on Small Scale Farms for the period 1954-1963 are obtained from Statistical Abstracts series 1 whereas those for 1964 - 1974 period are from the Statistical Abstracts series 2. A break in the series occured around 1963. Thus the figures for 1954 - 1963 period are not comparable to those for 1964-1974 period. The figure of 19.3 in the brackets refers to the new series whereas the figure 11.3 comes from the old series. The break in the series was the result of change in coverage within the Small Farm Sector.

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APPENDIX TABLE 2 WAGE EMPLOYMENT IN THE ECONOMY

YEAR	WAGE EMPLOYMENT IN AGRICULTURE	TOTAL WAGE EMPLOYMENT	% SHARE OF AGRICULTURAL WAGE EMPLOYMENT	% SHARE OF PUBLIC SECTOR WAGE EMPLOYMENT
1946	197,000	403,700	48.8	19.0
1949	190,500	430,100	44.3	24.5
1950	203,500	460,500	44.2	23.8
1951	205,100	452,100	45.4	23.6
1952	204,500	475,700	43.0	24.3
1953	213,100	498,400	42.7	27.0
1954	221,100	542,400	40.8	27.5
1955	247,900	615,100	40.8	28.5
1956	235,200	596,700	39.4	28.2
1957	253,400	614,400	41.2	27.2
1958	249,700	593,200	42.1	26.6
1959	251,700	596,900	42.2	26.8
1960	271,800	622,200	43.7	25.9
1961	252,000	589,800	42.7	28.3
1962	245,500	579,800	42.3	28.8
1963	215,700	539,200	40.0	29.6
1964	201,200	575,400	35.0	31.6
1965	202,400	582,100	34.2	31.8
1966	188,100	585,400	32.1	34.2
1967	172,300	597,500	29.0	35.5
1968	173,000	606,400	28.5	36.5
1969	178,700	627,200	28.5	37.8
1970	183,700	644,500	28.5	38.4
1971	189,600	691,200	27.4	38.7
1972	197,900	719,800	27.5	40.0
1973	220,600	761,400	29.0	39.3
1974	213,700	826,300	25.9	40.0

Sources: Republic of Kenya: Statistical Abstracts 1955, 1964, 1972 & 1975.

Republic of Kenya: Economic Survey 1975.

188/173 = 15 x 160/188 1580/188 = 1500/190 150/20 = 7.5

APPENDIX TABLE 3 LARGE SCALE FARMS: AREA AND NUMBER OF HOLDINGS

YEAR	NO. OF HOLDINGS	AREA THOUSAND HECTARES	AVERAGE SIZE PER HOLDING (HECTARES)
1956	3,322	2,938.7	864.6
1957	3,451	3,024.7	876.5
1958	3,540	3,060.0	864.4
1959	3,593	3,114.0	866.7
1960	3,609	3,128.7	866.9
1961	3,624	3,138.3	866.0
1962	3,606	3,116.8	864.3
1963	3,368	2,761.8	820.0
1964	2,958	2,751.8	930.1
1965	2,820	2,739.9	971.6
1966	2,750	2,641.9	960.7
1967	2,851	2,697.9	949.6
1968	2,953	2,652.9	// 898.4
1969	3,043	2,653.3	871.9
1970	3,175	2,688.6	856.8
1971	3,139	2,680.9	854.1
1972	3,166	2,688.4	849.2
1973	3,165	2,657.7	839.7
1974	3,217	2,673.7	831.1

SOURCE: Republic of Kenya: Statistical Abstracts 1965, 1970 and 1975.

APPENDIX TABLE 4(a) THE SIZE DISTRIBUTION OF THE LARGE S

HECTARES	1961		1963		1966		19
	NO. OF HOLDING	% TOTAL	NO. OF HOLDING	% TOTAL	NO. OF HOLDING	% TOTAL	NO. OF HOLDING
0 - 19	286	7.9	293	8.70	281	10.22	429
20 - 49	278	7.67	285	8.47	252	9.16	388
50 - 90	278	7.67	269	7.97	255	9.27	298
100 -199	388	10.70	363	10.78	344	12.51	380
200 -299	403	11.3	368	10.93	266	9.67	337
,300 -399	356	9.83	288	8.54	219	7.96	259
400 -499	347	9.57	276	8.20	181	6.58	202
500 -999	687	18.95	625	18.56	466	16.95	489
1000 -1999	317	8.75	313	7.80	246	8.95	210
2000 -3999	150	4.17	148	4.40	112	4.07	107
4000 -19999	120	3.32	126	3.74	115	4.18	102
Over 20,000	13	0.36	14	0.42	13	0.48	14
	3624	100.00	3369	100.00	2750	100.00	3165

SOURCE: Republic of Kenya: Statistical Abstracts 1970 and 1974.

APPENDIX TABLE 4(b) AGRICULTURAL HOLDINGS AND LAND BY SIZE

	HOLDINGS % TOTAL					LAND AREA	
HECTARES	1961	1962	1963	1969	1972	1961	1962
0 - 19	7.9	8.0	8.7	12.7	13.8	0.1	0.1
20 - 49	7.7	7.8	8.5	10.4	10.6	0.3	0.3
50 - 99	7.7	7.7	8.0	9.7	9.0	0.7	0.7
100- 199	10.7	10.2	10.8	11.6	11.7	1.8	1.8
200- 299	11.3	11.3	10.9	9.7	10.4	3.1	3.2
300- 399	9.8	9.5	8.5	8.1	8.1	4.0	3.9
400- 499	9.6	9.4	8.2	6.8	6.6	5.0	4.9
500- 999	19.0	19.1	18.6	15.8	15.7	15.5	15.7
1000-1999	8.7	9.3	7.8	7.8	7.0	13.8	13.9
2000-3999	4.2	4.0	4.4	3.5	3.5	13.0	12.9
4000-19999	3.3	3.3	3.7	3.5	3.4	31.0	30.8
Over 20,000	0.3	0.4	0.4	0.4	0.4	11.5	12.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Republic of Kenya: Agricultural Census - Large Scale Fa

APPENDIX TABLE 5

THE USE OF FACTOR INPUTS IN THE LARGE

YEAR	NO. OF TRACTORS IN USE	CAPITAL EXPENDITURE £ THOUSAND	EXPENDITURE ON MECH. EQUIPMENT £ THOUSAND	TRACTORS PER 1000 HECTARES	EXPENDITURE ON MECH. EQUIPMENT PER 1000 HECT.
1956	5435	4074.0	1795.0	1.85	610.0
1957	5735	4933.0	1864.0	1.91	616.3
1958	6136	5593.0	1642.0	2.00	586.6
1959	6232	5449.0	1722.0	2.01	553.0
1960	6403	5587.0	1698.0	2.05	542.7
1961	6422	4881.0	1509.0	2.05	484.8
1962	6418	3481.0	1284.0	2.06	416.6
1963	6111	2955.0	1115.0	2.22	403.7
1964	5765	3355.0	1362.0	2.11	445.1
1965	5729	4072.0	1966.0	2.09	717.5
1966	6145	4358.0	1828.0	2.33	691.7
1967	6617	4952.0	2109.0	2.46	781.7
1968	4804	4652.0	1775.7	1.81	669.3
1969	5998	5314.8	1962.2	2.26	739.5
1970	7247	5265.1	2108.0	2.70	784.1
1971	5891	5382.8	2172.2	2.20	810.3
1972	6028	6117.3	2181.4	2.25	814.4
1973	5721	6825.6	2413.5	2.16	908.4
1974*	6195	11273.5	3024.0	2.32	1131.0

SOURCE: Republic of Kenya: Statistical Abstracts, 1

** Provisional

* Crop land is defined as the area under temporary
permanent crops. Crop land together with tempora
and temporary meadows make up the cultivated are
of the cultivated area per tractor ranges from 12
in 1968 to 91 hectares in 1970.

APPENDIX TABLE 6 ACREAGE UNDER MAJOR CROPS - LARGE SCALE FARMS

Thousand Hectares

YEAR*	MAIZE	WHEAT	SUGARCANE	TEA	COFFEE	PYRETHRUM	SIS
1956	67.4	117.8	7.5	11.1	24.4	7.6	78
1957	71.9	101.9	10.8	12.4	25.3	8.4	91
1958	59.9	100.0	11.1	13.3	26.1	9.0	98
1959	54.3	102.8	14.7	14.6	27.5	11.3	98
1960	57.6	100.3	7.1	15.0	28.8	16.1	99
1961	64.1	91.4	17.8	16.0	30.1	19.6	110
1962	64.5	98.6	18.1	17.3	30.5	17.3	106
1963	45.3	112.5	18.5	18.0	30.7	11.7	108
1964	30.2	113.5	18.4	18.5	30.9	5.7	110
1965	3.9	108.5	18.3	19.3	29.5	4.8	107
1966	57.3	120.9	17.1	20.7	29.1	5.0	108
1967	57.6	133.1	21.9	20.7	28.7	4.8	103
1968	51.6	139.8	26.5	21.4	28.4	4.9	83
1969	55.8	137.3	26.1	21.8	27.6	3.0	85
1970	59.3	121.1	26.4	23.8	29.5	3.3	85
1971	66.3	92.7	28.1	23.8	28.4	3.7	82
1972	77.2	89.2	26.9	23.8	29.4	3.6	67
1973	75.8	83.6	27.1	25.5	28.6	3.2	74
1974	63.7	89.3	29.3	26.3	28.5	4.3	81

SOURCE: Republic of Kenya: Statistical Abstracts 1966 table 87pp
1975 table 91pp1

* From 1956 - 1959 the figures on acreage were given in acres, but we have converted them into hectares.

APPENDIX TABLE 7 LABOUR, VALUE ADDED, AVERAGE EARNINGS AND LAND AREA IN MODERN SECTOR AGRICULTURE

YEAR	LABOUR (Thousand)	VALUE ADDED (£ Million)	AVERAGE EARNINGS (£)	LARGE SCALE FARM AREA ('000 Hectares)
1956	235.2	33.43	40.82	2,923.7
1957	253.4	32.52	41.83	3,024.7
1958	249.7	33.70	43.25	3,060.0
1959	251.7	34.69	43.31	3,114.0
1960	271.8	39.47	45.97	3,128.7
1961	252.0	32.20	48.81	3,138.3
1962	245.5	39.01	47.25	3,116.8
1963	215.7	43.51	53.71	2,761.8
1964	201.2	53.85	59.53	2,751.8
1965	202.4	48.61	64.72	2,739.9
1966	188.1	58.38	68.58	2,641.9
1967	172.3	58.81	67.75	2,697.9
1968	173.0	60.68	71.10	2,652.9
1969	178.7	66.98	72.75	2,653.3
1970	188.7	77.48	74.58	2,688.6
1971	189.9	92.97	79.64	2,680.9
1972	197.9	119.92	93.99	2,688.4
1973	220.6	123.94	91.12	2,657.7
1974	213.7	127.31	95.93	2,673.7

SOURCE: Republic of Kenya: Statistical Abstracts 1964, 1972, 1974 and 1975;

Economic Survey 1975.

APPENDIX TABLE 8(a) DEMAND FOR LABOUR

$$\left(\frac{L_t}{Q_t}\right) = a_o + a_1\left(\frac{1}{w_t}\right) + a_2 x$$

Variable	Coefficient	S.E.	t	Signif. level	
(a) $\frac{1}{w_t}$	0.191	0.0075	25.63	0.005	
x	-0.103	0.2066	0.51	not signif.	
				$\bar{R}^2$ = 0.991	
(b) Const.	0.282	0.356	0.79	not signif.	$\bar{R}^2$ = 0.978
$\frac{1}{w_t}$	0.177	0.017	10.61	0.005	Dw = 1.7108
(c) $\frac{1}{w_t}$	0.189	0.00613	30.86	0.005	$\bar{R}^2$ = 0.991
(d) $\frac{1}{w_t}$	0.186	0.0083	22.54	0.005	$\bar{R}^2$ = 0.991
t	0.000089	0.000015	0.58	not signif.	

APPENDIX TABLE 8(b) DEMAND FOR LABOUR

$$\log L_t = a_o + a_1 \log\left(\frac{1}{w_t}\right) + a_2 \log Q_t + a_3 t + a_4 x$$

Variable	Coefficient	S.E.	t	Signif.level	
(a) const.	5.71	1.619	3.50	0.005	$\bar{R}^2$ = 0.82
log $\frac{1}{w_t}$	-0.255	0.167	1.53	0.10	Dw = 1.19
log Q_t	-0.337	0.504	0.67	not signif.	
t	-0.0034	0.1196	0.17	not signif.	
x	-0.242	0.079	3.15	0.005	

(b)	Const	8.385	1.688	4.79	0.005	$\bar{R}^2$ = 0.823
	$\log\frac{1}{w_t}$	-0.498	0.183	2.73	0.01	Dw = 1.1175
	$\log Q_t$	-1.23	0.511	2.41	0.025	
	t	-0.0046	0.024	0.19	not signif.	

(c)	Const	6.15	0.74	8.31	0.005	$\bar{R}^2$ = 0.893
	$\log(\frac{1}{w_t})$	-0.2524	0.161	1.57	0.10	Dw = 1.1975
	$\log Q_t$	-0.4002	0.329	1.22	not signif.	
	x	-0.2397	0.758	3.16	0.005	

APPENDIX TABLE 8(c) DEMAND FOR LABOUR

$$\log(L_t/Q_t) = a_o + a_1 \log(1/w_t) + a_2 t$$

	Variable	Coefficient	S.E.	t	Signif.level	
(a)	Const.	1.395	0.782	1.78	0.05	$\bar{R}^2$ = 0.952
	$\log(1/w_t)$	-0.169	0.243	0.70	not signif.	Dw = 0.6786
	t	-0.082	0.0203	4.04	0.005	

(b)	Const.	4.36	3.67	11.81	0.005	$\bar{R}^2$ = 0.900
	$\log(1/w_t)$	0.774	0.091	8.5	0.005	Dw = 0.6786

APPENDIX TABLE 9 RESULTS ON PER HECTARE BASIS

I $(L_t/Q_t H_t) = a_o + a_1(1/w_t) + a_2 t.$

	Variable	Coefficient	S.E.	t.	Signif.level	
(a)	$(1/w_t)$	0.0936	0.0038	24.47	0.005	$\bar{R}^2$ = 0.985
(b)	$(1/w_t)$	0.108	0.028	38.73	0.005	$\bar{R}^2$ = 0.985
	t	0.000032	0.0000043	7.28	0.005	

	Variable	Coefficient	S.E.	t	Signif.level
(c)	Const.	0.000062	0.00109	0.06	not signif.
	$(1/w_t)$	0.111	0.0043	2.89	0.01
	t	-0.000295	0.000037	0.81	not signif.

$R^2 = 0.979$

II $\log(L_t/H_t) = a_0 + a_1\log(1/w_t) + a_2\log(Q_t/H_t) + a_3 t$

Variable	Coefficient	S.E.	t	Signif.leve
Const.	1.726	2.194	0.79	not signif
$\log(1/w_t)$	0.724	0.465	1.56	0.10
$\log(Q_t/H_t)$	0.335	0.158	2.13.	0.025
t	-0.00128	0.0198	0.06	not signif

$R^2 = 0.643$; DW = 0.8709

III $\log(L_t/Q_tH_t) = a_0 + a_1\log(1/w_t) + a_2 t$

Variable	Coefficient	S.E.	t	Signif.leve
Const.	-0.921	1.737	0.52	not signif.
$\log(1/w_t)$	1.321	0.496	2.68	0.01
t	-0.021	0.026	0.82	not signif.

$R^2 = 0.984$

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