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ECONOMICS OF RURAL URBAN INTERACTION :

CASE STUDY OF KIKUYU DIVISION

BY

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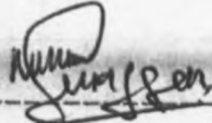
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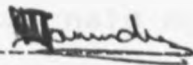


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ABSTRACT

This paper examines the impact of urbanization on farmers' management decisions on farms in the "fringes" of Nairobi City with a view to identify the factors responsible for farm dis-investment in favour of rental housing investment.

The farming business is evaluated using farm gross margins, and a standard housing evaluation technique is used to assess the value of the rentals. The value of farm output is subsequently scaled by an uncertainty factor; The values of the two investment options are then discounted over a selected range of discount rates for a period of five years, the effective life of wooden rentals, the predominant type of rentals constructed by the farmers.

An econometric model is used to isolate factors responsible for allocation of land to rental housing construction by the land owners.

The study shows that the farmers investment decisions are rational. Land subdivision is identified as the main cause of farm disinvestment, while rural electrification and access roads have significant influences on the attractiveness of rentals in the farms.

The paper suggests that the areas which are already in the middle of the economic transformation should be encouraged to convert their land to rentals.

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CHAPTER ONE

STATEMENT OF THE PROBLEM.

1.1. Urban areas in Kenya have had to contend with a serious shortage of housing to accomodate the urban residents. As a result there has evolved various innovative methods by people, in an attempt to provide shelter for themselves. On account of the sustained pressure on the available housing stock, there has emerged a new style of housing provision in the areas around Nairobi (peri-urban areas) on formerly agricultural land. The construction of houses by the land owners in the periphery has been an attractive income earner to them so that agricultural occupations are being marginalised. This paper investigates the factors responsible for conversion of former agricultural land to rentals and how the housing shortage in Nairobi can be alleviated by intervention in the periphery.

Kenya's rate of overall population growth is currently estimated to be about 4 per cent per annum while population growth in urban areas is about 7.1 per cent. (Development Plan 1984-1988:176). In the medium and long term, the key to rapid growth, alleviation of poverty, reduction of unemployment and narrowing of urban-rural income differential lies with increasing productivity in the rural economy. However, due to the rapid population growth there has been so much pressure on land for intensive cultivation that almost all high potential land is now under use.

According to the 1989-1993 Kiambu District Development Plan the most serious problem in the district is the need to

generate jobs for its youthful population. It is projected that some 70 per cent of these people will have to be absorbed in agriculture if they are to be gainfully employed. The plan states that Kiambu District land resources for agriculture have already reached a critical limiting stage so that the district may be unable to meet its food requirements in the future. The major task of its landowners is to ensure that the land they currently farm is more productively.

Given the heavy densities of population in the district the landowners have a major task at hand to ensure increased farm production to raise incomes and generate significant employment opportunities.

However, this problem of raising food production may be constrained by the conversion of agricultural land to non-agricultural uses on account of the ongoing urbanization in the area. This urbanization has occurred mainly as a result of the spatial spread of industries from Nairobi and the increased movement of urban workers from the city in search for low-rent accommodation in the urban-periphery. Landowners are increasingly diverting their land from agricultural production to rental housing in order to meet this growing demand for shelter. The market signals in favour of investment in rental housing by the landowners are so strong that agricultural investments especially in Kikuyu Division risk being completely marginalised; this is due to the fact that returns from rental housing are higher and not subject to as much uncertainty as those from farming. Investment in rental housing offers an opportunity to raise regular and steady cash income for

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the landowners. Given that such housing investment is made on former agricultural land without essential services, there are dangers that slums will proliferate in the urban periphery, on account of unplanned housing development. While such provision of rental housing by the land owners may benefit tenants who have been marginalised from the city's residential system, a long-term solution to Nairobi's housing problem is needed.

1.2 Background to the Study.

Rapid population growth in urban areas has increasingly become an area of concern to economists and urban planners (Hutton 1972:2). Some of the problems which have been associated with urbanization both in Kenya and other Third World countries have been the increased rate of rural-urban migration leading to considerable difficulties in the provision of basic services to the city residents.

The magnitude of the problems of uncontrolled city growth, have been widely discussed (see for example Dunkerley (1983) and the report of the Kenyan Urban Housing Survey carried out in 1983). According to Dunkerley, by the year 2000, as many as forty cities in the developing world will have populations exceeding 5 million inhabitants, while 10 or 11 cities, are likely to exceed 11 million. The effect of this human relocation as noted by Dunkerly (1983:1) is that "well within the lifetime of most persons being born today, the majority of the population

of the developing countries are likely to be urban" when this explosion of urban growth is set against limited available resources to provide housing, work places, roads and many other requirements of urban life, then the magnitude of the urbanization pressures becomes very clear. The task of directing and coordinating the wide variety of activities that interact in this process of urban development is thus quite complex.

Sharply rising urban land prices have been identified as one of the most serious problems facing countries during the urbanization process (Dunkerley 1983:6). The expansion of urban population has led to a rapid increase in the demand for land, since land location is specific and existing urban plots cannot be reproduced (Dunkerley 1986:6). Consequently, much strain has been placed on the housing sector, for while rural populations are usually able to provide their own housing through own construction using local materials, the housing of urban population is more complex and will usually follow the following lines:-

- Public provision of housing by a public housing agency.
- Making residential site and services available to low income populations on which to construct their dwellings.
- Illegal building by squatters populations on public or private land usually with negligible services.
- Construction of houses by the private sector for the rich and middle classes.

So, whatever mix of the above alternatives is chosen, any

developing country will be hard pressed to cope with the rapid growth in urban population.

Table 1.1 Reported New Residential buildings in Nairobi.

Habitable Rooms	1979	1980	1981	1982	1983	1984	1985	1986	1987
One	48	7	2	13	23	12	47	1	-
Two	64	77	122	79	72	120	4	53	83
Three	249	393	382	349	212	256	76	95	66
Four	326	544	826	203	63	110	77	103	172
Five	444	558	380	147	68	84	45	19	75
Six or more	332	340	375	197	56	56	41	219	150
	1463	1939	2087	988	494	638	290	490	546

Source: Republic of Kenya, Statistical Abstracts (various issues).

Table 1.2 Index of rents in Nairobi by income groups, 1979-1987.

1975 = 100

Year	Upper Income	Middle Income	Lower Income
1979	164.2	219.9	314.6
1980	186.1	187.7	277.6
1981	221.1	160.1	232.0
1982	259.4	144.8	205.1
1983	286.1	317.3	346.0
1984	307.4	352.1	383.6
1985	333.7	392.3	423.3
1986	347.0	415.2	440.2
1987	382.8	457.2	464.9

Source: Republic of Kenya, Statistical Abstracts, (various issues).

The dire shortage of housing stock in Nairobi is shown in Table 1.1 on the reported new residential buildings in Nairobi. The number of annually completed houses declined from 1,463 units in 1979 to only 546 in 1987. As a result, there has been a rise in rents in Nairobi for all houses occupied by all income

groups. Table 1.2 shows that between 1979 and 1987 rent for dwelling units in the upper and middle income groups roughly doubled.

As a result of the escalating urbanization difficulties in many parts of the world caused by limited and expensive, urban land space, much economic activity is being increasingly shifted towards adjacent rural and peri-urban areas. Thus most modern cities have tended to develop around them extensive suburbs. This expansion has been attributed to increased population in those cities whose dynamic economies has allowed them to attract migrants (Davies: 1976:9). The available economic opportunities make them grow and since central areas of cities are too expensive and in scarce supply both the increased demand for housing and employment opportunities have been partially met by shifting economic activities toward the city's outlier areas. The urbanization process expands as these peripheral areas continue to grow. This growth is to some extent constrained only by availability of transport services to move people back and forth from the Central Business District (CBD) within reasonable time.

In Kenya, the private sector has responded to expensive urban land by shifting industrial establishments away from city centres to smaller towns and peri-urban areas. The Government has played its role through the formulation of policies which incorporate incentives to potential rural entrepreneurs and also through Government investment. Daly and Webber (1973) have elaborated the economic decentralization process necessary to ease urban

congestion. Factories have been spread over broad areas of the cities with diversification of manufacturing, causing the manufacturing labour force to spread from the city centre towards the urban periphery. These locational changes have been accompanied by urban land.

The Government of Kenya stresses the importance of the creation of rural growth centres in its District Focus Development due to several other reasons. Despite the phenomenal growth of the urban population, corresponding growth in industry has not taken place. The establishment of manufacturing units in rural areas therefore provides an important stimulus to the whole economy through their linkage effects (Kundu 1979:43)

An important objective of the Government of Kenya as stated in the National Urban Development Strategy report of 1977 has been that of slowing down the growth rate of Nairobi. This report contends that the rate of growth of Nairobi has been too rapid to the extent that the economic and social costs of agglomeration have exceeded the corresponding economic and social benefits.

The purpose of this study is to examine the economic reaction of landowners in the peri-urban areas of Nairobi to the growth of Nairobi and growth of industries in the area. The study uses Kikuyu Division in Kiambu District as a case study. The study also examines the extent to which the City of Nairobi whose location is in close proximity to Kikuyu Division has influenced landowner's investment decisions regarding land use in Kikuyu Division.

According to Found (1972:22) "Man is a decision maker who is very sensitive to variations in the land resource base and displays strong rationality by reacting sensibly to them". Such reactions, however, as argued by Toyne (1974:73) do not always lead to optimal patterns of land use since they are normally not based on optimization principles.

Consequently a careful analysis of the causes of the various needs for land and understanding of economic characteristics of land at different locations is necessary to acquire better land management decisions.

As the size of towns and cities grow and as household dwelling units become more scattered across the rural areas, there appears an imbalance between the demand for and supply of land especially in areas and countries where the total amount of land available is limited (Wibberley 1959:60), thus requiring optimal decision making in land resource use.

Kiambu District is one of the five districts of the Central Province in Kenya. According to the 1989-1993 District Development Plan, Kiambu District is not well endowed with natural resources. It has limited land, water and forestry resources so that their contribution to its development depends on how these resources are managed and exploited. While agriculture dominates the economy of Kiambu District, providing livelihood to about 75 per cent of the population (see Kiambu District Development Plan, 1989\1993) as well as being an important supplier of vegetables to Nairobi, rapid population growth in the district poses serious problems with respect to the provision of food to the population. Table 1.3 shows the projected

consumption and supply of food for Kiambu District from the years 1989-1993

Table 1.3. Food Supply and Consumption Of Kiambu District 1989-1993

	Tonnes				
Drop	1989	1990	1991	1992	1993
-----	-----	-----	-----	-----	-----
Maize:					
Production	47,320	32,700	57,800	61,000	61,200
Demand	112,320	116,812	121,485	126,345	131,399
Deficit	65,000	64,112	63,685	65,145	70,200
Potatoes:					
Production	86,350	96,000	104,000	112,000	120,000
Demand	23,400	24,336	25,309	26,322	27,375
Deficit	62,950	71,664	78,691	85,678	92,625
Beans:					
Production	6,375	9,000	13,500	18,000	18,000
Demand	10,296	10,708	11,136	11,582	12,045
Deficit	(3,921)	(1,708)	(2,364)	(6,418)	(5,955)
Fruits and Vegetables:					
Production	136,389	148,560	160,940	178,320	185,700
Demand	13,759	14,310	14,882	15,477	16,096
Surplus	122,630	134,250	146,056	157,843	169,604

Source: Kiambu District Development Plan 1989-1993 pp 52

The table shows that Kiambu District will continue to face food deficits except for the projected surplus production of fruits and vegetables. When these food deficits are considered against a high natural population growth rate (estimated at 3.7 per cent annually by Kiambu District Development Plan 1988-1993:15) and the district with significant immigration from Nairobi and other districts (see Kiambu District Development Plan 1989-1993:17) the precarious position facing the agricultural sector in the district

becomes evident. Thus Kiambu District can only increase its agricultural productivity by raising output per land unit on the small farms since there is little land available to be opened up for farming purposes.

The land use patterns in districts near Nairobi, are shown in Table 1.4. While Kiambu District has the second smallest agricultural land after Kirinyaga District, in Central Province, it has the largest agricultural population, and by the year 2000 land availability per person in the district will have declined to about 30 per cent that of 1969.

Table 1.4. Agricultural Potential and Land Pressure in Central Province.

District	Agricultural land	Agricultural population 1969 ('000)	Natural increase % p.a.	Projected Agricultural population*	Hectres Per person	Projected Hectres per person year 2000
Kiambu	1980	455	4.0	1533	.3	.09
Kirinyaga	1080	217	"	721	.3	.10
Muranga	2160	440	"	1483	.4	.12
Ngandarua	2640	169	"	570	.3	.24
Nyeri	4310	349	"	1176	.3	.09

Source: National Urban Development Strategy 1977
* refers to year 2000, Dimension is '000.

Table 1.5 Population of Towns in Kiambu District, 1977.

	Population	Density/Km(2)
Kiambu	1982	2,183
Ngika	23,804	157
Ngithunguri	1,270	2,420
Ngikuyu	2,145	5,501

Source: Republic of Kenya
1979 Population Census Report Vol.3
Urban population.

Table 1.5 shows the population density of four urban

centres in Kiambu District according to the 1979 Population Census. Although Thika Town had the largest population in terms of absolute numbers, it had the lowest density. On the other hand, Kikuyu Town had the highest population density indicating very heavy pressure on available land for commercial, industrial and residential uses as well as for agricultural use.

OBJECTIVES OF THE STUDY

1.3 The rental housing- agriculture portfolio selection by landowners underlies a behavioural relationship connected with efforts by the land owners to raise a cash income.

Thus a primary objective of the study is to examine the behaviour of farmers in their investment decision making. This will be done in the following ways:-

- 1) Conducting farming investment analysis using the farm gross margin approach over a cross-section of field crops in areas selected from Kikuyu Division.
- 2) Carrying out an economic analysis of rental housing investment by the land owners in Kikuyu Division.

The above two objectives will reveal the farmers' rationality in their land use decisions.

- 3) In order to capture the behavioural relationships underlying the farmer investment choices, a land supply function allocated to rental housing is estimated incorporating data from the farm.

JUSTIFICATION OF THE STUDY

1.4 Land in Kenya, especially high potential agricultural land, is an important resource which has political implications underlying its economic use given the country's heavy reliance on agriculture. The extent of the scarcity of productive land is shown by the concerted efforts by the Government to reclaim arid areas for settlement and food production. A corollary of such reclamation efforts is for the preservation and efficient use of already available high potential land through appropriate policies. The increasing shifting of land to rental housing by farmers as an alternative to farming in Nairobi's Peri-urban areas has not been adequately studied. This type of housing development is common in Third World countries where capital for developing expensive and huge residential estates is scarce. This paper is an attempt to provide some insight into the land owners' behavior with regard to his choice between agricultural production and the development of rental housing. The study will help close the existing information gap in this important issue.

CHAPTER 2

LITERATURE REVIEW

Calvin (1976) explains the process through which population growth has shifted away from major urban centres towards rural and small towns. He cites decentralization of manufacturing to rural areas, in order to benefit from underemployed rural labour force, low wages and availability of cheap land. He notes that while there are potential benefits to be gained such as reduction of rural-urban income gaps and substantial reduction in housing costs, the risks involved include loss of farm employment and a shift from farming activities.

The socio-economic problems associated with urbanization in Third World countries are described by Johnson (1970). He criticizes the location of development projects in urban areas without consideration of the total social and economic cost involved:

"An enterprise need not consider as a cost the probability that it may soon contribute to an over-loading of city's housing, its sewage system or its capacity to generate electric power; because cost-benefit analysis has not been employed, the new firms are not asked to bear special responsibility for the rising over-head costs"

(Johnson 1970:157)

These views on urbanization are also highlighted by Hoselitz (1955:280) who refers to urban areas as "generative" or "parasitic" according to whether their impact on economic growth on its wider geographical unit is positive or negative

A more balanced view on the rural-urban interaction is provided by Vink (1955:177). While he agrees on the competitive relationship for land between urbanization, industrial development and agriculture, he contends that the horticultural industry can be stimulated by nearby available markets.

Sinclair (1967) argues that land near cities may be more valuable for its expected increase in price than for its income from agriculture. Webber (1972) attributes low intensity of agricultural production near cities to the fact that farmers have less time in which to pay off long term agricultural investments on the land due to anticipated urbanization.

Gasson (1966) has documented some aspects of interaction between town and country. She highlights the effects of increasing urbanization on farms and those who live and work on them. She argues that "urbanization" affects the rural economy by absorbing agricultural land and farm workers. The different types of economic transformations occurring in the rural economy as a consequence of urban pressures do not indicate competition for agricultural resources, but a merger into a new economic system (Gasson 1966:1)

Conklin (1974) relates the transfer of large amounts of land from agriculture to urban uses to rising population numbers and increases in per capita incomes. Rural land, apart from being used as a hedge against inflation, leads to speculative expectations, as a result of its expected increase in value. This has in turn led to increased uncertainties under which farmers in the urbanizing area must make their decisions.

The conversion of land from agricultural to non-agricultural uses (Snyder 1966) is a normal aspect of economic growth, with specific reference to the State of California in the U.S.A., long considered as endowed with "Limitless land and water resources". However, it has been argued that population pressure coupled with the attendant urbanization, poses a serious problem to the stability of its economically important agricultural sector:

"The particular combination of natural conditions that stimulated a highly specialized agriculture has now attracted and stimulated a rapidly expanding urban population, which has begun to compete with agriculture and frequently to agriculture's disadvantages for use of limited land resources" (Snyder 1966:1306)

The huge amount of land shifting from agriculture to urban uses (Allee:1966), no longer provides satisfactory labour returns, while alternative non-farm uses keep their value well

above zero. Farmers who have quit farming, have done so with very low incomes, including off-farm work, and have frequently lived by liquidating their assets. The low rates of return to agriculture relative to other land use types suggest that these land resources, have better use elsewhere, such as their use for urban investments.

Using critical path analysis, Wright (1966) has studied farmers' reactions towards urban expansion with respect to agriculture in Ontario, Canada. In a sample of 54 farmers surveyed, virtually every farmer expressed uncertainty as to the future of his farm operations within the following few years. These uncertainties were especially evident in farmers' management decisions.

Wright argued that most of the farmers affected by urban expansion, continued to farm because prior to the encroachment of urbanization, they had no option except the farming occupation. Consequently, being rational decision makers, they could not be expected to remain in the industry when better urban investment opportunities arose.

Conflicting land use in urbanizing areas is attributed by Brubaker (1977) to increased competition for land. While pinpointing physical capabilities and economic demand for land as important determinants of land use, he agrees with the proposition that land demands for urbanization will normally outbid all other land uses, especially crop land.

Platte (1980:537) discusses whether a conflict exists between urbanization of agricultural land and future farm land needs in the U.S.A. He estimates the demand for and supply of agricultural output, and uses the output projections to the year 2000 to estimate future farm land needs. He concludes that under high demand for agricultural output, prices of farm products will rise, thereby bringing less productive land into agricultural production. The shift will lead to reduced land productivity and yield and as a result output prices will rise, while costs, due to erosion and environmental degradation, will be increased.

Fischel (1982:249) uses a capital utilization model to raise scepticism against the arguments given by agricultural land preservationists with the help of two propositions:

- 1) The private market will guide conversion of land less suited for crop land if it is in society's interest to do so.
- 2) It may be in society's interest to convert good crop land to alternative uses and induce the farmer to take up alternative land uses even when such land is of low potential .

Yahya (1969) notes that Nairobi has a strong agrarian tradition incorporating part-time farming, scattered houses,

forests and vacant land. He notes that in the Central Province average size of land holdings is about 3.8 acres while in Kiambu District near Nairobi average land holdings is about 2.7 acres. He argues that due to strong urbanization pressures exerted by Nairobi City, agricultural land within the fringes of the City is under great pressure from land speculation for property development. Land use in the Nairobi periphery, according to Yahya, is changing its character:

"Intensive use of agricultural land is necessary in order to tap the urban market which is expanding rapidly as a result of population growth and rising personal incomes. Dairy farming within and [its surrounding areas] is characterized by small herds with high productivity with production of poultry being an important industry"

Yahya (1969:37)

Yahya, however, concedes that the city growth and its attendant demand for land poses a serious threat to agriculture in the periphery areas. Agricultural activities must be highly productive to compete with the alternative land uses.

In his study of the impact of a new road in Kikuyu Division on use of land, Kinyanjui (1976) regards availability of reliable transport services, rising incomes, density of population and family characteristics as some of the factors determining the extent

of influence of a city on its hinterland. He defines the "far fringe" of the City as the farthest area from the city centre where the influence of the city has impact, and where agriculture is still the main activity. Thus Nairobi City's far fringe would incorporate Kikuyu Division, Ngong, Embakasi and Kiambu Town.

While the effect of a single farmer turning his land away from agricultural production would not be felt by the economy, if many small farmers were to do so, the aggregate effects would have significant impact on food production in the area.

According to Kinyanjui, the factors determining the land use include its size, expectations about its future productivity, household incomes and expenditure and the political climate. In other words, the demand for and use of land parcels depends on expectations such as changes in economic conditions, development of roads, trading centres and other areas of economic activity. Kinyanjui ascribes changes in land uses to differences in the present value of future net expected income flows between current owners of the land and potential buyers.

Kinyanjui's supply and demand function for land parcels (1976:81) is based on the following model.

$$P = f(In, Si, D \text{ City}, D \text{ Highway}, Tax \text{ Ow}, Eth, zone, X)$$

Where

P = Per unit value of land Parcel

In = Individual buyer's income expectatoin

S_i = Area of land parcel

$DCity$ = Distance of parcel from urban centre

$DHighway$ = Distance of Parcel from a major road
and accessible routes.

Tax = Property Tax structure e.g Stamp Duty

Dw = Ownership and Tenure System of land.

Eth = Ethnic Variable

$Zone$ = type of Development that has already been effected
within immediate vicinity.
(type of neighbourhood)

X = A vector representative of other characteristics
on land.

Though Kinyanjui notes the fast rate at which agricultural land is being converted to residential use, he does not provide empirical justification of his claims by statistically testing his model. Kinyanjui attributes all land use changes to a change of land ownership because of the differences in future income expectations of the piece of land when the land changes hands. Although the assertion is correct, it however need not always hold true. Autonomous land use changes attributed to a single land owner may significantly influence the economic use of land. Depending on availability of development resources to the land owner, the farmer can venture in different investment projects on his land on the basis of a portfolio selection of assets according to the relative levels of profitability and the degree of farmer's time preference and risk averseness.

Thus individual Kikuyu farmers can allot their land parcels to farm and non-farm investment based on the farmer's assessment of their risks and return potential. In the case of farming vis-a-vis rental housing investment, the farmer assesses the risks and returns likely to be obtained on the background of size of his land parcel, and capital availability for development.

An Overview.

All the studies cited above on the impact of urban growth on periphery agriculture have not given adequate attention to the nature of land management reactions by the landowners, as a result of urban pressures. That is the arguments posed in the various studies do not tackle specific land use changes attributable to individual landowners. Moreover both the studies in Kenya and foreign countries consider change in ownership of the land as a critical factor determining the future use of the land; such a process of urban development may be possible in the developed world. Once agricultural land in the periphery loses its value on account of competition from urban use, it will usually be sold to land developers and the farmers encouraged to take up alternative land in the hinterland. On the other hand selling of land in Kenya is restricted somewhat by the state and through social pressure. Consequently although land use changes can be attributed to differences in income expectation via a change in ownership of the land, the contention is that single owners of the land can diversify the investments on their land by reacting

rationally to market forces; subject to constraints of development resources . The present study thus focusses on the behavioural characteristics of the land owners ,to analyse the underlying forces behind the portfolio balancing between farming and rental housing.

CHAPTER 3.

METHODOLOGY AND HYPOTHESES

Definition of terms used in the study

Opportunity Cost

The opportunity cost of the current use of some good is its worth in some alternative use.

The Net Present Value (N. P. V).

The excess of benefits over costs of a particular investment stream when discounted at an appropriate rate is called the net present value of the project.

Given a stream of net benefits $B_0, B_1, B_2, \dots, B_n$

where the $B_t = 0$, $t = 0, 1, 2, \dots, n$

then the net present value of the stream of benefits is given by :

$$NPV = \sum_{t=0}^n \left(\frac{B_t}{(1+r)^t} \right) \quad \text{where } r \text{ is the rate of discount, and } t \text{ represents the planning horizon of the investor.}$$

Rate of discount

This is the rate by which the present value of benefits accruing from a project in the future can be computed. - For example, a household may have a sum of Kshs 1000 ;if it deposits the money in a bank offering an interest rate of 5% each year,

then after one year, the household will have a total of Kshs1050. Thus from the point of view of the household, a shilling in hand today is worth more than a shilling one year later, since the money at hand today can grow into more money later. Similarly in making decisions about when to spend money or invest resources, people must have a rate of time preference to divide between present and future consumption (Gramlich 89:1981). In our household example, one shilling received 1 year from now is worth 5% less than a shilling received now, so that the present value of Kshs1000 today is Kshs 1000 and, if 5 percent were the proper discount rate, the present value of Kshs 1050 one year from now would also be Kshs1000.

risk factor p.

This represents a measure of probability of "success" of a particular farming activity, and lies between zero and one. i.e $0 < p < 1$

3.2

Farm gross margin analysis has been considerably used by researchers in Kenya; Irea (1979), Kang'e (1981) and Bagazonzya (1983). The above studies used gross margins technique combined with linear programming to estimate optimal combinations of resource utilization for maximum yields to farmers. In this study, gross margins analysis is used

to estimate relative profitabilities for land used in farming or rental housing under given investment conditions.

Let the Gross Margin per farming activity j be represented by

$$GM_j = X_j P_j - U_j \quad [1]$$

Where Gm_j = Gross Margin of Output of activity j

X_j = Physical Output of activity j per acre of land

P_j = Unit Price of farming activity j

U_j = Total Costs of production of j

that is U_j incorporates expenditure on all farm inputs used in production of product j .

For a set of n farming activities carried out in a farm, the total

Gross Margin is given by

$$\sum_{j=1}^n GM_j = \sum_{j=1}^n X_j P_j - \sum_{j=1}^n U_j \quad (2)$$

where $\sum X_j P_j$,

is the current market value of output of the n farm activities in a particular farm.

and $\sum U_j$, is the total costs of production of the farming business.

The present value of the farm business assuming that all land under farming is taken as a single farm business would be equal to the annual net margin (Scott 1976:344) discounted to the present.

The discount rate reflecting the opportunity cost of capital can be taken as the market rate of interest. Another assumption in the farm business regarding the farmers over their future attitude to the business is that they do not expect any change in long-term growth in farm profitability, such as that emanating from greater efficiency and use of new technology.

Thus using a discount rate r , the N.P.V. of the farm business is given by:—

$$z = \sum_{j=1}^{j=m} \frac{U_j}{(1+r)^t}$$

$j = 1, 2, 3 \dots m$ [3]
 are land-use activities.
 $t = 0, 1, 2 \dots n$
 represents the
 farmer's planning horizon

Since the farm business proceeds with a quantifiable element of uncertainty, we introduce a measure of uncertainty p into expression [3]

Thus the expected value of the farm output is given by :

$$E(z) = p(z) \quad [4]$$

Now let the farmer allocate a part of his land towards rental housing. In the valuation and assessment of these houses, the farmer treats them as having finite economic lives. We further assume that the constructed rental units will produce a predictable future flow of income during their life spans. Thus the farmer will

construct rental houses depending on the relationship between the expected investment costs and returns during the economic life time of the houses (Barlowe 1978:185)

thus if we have,

A = Annual Income from rental houses.

B = Initial Construction Costs of the houses.

C = Annual Expenditure on repairs and maintenance of houses.

e = Rate of return on the investment. (Fraser 1984:66)

The Net Present Value of expected future flow from rental houses is given by the expression:-

$$N.P.V = -B + \frac{A-C}{(1+e)} + \dots + \frac{A-C}{(1+e)^n}$$

$$\sum_{t=0}^n \frac{A-C}{(1+e)^t} \quad t=0,1,2,\dots,n$$

[5]

In expression (5) we assume that the annual rental returns and the annual maintenance costs will remain constant. Relaxing the constancy of rental charges and assuming a certain per cent increase(*) in rents related to increased demand for housing, we have:-

$$V = -B + \sum_{t=0}^{t=n} \frac{(A+*1)-C}{(1+e)^t} \quad t = 0, 1, 2, \dots, n$$

[6]

Comparing equations (4) and (5) or (6), we find that the farmer will be willing to allocate his land between the farm business and rental housing investment accordingly as:-

$p(z) > V$ There will be no incentive for the farmer to shift his land from farming.

$p(z) = V$ The farmer is indifferent between farming and rental housing

$p(z) < V$, there are incentives for the farmer to withdraw land from agriculture to rental housing.

For analytical convenience, it is assumed that all the sampled farms constitute a single farm business. The net present value of the expected present cash flows for the farm output and from different types of rental units constructed in the farms are then computed and compared to arrive at decisions from the landowners point of view.

The Model Used

Wiltshaw (1985) explains the concept of supply of land for a particular purpose, using a standard model applied to analyse the supply of labour. He notes that workers weigh the opportunity costs between work and leisure, and such a parallel relationship exists on land allocation by land owners:

"Land owners are assumed to get greatest satisfaction from using their land for some commercial use...and have to be compensated through rent for the loss of direct utility if they are to commit it to commercial use"

(Wiltshaw 1985:50)

Due to the fixed size of aggregate supply of land, its supply curve is consequently vertical (Neutze 1976:379). However as noted by Neutze, the supply of land for a particular activity is normally quite elastic and the land "will be used for that purpose which yields highest rent"

Factors affecting the allocation of land by landowners to rental housing construction.

In this group the factors responsible for the landowners' behaviour to construct rentals on their farms into two categories.

Socio-Economic characteristics of the landowners themselves, such as

- (i) Income from rental houses.
- (ii) Farm output from plot of land.

(iii) Total amount of land owned.

(iv) Household income of the landowner

(v) Availability of water.

(vi) Availability of electricity.

) The Locational-Economic characteristics of the land source, such as :

(i) Distance of farm from highway.

(ii) Distance of farm from shopping centre.

4

Hypotheses.

It is hypothesized that the landowner's decision to construct rentals on farms is influenced by the following factors:

X1 = Annual income from rental houses accruing to landowner

X2 = Annual farm output from the plot of land.

X3 = Total Acreage owned.

X4 = Distance of farm from a highway or access route.

X5 = Distance of farm from shopping centre.

X6 = Household income of the landowner.

X7 = Availability of electricity.

X8 = Availability of water.

Letting Q_s to denote the amount of land allocated to rentals, then;

$$\frac{dQ_s}{dX_1} > 0$$

That is, landowners will be motivated to allocate parts of their land

to rentals if incomes derivable from the houses increase.

$$\frac{dQ_s}{dX_2} < 0$$

Landowners will be unwilling to withdraw land from farming to rentals if farm profits are increasing.

$$\frac{dQ_s}{dX_3} > 0$$

The influence of land size on supply of land for rentals can be either positive or negative. In some cases large size of land may encourage construction of rentals because the owner's can afford to diversify into rentals without serious adverse effects on food production. On the other hand, large size of land may discourage the owners from construction of rentals because profitable commercial farming is feasible.

$$\frac{dQ_s}{dX_4} < 0$$

Landowners will be less motivated to allocate their land parcels to rentals as the distance of the farms from the highways increase; i.e if the farms are inaccessible.

$$\frac{dQ_s}{dX_5} < 0$$

Landowners will be less willing to allocate their land to rentals if the plots are not easily accessible from shopping centres, which

adversely affects tenants willingness to rent such rentals, or makes it difficult to earn high rents from the rentals.

$$\frac{dQ_s}{dX_8} = 0$$

The relationship between income of landowners and the construction of rentals on farms is indeterminate; on one hand better off households may be uninterested in rentals for reasons of privacy and their propensity for "luxury farming". On the other hand since they are more likely to have access to housing development funds and larger land parcels, they can be expected to allocate part of their land resources to rentals if they can bring forth better returns than farming.

Since electricity, and water are represented by dummy Variables, X_7 and X_8 respectively they do not have marginal effects on the supply of land for rentals. Thus we generate the following two hypotheses:

There is a positive relationship between the allocation of land for rentals construction and

- (i) Availability of electricity in the farm. X_7
- (ii) Availability of water in the farm. X_8

3.5 Model Specification

Two model specifications were tested, the additive general linear model and the multiplicative general linear model.

(1) The Additive model

The general multiple linear regression model takes the form

$$Q_s = a_o + a_1 X_1 + a_2 X_2 + \dots + a_n X_n + U$$

[7]

where Q_s is the dependent variable

and $X_1, X_2, X_3, \dots, X_n$ are the independent or explanatory variables.

$a_o, a_1, a_2, \dots, a_n$ are the parameters to be estimated.

U is the random or error term of the model.

Using the model of least squares, the estimated coefficients $\hat{a}_o, \hat{a}_1, \hat{a}_2, \dots, \hat{a}_n$, are minimum variance and unbiased estimators under the following assumptions about the error term u_i (Maddala 1977:75):

- (i) $E(u_i) = 0$ for all i . That is on average, errors committed on different observations cancel out.
- (ii) $V(u_i) = \sigma^2$ This is the constant variance specification assumption
- (iii) $E(u_i) \neq E(u_j)$ That is ,errors on adjacent observations are independent.
- (iv) The explanatory variables are non- stochastic.
- (v) The error terms are independent and normally distributed with a mean of zero and have a constant variance; i.e. $u_i \sim N(0, \sigma^2)$.

The fifth assumption allows us to use the "t" statistic and to test hypotheses about the estimated coefficients.

However if the error term in the model violates some of the assumptions; for instance, the constant variance specification assumption, i.e. $E(u_i) = \sigma^2$, the ordinary least squares estimation technique becomes inappropriate thus requiring the use of maximum likelihood estimation method (Koutsoyiannis 1977:471).

Both the additive and multiplicative models are computationally simple and the only difference in the estimated coefficients by the two processes is in their interpretation. The coefficients of the additive model are marginal effects of the respective

independent variable on the dependent variable, all the other independent variables held constant ; On the other hand the coefficients of the multiplicative model are elasticities. In addition, the multiplicative model collapses if any of the explanatory variables assumes a value of zero. This will be assumed not to happen in our model.

The Multiplicative model

The general form of this model is specified as follows:

$$Q = b_0 X_1^{b_1} X_2^{b_2} X_3^{b_3} \dots X_6^{b_6} \dots X_{10}^{b_{10}} e^U \quad [8]$$

In our model specification of land supply to rental housing, X_7 and X_8

X_9 , are dummy variables. (See section 3.4)

If the model is fitted in the form presented in [1], the estimation procedure collapses, immediately any of the variables takes a value of "0"

Consequently the model has to be specified in the form

$$Q = b_0 X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^{b_7 X_7} e^{b_8 X_8} e^U \quad [9]$$

e = Niparian base having value 2.73

Taking natural logs on both sides of [9] we get

$$\ln Q = \ln b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 X_7 + b_8 X_8 + U$$

Taking the appropriate transformations, that is putting

$$\frac{Q^*}{s} = \ln \frac{Q}{s}$$

$$\frac{b^*}{0} = \ln \frac{b}{0}$$

$$b1X1 = \ln X_1$$

$$b2X2 = \ln X_2$$

$$b3X3 = \ln X_3$$

and so on , we then obtain

$$\frac{Q^*}{s} = \frac{b^*}{0} + \frac{b^*}{1} X_1 + \frac{b^*}{2} X_2 + \frac{b^*}{3} X_3 + \frac{b^*}{4} X_4 + \frac{b^*}{5} X_5 + \frac{b^*}{6} X_6 + \frac{b^*}{7} X_7 + \frac{b^*}{8} X_8 + U^* \quad [10]$$

ordinary least squares (OLS) estimation technique can then be used in estimation of the coefficients of the linear transformation.

The present study estimates the amount of land allocated to rental housing by farmers using both an additive and a multiplicative model, in order to determine the model with the best fit.

3.6

Survey Design and Data Collection

Sample Frame

The sample frame used was the one applied by the Central

Bureau of Statistics (CBS) in its National Sample Survey and Evaluation Programme (NASSEP II 1985/1989). The manual lists rural clusters normally used to interview respondents on household statistics. The use of already designed household listing frame together with cluster maps was of much assistance in locating respondents and their farms.

The three enumeration cluster areas selected were:-

- 1) Gikambura
- 2) Kinoo
- 3) Muguga Jet Scheme

Using the 1979 population census, the sample sizes of the three locations in Kikuyu Division were determined on the basis of weights of the respective population sizes in the three survey areas.

Table 3.1
Population Distribution of Selected Sample Population Areas

<u>Location</u>	<u>Population</u>	<u>Km2</u>	<u>Density</u>
Gikambura	7,853	11	710
Kinoo	5,419	26	788
Muguga Jet Scheme	9,192	23	385
Total	22,464		

Source: Kenya Population Census Report 1979: pp 33

After selection of sample sizes, a random sample was selected for each of the 3 survey areas; using the method of sampling with probabilities proportional to size (SPPS). A sample of 120 farm units was selected - 42 from Gikambura, 30 in Kinoo and 48 from Muguga.

The primary data collection was based on a questionnaire (see

Appendix 1). Interviews were conducted on an already coded questionnaire focusing on the socio-economic characteristics of the landowner, information on land use and farm locational characteristics.

Recall from memory was needed from the landowner regarding building costs and repair expenses incurred. The amount of land allocated towards rental houses also needed to be estimated. An important characteristic observed regarding the sampled farms was the small size of the land parcels as a result of land subdivision. The largest size of the farms visited was 30 acres while the smallest was 0.1 of an acre. Consequently, the most serious problem encountered was in the assessment and estimation of the land allocated to different crops. In most of the farms visited, a mixed system of agricultural cropping system was common including non-farm activities. Maize, a predominant crop under cultivation, was in most cases mixed with beans and potatoes. The procedure adopted to classify different acreages was dividing the area among various crops without exceeding the total area under crop production (Casley; Lury 1981:213).

Collection of data on farm output and input requirements also required a fair amount of memory recall on the part of the respondents. While the questionnaire was designed to take standard units of measurement like a 90 kg. bag for maize, beans and potatoes, most of the respondents in small plots reported small harvests for example "3 debes of beans", "4 debes of maize" or "Cowboy tins of beans". The procedure adopted in the analysis was to value the physical output per crop in Kenya Shillings and then an aggregate value for all the crops. This, however, introduces a weakness in the procedure due to the fact that the value of gross margin

per crop is obscured. Only the total farm gross margin was computed. This also need not constitute a major weakness in the analysis since the objective was to estimate the value of land under different investment choices. Most of the respondents did not report any sales of output.

End Notes

1. See Mishan E.J. Cost Benefit Analysis: An Informal Introduction . London George Allen and Unwin Limited; Ruskin House, Museum Street 1975 [1971] p 65.
2. Commercial banks' lending rates are assumed to be the appropriate discount rate since individual farmers borrow from these banks and generally behave as entrepreneurs interested in maximising profits.

CHAPTER 4.

EMPIRICAL ANALYSIS

Aspects of acquisition and subdivision of farms.

4.1 Statistics on land subdivisions (Table 4.1) show that out of the 120 farmers interviewed, slightly more than 24 per cent of them had never sub-divided their land while the rest had subdivided.

Table 4.1 Subdivision of Farms.

	Percentage
Farmers who have not subdivided their land	24.2
Farmers who have subdivided within last 2 years	10.0
Farmers who subdivided between 3 and 5 years ago	15.0
Farmers who subdivided between 5 and 10 years ago	36.6
Farmers who subdivided over 10 years ago	14.2
	100.0

Table 4.2 Nature of land acquisition

	Percentages
Farmers who have inherited land	58.3
Farmers who have bought land	31.7
Farmers who have both bought and inherited land	10.0
	100.0

Table 4.2 shows that most of the landowners in the study area have acquired their plots through inheritance, while about 52 percent have bought; 10 percent of the respondents had both bought and inherited land.

4.2 Farmers sources and level of income.

Table 4.3 Off-Farm Employment .

Farmers in wage employment		Farmers in Business	
Percentages		Percentages	
Yes	47.5	Yes	54.2
No	52.5	No	45.8
100.0		100.0	

About 48 per cent of the farmers interviewed stated that they were engaged in full-time wage employment while 54 per cent were involved in income generating activities other than farming. Thus farming in Kikuyu Division is part time in nature and is not the sole source of livelihood for about 50 per cent of the land owners. This is confirmed by the monthly incomes of the households shown in Table 4.4

Table 4.4 Household Income Summary Statistics in Kikuyu Division
(Kenya Shillings)

Average	4858.40
Median	2500
Mode	2000
Minimum	100
Maximum	50000

Sample size = 120 households

The monthly household income of the respondents showed high variation, with majority of households having income of 2,000/-. Minimum income recorded was 100/- per month, while the maximum recorded was 50,000 per month. The farmer with the highest income was engaged in horticulture. The major sources of the household income were businesses and wage employment.

4.3 The Nature of farms environment.

Table 4.5 Farm neighbourhood Characteristics

	Proportion (%)
Farms in a total agricultural surrounding	52.5
Farms totally converted to rentals	5.0
Farming mixed with rentals	36.7
Farms in industrial surrounding	5.8
	100

Table 4.5 shows that about 50 per cent of the sampled farms did not have non-farm economic activities and farming is carried out on all farms in the areas ; only five per cent of the plots had all the farms converted fully to rentals. More than one-third of the

farmers are engaged in mixed farming and non farm activities. About 51 per cent of the farms were located around areas with substantial amount of industrial activities. Land located near industrial area has a higher probability of being diverted from farming over time due to the higher returns from industrial activities, relative to farming.

Table 4.6 Provision of amenities in the farms

	Electricity	Piped Water	Telephone
available	43.3	94.2	9.2
not available	56.7	5.8	90.8
	100.0	100.0	100.0

Survey data on amenities (Table 4.6) shows

that 43 per cent of the farms had electricity provided on farm, 5.8 per cent had piped water and 9 percent had telephone facilities.

Table 4.7 Cross-Tabulation of Availability of Water by Construction of Rental units on Farm.

	Water Not Available	Water Available	Row Total
Rental Units in Farm	7 100.0*	72 63.7	79 65.8
Rental Units Constructed	0 0	41 36.3	41 34.2
Column Total	7 5.8	113 94.2	120 100.0

Figures at bottom of all cells are percentages.

As shown in Table 4.7 about 64 per cent of the plots visited which had water facilities had not constructed rental units, compared to 36 per cent of farms which have both water and also constructed rentals in the farms.

Table 4.8 Cross-Tabulation of Availability of Electricity by Construction of Rental Units on Farm

	Electricity Not Available	Electricity Available	Row Total
No Rental Units in Farm	60 88.2	19 36.5	79 65.8
Rental Units Constructed	8 11.8	33 63.5	41 34.2

Table 4.8 shows that about 64 per cent of farms with electricity had rental units against 12 per cent of the plots without electricity which have constructed rental units.

Similar cross tabulation of availability of telephone facilities and rental units (see Table 4.9) was performed.

Table 4.9 Cross Tabulation of Construction of rental units in the farms by availability of telephone services

	Telephone Not Available	Telephone Available	Row Total
No Rental Units in Farm	72 66.7	7 58.3	79 65.8
Rental Units Constructed	36 33.3	5 41.7	41 34.2
Column Total	108 90.0	12 10.0	120 100.0

Footnote : Figures at the bottom of the cells are percentages.

Table 4.9 shows that only 10% of the farms in the study area have access to telephone facilities. Similarly about 42% of the farms with rentals reported as having telephone services.

4.5 Competing Uses of the Land Resource.

Table 4.10 Comparing Land Use Between Main Economic Activities

	<u>Acres</u>	<u>Proportion</u>
Total Crop Land	214.9	61.3
Livestock Farming	112.7	32.2
Rental Allocation	22.8	6.5
	350.4	100

Despite the strong urbanising trends in Kikuyu Division, data drawn from the sample indicates that 61 per cent of the land is still held under crop production, and another 32 per cent is allocated towards livestock farming. However, total land acreage under rental housing is expected to increase due to the increasing demand for housing in Nairobi. On account of the small sizes of the land units and low farm-output potential households, with increasing development land-owners will find it profitable to allocate more of their land to rentals.

Table 4.11

Average Land acreage under Various
Economic Activities Per Farm.

	Average Size of Farm (Acres)
Size of land Holding	3.2270
Crop Land under:	
Maize	0.665
Beans	0.455
Potatoes	0.3921
Livestock	0.939
Vegetables	0.1875
Tomatoes	0.06
Land area under Rentals	0.1875

Table 4.11 shows the land area under various agricultural and non-farm economic activities from sampled farms in Kikuyu Division. Livestock farming had, on average, 0.9 acres of land allocated to it per farmer, followed by maize and beans with 0.7 and 0.45 acres respectively. Both rental housing and vegetable crop acreages were about 0.2 acres on the average, while tomatoes occupied a mere 0.1 acres.

Farmers Investment Priorities.

Table 4.12 shows farmer's ranking of investment priorities such as crop farming, poultry, dairy and rental housing, taking into account their respective risk and return potential.

Table 4.12 Summary of farmer's preferred investment choices
(proportions)

	Crop farming	Poultry farming	Rental housing	Dairy farming
First choice	18.8	3.4	41.0	36.4
Second "	39.3	20.5	6.0	37.2
Third "	27.4	34.2	17.9	19.5
Fourth "	14.5	41.9	36.0	8.5
	100.0	100.0	100.0	100.0

The data show that rental housing had the largest percentage of farmers (41%) who ranked it first followed by dairy, crop and poultry farming respectively.

characteristics of farming as a business

4.7 Data on average farm output obtained during the survey (Table 4.13) shows that average annual output obtained was Kshs 8300 with a median farm annual income of Kshs 2550. Thus a considerable proportion of respondents reported that they do not sell their output for cash income; slightly more than 50 per cent of the farmers were selling their maize produce, 40 per cent beans, 44 percent sold potatoes, 54 per cent sold vegetables and 68 per cent sold milk. That is, about 50 per cent of the farmers sell their produce and use the rest for household consumption.

Table 4.13 Summary statistics on farm production and sales

Percentage of Farms selling Crops						
	Farm Income (Kshs)	Maize	Beans	Potatos	Vegetable	Milk
Sample Size	120	50.8	42.5	44.2	54.2	68.3
Average	8300.03	1464.28	123.06	1584.81	11808.2	9049.83
Median	2550	700	0	800	0	6030
Maximum	320,000	9,600	33,750	8,750	280,000	48,000

The costs of inputs in the farming business is represented in Table 4.14

Table 4.14 Farm Input Costs (in Kenya Shillings)

	Fertilizer	Manure	Pesticides	Labour Costs
Sample Size	120	120	120	120
Average	109.3	416.5	121.7	3666.84
Minimum	40.00	90.00	0	950.00
	292.275	1998.3	409.451	7.9x10 ⁻⁴
Maximum	2500.00	20000.00	3000.00	50428
Mean	2500	20000	3000.00	50428

average farmer in Kikuyu Division uses more manure in monetary terms than fertilizer. Pesticides are used in moderation but an important feature is the reported costs of hired labour. The average labour costs reported was Kshs 3,689, per farm.

4.8 Characteristics of rental housing investment.

Table 4.15, 4.16, 4.17 and 4.18 illustrate the distribution of rents and the earning potential of these houses. For a total of 138 units of wooden buildings constructed inside a total area of 3.7 acres, the average monthly rent collection per unit was Kshs 130.72 with each unit occupying 0.03 acres.

Table 4.15 Monthly Rents from Wooden Rentals.

Serial Number	Rent(Shs) Collected	Number of units in the plot	Size of the plot
1	75	2	0.5
2	80	10	0.4
3	90	4	0.5
4	90	24	0.5
5	150	15	0.5
6	200	40	0.5
7	90	4	0.1
8	90	16	0.3
9	80	10	0.2
10	80	14	0.1
11	75	8	0.1
18,040			3.7

Mean monthly rent collected from wooden rentals =130.72

Table 4.16 Monthly Rents for iron sheet walled building.

Observation	Rent per Unit	Number of Units	Acreage
1	200	20	0.4
2	160	6	0.5
3	185	40	2.0
4	150	10	1.0
5	200	20	1.0
6	90	30	1.0
7	180	10	0.5
8	150	10	0.5
9	180	25	1.0
10	240	10	1.0
11	180	2	0.4
12	150	10	0.5
13	245	4	0.6
14	195	10	0.3
15	180	20	0.5
16	185	10	0.4
17	90	10	0.3
18	150	10	0.5
19	200	1	0.1
20	120	4	0.2
21	150	6	0.2
22	200	10	0.2
23	130	10	0.3
	48280	298	13.4

Table 4.16 shows that for a total of 298 iron sheet walled rentals constructed in the farms for rental purposes, the average monthly rents collected per unit was 162 shillings. Average space per unit was computed as 0.04 of an acre.

Table 4.17 Monthly Rents for stone walled buildings

Observation Number	Rent/Unit	Number of Units	Acreage
1	360	10	1.0
2	240	10	0.5
3	300	70	1.5
4	300	10	0.5
5	225	20	1.0
6	225	10	0.4
7	300	10	0.5
	39,746	140	5.4

Monthly average rents collected from a single stone walled walled rental =283.90 shillings.

The data on economic use of land allocated to stone walled rentals (Table 4.17) with iron roofing indicated an average monthly rent of 283.90 shillings with each unit occupying a space of 0.04 acres. On the other hand, complete modern bungalows had monthly returns of Kshs777.30 (Table4.18) and occupied an average of 0.27 acres per unit.

Table 4.18 Monthly rents from bungalows constructed inside farm.

Observation Number	Rent	Number of Units	Acreage
1	750	2	1.0
2	800	2	0.25
3	600	1	0.6
4	750	3	0.5
5	800	2	0.4
6	1000	1	0.2
	8550.30	11	2.95

Chapter 5

ANALYSIS AND FINDINGS

5.1

The present value of the business- farm, assuming that all land under farming in the selected sample can be taken as a single business is equal to the annual net margin viewed as the surplus obtainable indefinitely divided by an appropriate discount rate (Scott 1976:344). A range of discount rates, (ten , fifteen, and twenty per cent) were used to discount the farmers' future earnings, assuming that they do not expect any long term changes in profitability, such as those likely from efficient use of available inputs, adverse weather or the application of new technology. A factor for risk and uncertainty (p) was introduced in the valuation of farm output since the farm business is assumed to operate under uncertainty. For the purpose of comparison with rental housing investment, farm earnings were discounted for a period of 5 years, assuming that the life period of a building constructed with wooden walls is about 5 years¹ (Scott1976 :190).

5.2

Valuation of Farm Investments.

The annual output per acre accruing to farmers from their farm business (see Appendix2) was obtained as 3724.88 shillings.

Table 5.1 presents data on valuation of farm output using a range of discount rates and an uncertainty factor p.

Table 5.1 Valuation of Farm output (Per Acre)
Kenya shillings.

	Annual farm output	Discount rates		
		10%	15%	20%
$E(z)$ =pz p=1	3724.85	15,530.01	14,354.57	13,364.87
$E(z)$ =pz p= 0.5	1862.42	7765	7177.28	6682.43

Similar valuations were done for the different types of rental house constructed (see Appendices 3 to 6). These results are summarized in Table 5.2

Table 5.2 Per Acre Valuation of rental houses

(Kenya shillings)

Discount Rate Rental Type \	Annual rental income	10% Discount Rate	15% Discount Rate	20% Discount Rate
Iron Sheet walled rentals	40,211.30	-14,331.43	-26,973.89	-37,698.25
Stone walled rentals	87,032.70	51,202.73	23,735.21	610.62
Wooden rentals	83,203.70	198,873.41	172,714.17	150,507.10
Mungalows	28,313.08	-322,131.76	-331,067.37	-338,590.15

Tables 5.1 and 5.2 present details of the investment alternative potential of land owners in Kikuyu Division, over a range of discount factors. Returns from annual farm output per acre are lower than returns per acre of land from all types of rentals. Farm returns are on average 6.24 percent of the rental earnings, assuming that the farm business operates under certainty ($p=1$). When the probability of success of farming consequently drops to 50 per cent, the farm returns fall to about 3.1 percent of the earnings from rentals.

Table 5.2, shows that the best investment decision of the landowners will be construction of stone-walled rentals and wooden rentals since they have positive net present values. Construction of iron sheet rentals has positive values when undiscounted but becomes negative, when discounted. Similarly construction of bungalows is associated with negative net present values at all discount rates.

5 Regression analysis.

Two models were estimated for the supply of land towards rental housing using the Ordinary Least Squares (OLS) and the Statgraphic computer package.

- 1) An additive model
- 2) A multiplicative model.

The additive model model form estimated was specified as follows:

$$Q_s = a_0 + a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 + a_5 X_5 + a_6 X_6 + a_7 X_7 + a_8 X_8 + U$$

- Where x_1 = Annual Rental Income
 x_2 = Annual Farm Output
 x_3 = Total Acreage owned by farmer
 x_4 = Distance of Farm from highway
 x_5 = Distance of Farm from shopping centre
 x_6 = Household Income (monthly)
 x_7 = Availability of Electricity
 x_8 = Availability in farm of water
 U = Error term

The linearised form of the multiplicative model estimated was of the form ,

$$\ln Q = \ln b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 X_7 + b_8 X_8 + U$$

$\ln$ = the natural logarithms to base e

5.4

Model Fitting Results

The Additive model.

Dependent variable = rental acreage allocation

Independent variable	Coefficient	"t" Value
Annual Rental Income	8.09×10^{-6}	12.2109
Annual Farm Output	6.49×10^{-7}	1.0951
Total Acreage	0.011	2.5694
Distance of Farm from Highway	-1.3×10^{-4}	-2.0943
Distance from shopping centre	-5.7×10^{-6}	-.8246
H/H income	-5.13×10^{-6}	-1.5424
Electricity	0.1206	2.7154
Water	-0.01	-.1315

R^2 (adjusted) = 0.7095

Number of observation fitted = 119

Degrees of freedom = 111

The Log-linear model.

Dependent variable = log rental acreage allocation

Independent variable	Coefficient	" t" value
	-2	
log(annual rental income)	7.4×10^{-2}	7.7614
	-2	
log(annual farm output)	6.9×10^{-2}	2.9703
	-2	
log(total acreage)	-1.99×10^{-2}	-1.0565
	-1	
log(Distance of farm from highway)	-2.5×10^{-1}	-1.9723
	-1	
log(Distance of farm from shopping centre)	3.01×10^{-1}	2.0998
	-2	
log(Household income)	2.28×10^{-2}	-0.2404
	-1	
Electricity	-3.02×10^{-1}	-1.4635
	-2	
Water	-7.7×10^{-2}	-2.3 $\times 10^{-1}$

2

R (adjusted) = 0.6184

Number of observations fitted = 119

d.f = 111

Comparision of regression results of the two models fitted.

Both the Linear and log-linearised models fitted came out with high coefficients of determination, adjusted for degrees of freedom (d.f.) (i.e. 70.9 and 61.8 percent respectively). The linear model gives a slightly better fit than the multiplicative version. Thus the additive model's results are analysed hereafter.

Interpretation of Regression Model

5.4.1

Annual Rental Income

The expected sign (+ve) was obtained, implying that increases in rental incomes lead to more land being allocated to rentals by the land owners. However the value of the coefficient (8.09×10^{-6}) is very small. The very high value of computed t statistic (12.2109) leads to the rejection of the null hypothesis, at the 5 per cent level of significance, that increases in rental income have no influence on withdrawal of land from farms. Thus more farmland will be allocated to construction of rentals to increases in rental income. It can be said that if rental incomes increase by 1 million shillings annually, an extra 8.09 acres of land will be allocated towards rentals construction per annum. That is the per acre increase in annual rents required to bring forth an extra acre of land to rentals construction is 123,609.39 shillings. Cash flows accruing to the owners of the rentals (see appendices 3 to 6) are summarised below.

- (1) Wooden annual net (undiscounted) rent per acre = 88,333.33 shillings.
- (2) Iron sheets annual (undiscounted) rent per acre = 43,232.24
- (3) Stone walled annual (undiscounted) rent per acre = 91,435.55
- (4) Bungalows annual (undiscounted)
rents per acre = 34,780.90 shillings.

The initial construction costs for the four respective types of buildings constitute roughly 73 per cent, 328 per cent,

246 per cent and 1180 per cent of the annual rents collected respectively for the different types of houses. The initial construction costs of the rentals is more than 4 times the average annual rental incomes. This means that as long as construction costs of the rentals remain high, the tendency to construct rentals in the farms will be checked. However, since rental charges cannot remain constant for long, as long as demand for housing increases it can be inferred that any land available will be allocated to construction of rentals since it is capable of bringing 123,609.39 shillings per acre annually.

5.4.2

Effect of Annual Farm Output

An unexpected (+ve sign) was obtained and with very small coefficient (-7×10^{-6}). The t value obtained was 1.0951, and the null hypothesis that farm output does not influence the supply of land for rentals cannot be rejected at the 5 per cent level of significance. This is partly explained by the levels of farm subdivision and the fact that the majority of the farmers do not have significant output from their farms. This has tended to marginalise farming with the land being put into other more profitable uses. Similarly, much of the farming is for subsistence. A wise selection of profitable crops will increase the range of farm investment priorities if landowners are provided with the appropriate incentive and marketing packages.

5.4.6

Farms Distance from Shopping Centre

The expected sign (-ve) was obtained showing that increasing distance of farms from shopping centres have decreasing effects of construction of rental houses; however, the effect is not as high as that of the distance from the highway. There is hence no sufficient evidence to accept the alternative hypothesis that distance from shopping centres affects significantly the conversion of agricultural land to rentals.

5.4.7

Effect of Household income

As household income increases the construction of rental houses decreases as shown by the negative sign of the coefficient. This empirical finding is contrary to our prior beliefs that household income has positive effect. The difficulty may be as a result of the data limitations.

Further cross tabulation of construction of rental houses by household incomes, was performed.

Table 5.3 Cross tabulation of rental construction by house-hold income

Income Groups	Sample size	Proportion with rentals	Sample size	Proportion without rentals
1001 - 3000	15	37.8	29	73.5
3001 - 7000	19	45.9	36	14.4
7001 - 10,000	1	2.8	2	4.8
> 10,000	6	13.5	12	7.3
	41	100.0	79	100.0

Table 5.3 shows that households in the income bracket (3001-7000) shillings had the highest percentage of rental units on farms (46%), followed by the low income groups (1001-3000) with 38 per cent of the rentals on farms. On the other hand, low income groups constitute the large percentage of people without rentals on their farms (73.5%). The results shows that perhaps, the low income people are unable to raise adequate funds for rentals construction.

5.4.9 Effect of Electricity on Construction of Rental Units

The sign obtained was as hypothesised (positive) implying an important tendency for availability of electricity to influence the construction of rentals on farm. The coefficient obtained was significant at the five per cent level. Thus the government can influence construction of rentals in the farms by spreading the electricity network in the area.

5.5.1 Effect of water on allocation of land towards rental housing

The sign of the coefficient obtained was negative, contrary to what was expected. This is probably a result of data weakness. Our prior beliefs were that the availability of water in the farms would make these farms more attractive for the construction of rentals.

End Notes

1 A study conducted by Scott et. al (1976) in Mathare Valley on evaluation of accounting prices for urban housing assigned a life span of two years to mud walled houses, and five years to tin roofed wooden houses; for details see Scott, M.F.G., Mac Arthur, J.d., Newbery, D.M.G., Project Appraisal In Practice, Heinemann Educational Books, London, 1976.

CHAPTER 6

Summary and Recommendations.

This study has demonstrated that the largest proportion of land in the survey area is still held under farming with 61 percent of the land being under crop production, 32 percent under livestock and slightly more than 6 percent under rental housing.

Land owners who are farmers were found to be practicing subsistence farming with no substantive commercial farming. The range of land size of the individual plots included in the sample was between 0.1 of an acre to thirty acres, with the median size being 0.5 of an acre. This small size of land indicates the rapid subdivision of farms which is taking place in the area, due to the encroaching urbanization. Subdivision of land plots for construction of rental units or for other purposes is rapidly making farming more or less a non-profitable economic activity.

About 47 percent of the farmers interviewed were engaged in full-time wage employment, while 54 percent were involved in other non-farm occupations, suggesting that about 50 percent of the Kikuyu Division land owners are part-time farmers who do not depend solely on farming as a source of income. The annual gross returns from an acre of land under the farm business was about Kshs 3724.83, a mere 6.2 percent of the earnings obtainable from an investment in rental houses on land of similar size. Due to heavy demand for housing from workers in Nairobi, rental incomes are expected to grow even more in future.

and lead to more land being converted from farming to rental residential units. Thus if the farmers have enough money to invest (housing investment entails fairly heavy financial outlays) most of available land previously under farming may be converted to rental housing. Although the discounted cash flows for an investment in bungalows indicate a significant element of investment risk by the landowners (it was shown that the construction costs of bungalows are roughly twelve times the annual rent paid for them) their potential for attracting middle and high income tenants should in the long run make them viable income generating projects.

The availability of electricity in the farms confirmed the a priori belief that its installation on farm serves as an incentive to construct rental units in the farms. The probability of land being converted to rentals decreases as distance from the roads increases. This is, however, expected to remain the case only in the short run. The increasing demand for rentals, coupled with pressures to improve road network in the area are expected to change this.

Recommended policy action.

(i)

A recommended policy action is to integrate the already changing areas with the City's housing development strategy to ensure that housing development is done in an orderly way to avoid development of sub-standard housing or slum areas. The central government must also recognise the role the peri-urban areas are playing in the alleviation of housing shortage in Nairobi and provide support services to help these areas play this role more

effectively. These support services include improvement in the road network, electrification, water supplies and other infrastructure including schools and hospitals.

The study has shown that the crops grown in the region are for subsistence and clearly unable to withstand urbanization pressures, due to their low profitability. If farming is going to remain an important activity in the area in the future, there is an urgent need to introduce farming activities which are both profitable and land using. For instance, farmers should be encouraged to go into the poultry industry, rearing pigs zero-grazing and horticultural crops.

(iii)

The survey revealed that farm produce is sold by about 50 percent of the landowners. The problems in commercial agriculture are obviously linked with the product mix of the farms which have been shown to be largely for subsistence. The marketing policy needed to assist the farmers to sell their surplus production should be integrated with an overhaul of the farm product mix towards more land using technologies. That is, emphasis on the agricultural programme of the area should be on marketable crops such as cut flowers, and french beans; and other products which are in high demand from Nairobi. The Kikuyu Division farmers can take advantage of their proximity to Nairobi by supplying those commodities in high demand from the urban population.

(iii) Housing development in peri-urban areas

Development of better rental units is to some extent constrained by lack of adequate financial resources for the land owners. Thus, one area in which the government can assist in the development process taking place in the area is to encourage existing or new housing finance corporations to assist by providing credit and mortgage facilities using the houses as security for the loans. Alternatively, the farmers should organise themselves into housing development co-operative groups to raise the required financial resources.

The economic change occurring in Kikuyu Division, whereby a multitude of interactions among several factors is leading to the marginalisation of agriculture as a form of land use may also be taking place in other areas in the country. There is therefore need to monitor the forces that are the cause of such changes to enable the government to draw up a policy which is able to anticipate and accommodate the impact of rapidly urbanizing areas.

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Appendix 1
QUESTIONNAIRE

Date of interview

1) Respondent Number

2) Location of Farm

3) Total acreage of Farm

4) Level of Education of Farmer

1 = Primary Level

2 = Secondary Level

3 = University/College

5) What is your age (years) ?

6) Marital Status:

1 = Single

2 = Married

3 = Divorced

4 = Widowed

5 = Other (Specify

7) What is the size of your household ?

8) How did you acquire the present parcel of Land?

1= Inherited from parents

2= Bought

3= Both (1) and (2)

4= Other (specify)

9) If the land was bought state the year of purchase -----

10) How much of the land did you buy? Acres -----

11) How much did you pay for this land? ksh. -----

12) Do you have any other parcel of land
in this area apart from this one?

1 = Yes

2 = No

13) If yes what type of economic activity
is carried out there?

1 = Farming

2 = Rental Housing

3 = Other (specify)

14) When did you last subdivide your land?

1 = Within the last 2 years

2 = Between 3 and 5 years ago

3 = Between 5 and 10 years ago

4 = Over 10 years ago

0 = Not subdivided

15) Apart from income from your farm do you
get cash income from the following sources?

a) Wage employment 1 = Yes 0 = No

b) Business enterprise 1 = Yes 0 = No

c) Other (Please specify) 1 = Yes 0 = No

16) FARM CHARACTERISTICS

Distance of the farm from Highway

1 = Less than 100 metres

2 = 101 < 200 metres

3 = 201 < 300 metres

4 = 301 < 400 metres

5 = 500 < 1000 metres

6 = > 1000 metres

17) Distance of Farm from shopping centre

1 = less than 100 metres

2 = 101 < 200 metres

3 = 201 < 300 metres

4 = 301 < 400 metres

5 = 401 > 1000 metres

6 = > 1000 metres

18) Type of farm neighbourhood

1 = All Agricultural farms

2 = All farms converted to rental house

3 = Farming mixed with rentals

4 = Farm in an industrial/commercial surrounding

19) Availability in the Farm of

1) Water 1 = Yes 0 = No

2) Electricity 1 = Yes 0 = No

3) Telephone 1 = Yes 0 = No

What amount of land is allocated
between the following activities?

i) Crop land	acres	----- -----
ii) Livestock grazing	"	----- -----
iii) Rental housing	"	----- -----
iv) Other (please specify)	"	----- -----

Do you have rental units in this farm?

1 = Yes

0 = No

	Number	Rent/Unit/Month
If yes what type of		
rental units?	----- -----	----- -----
1 = Row of Wooden/mud		
housing	----- -----	----- -----
2 = Row of stone walled		
building	----- -----	----- -----
3 = Row of iron sheet		
walled building	----- -----	----- -----
4 = Modern stone bungalow	----- -----	----- -----

When did you first construct these rental houses?

1 = Within the last 5 years

- 2 = Between 5 and 10 years ago
- 3 = Between 10 and 20 years ago
- 4 = > 20 years ago

How did you acquire money to construct these rental houses?

- | | | |
|---|----------------|-----|
| i) Obtained loan with land as security | 1 = Yes 0 = No | --- |
| ii) Sold off part of the land | 1 = Yes 0 = No | --- |
| iii) Obtained loan without land as security | 1 = Yes 0 = No | --- |
| iv) Farm income accumulation | 1 = Yes 0 = No | --- |
| v) Obtained funds from N.H.C. | 1 = Yes 0 = No | --- |
| vi) Obtained loan from insurance companies | 1 = Yes 0 = No | --- |
| vii) Other (please specify) | 1 = Yes 0 = No | --- |

How much did it cost you to put up these rental unit(s)?

----- Ksh.

How much did you spend annually on repairs and maintenance

----- Ksh.

Where do your tenants work?

a) Nairobi ----- Nos.

- | | | |
|-----------------------------------|-------|---|
| b) Factories in the neighbourhood | ----- | " |
| | ----- | |
| c) Government workers in the area | ----- | " |
| | ----- | |
| d) Farm workers | ----- | " |
| | ----- | |
| e) Jua Kali artisan | ----- | " |
| | ----- | |
| f) Other (specify) | ----- | " |
| | ----- | |

QUESTIONS ON FARM CHARACTERISTICS

What is the allocation of land between the following activities in your farm?

- | | | |
|----------------------|-------|-------|
| a) Maize crop | ----- | Acres |
| | ----- | |
| b) Beans - | ----- | " |
| | ----- | |
| c) Potatoes | ----- | " |
| | ----- | |
| d) Livestock Farming | ----- | " |
| | ----- | |
| e) Green Vegetables | ----- | " |
| | ----- | |
| f) Tomatoes | ----- | |
| | ----- | |
| g) Coffee | ----- | " |
| | ----- | |
| h) Tea | ----- | " |
| | ----- | |
| i) Other (specify) | ----- | " |
| | ----- | |

How much of the following crops did you harvest in the last season?

- | | | |
|---------------------|----------------|---------------|
| a) Maize | -----
----- | 90 kg. bags |
| b) Beans | -----
----- | " |
| c) Potatoes | -----
----- | " |
| d) Tomatoes | -----
----- | 80 kg boxes |
| e) Green Vegetables | -----
----- | 90 kg. Bags |
| f) Coffee | -----
----- | 90 kg. Bags |
| g) Tea | -----
----- | 90 kg. Bags |
| h) Other | -----
----- | Specify units |

How long do the following crops take in the field before they are harvested (in months)

- | | |
|---------------------|------------|
| a) Maize | ---
--- |
| b) Beans | ---
--- |
| c) Potatoes | ---
--- |
| d) Tomatoes | ---
--- |
| e) Green Vegetables | ---
--- |
| f) Coffee | ---
--- |
| g) Tea | ---
--- |

h) Other

31) How much of the following inputs did you use last year?

Specify units cost per unit (Ksh)

Fertilizer

Manure

Pesticides

32) Do you use hired labour in your farm?

1 = Yes 0 = No

33) If yes,

a) How many workers

b) What was the total cost of labour
last season?

34) Where do you market the following produce once harvested?

	Destination:	Transport Cost/Unit	Selling Price per unit per unit	Ksh. Total
Maize				
Beans				
Potatoes				
G/Vegetable				
Coffee				
Tea				
Milk				

35) Rank the following activities in their order of profitability:

	Ranks
Crop Farming	----
Rental Housing	----
Dairy Farming	----
Poultry Farming	----

36) What is your households monthly income?

Appendix 2

Valuation of Farm Output

Total acreage under crop farming	=	214.95 acres
Total Annual Output from crops	=	9,96005.00 Kshs.
Annual milk sales	=	7,42086.00 Kshs.
Total farm output	=	17,38091.00 Kshs.
Hence output per acre	=	4,635.60 Kshs.
Total labour costs (Annual)	=	4,400.21
Fertilizer costs	=	13,212.00
Pestsides	=	14,509.00
Manure	=	49,985.00
Total inputs	=	517,636.00
Per acre costs	=	1,579.84

Hence, the annual surplus per acre accruing to farmers from farming:-

$$= 4633.60 - 1579.84 = 3724.88 \text{ Kshs.}$$

Assuming a 15 per cent discount rate for a period of 5 years

(Equivalent to the life span of wooden buildings).

$$\begin{aligned}
 & \sum_{i=0}^4 \frac{3724.88}{(1+0.15)^i} \\
 &= 3724.88 + \frac{3724.88}{(1+0.15)} + \frac{3724.88}{(1+0.15)^2} + \frac{3724.88}{(1+0.15)^3} + \frac{3724.88}{(1+0.15)^4} \\
 &= 14,356.80
 \end{aligned}$$

i.e. That is the per acre present value of expected annual flow of income from farming over a period of 5 years discounted at a rate of 15 per cent per annum.

= 14,356.80

Appendix 3

Valuation of wooden/Houses

Total acreage in the sample under wooden houses = 5.4 acres

Total construction costs	=	350,050 Kshs.
Annual Repairs	=	27,700.00
Annual Rental income	=	477,000.00

Letting the economic life of the wooden buildings to be 5 years and earnings to be discounted at 15 per cent we have the following cash flow:-

	Years				
	0	1	2	3	4
Total costs	- 350,050				
Annual Repairs		-27,700	-27,700	-27,700	-27,700
Annual Rental Income		477,000	477,000	477,000	477,000
Net Cash flow	- 350,050	449,300	449,300	449,300	449,300

Net per acre cash flow

$$= - 64,824.07 + 83,203.70 + 83,203.70 + 83,203.70 + 83,203.70$$
$$= 26799.74$$

$$N.P.V. = C_0 + \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \frac{C}{(1+r)^4}$$
$$= -64824.07 + \frac{83,203.7}{(1.15)} + \frac{83,203.7}{(1.15)^2} + \frac{83,203.7}{(1.15)^3} + \frac{83,203.7}{(1.15)^4}$$
$$= -64824.07 + 83203.7[0.8696 + 0.7561 + 0.66575 + 0.5717]$$

= 172,714.17 shillings

i.e. The per acre Net Present value of an investment in wooden rental houses discounted at a rate of 15 per cent over a period of 5 years is 172,714.17 shillings.

Appendix 4

Valuation of Iron sheet walled buildings

Total acreage allocated to iron sheet rentals in sample = 13.4

Total construction costs = 1,899,760 Kshs.

Total Annual Repairs = 40,480 Kshs.

Annual Rental income = 579,312 Kshs.

	Years				
Cash flow	0	1	2	3	4
Total costs	- 1,899,760				
Annual Repairs	-40,480	-4,4800	-40.480	-40.480	
Annual Rental Income	579,312	579,312	579,312	579,312	
Net Cash flow	- 1,899,760	+538,832	+ 538,832	+ 538,832	+538,832

Per acre Net Cash flow

$$= -141,773.13 + 40,211.3 + 40,211.3 + 40,211.3 + 40,211.3$$

$$= 19,072.24 \text{ shillings}$$

Therefore, Discount cash flow at 15 per cent over a period of years is:-

$$\begin{aligned} \text{I.P.V.} &= C_0 + \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \frac{C}{(1+r)^4} \\ &= -141,773.13 + \frac{40,211.3}{1.15} + \frac{40,211.3}{(1.15)^2} + \frac{40,211.3}{(1.15)^3} \\ &\quad + \frac{40,211.3}{(1.15)^4} \\ &= -26.973.89 \end{aligned}$$

Appendix 6

Valuation of stone walled buildings

Total acreage allocated to stone walled buildings	= 5.4
Total construction costs	= 1,213,
Total Annual Repairs	= 23,
Annual Rental income	= 493,

	Years				
Cash flow	0	1	2	3	4
Total construction Costs	-1,213,000				
Annual Repairs		-23,775	-23,775	-23,775	-23,775
Annual Rental Income		493,752	493,752	493,752	493,752
Net Cash flow	- 1,213,000	+469,799	+ 469,977	+ 469,977	+469,977
Per acre cash flow	=- 224630	+ 87,032.70	+87,032.70	+87,032.70	
		+ 87,032.70	-		
		= 123,501.10	shillings		

And similarly, discounting the per acre cash flow at 15 per cent for 5 years, we get the Per acre Net Present Value of income derived from stone walled buildings as:-

23,839.65 shillings.

Appendix 6

Valuation of Bungalows constructed in farms as income generating projects via their rent earning potential.

Total acreage allocated	=	2.95 acres
Total construction costs	=	1.215,000 Kshs.
Total Annual Repairs	=	19,080 Kshs.
Annual Rental income	=	102,603.60

		Years			
Cash flow	0	1	2	3	
Total construction Costs	-1,215,000				
Annual Repairs		-19,080	-19,080	-19,080	-19,080
Annual Rental Income		102,603.60	102,603.60	102,603.60	102,603.60
Net Cash flow					
	-1,215,000	+83,523.60	+83,523.60	+83,523.60	+83,523.60
Per Acre Cash flow	= - 411,864.40	+28,313.08	+28,313.08	+28,313.08	+28,313.08
		+28,313.08	= - 298,612.00		

Net present value of expected future earnings from construction of bungalow over a period of 5 years at 15 per cent discount rate is:-

$$= 411,86.40 + 28,313.08 \times 2.8549 = - 331,033.40 \text{ shillings}$$