ESTIMATION OF THE SOCIAL PRICE OF INVESTMENT AND THE SHADOW WAGE RATE OF UNSKILLED LABOUR FOR THE KENYAN ECONOMY.

by

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A thesis submitted in fulfillment for the Degree of Master of Arts in Economics in the University of Nairobi.

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

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This thesis has been submitted for examination with our approval as University Supervisors.

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ABSTRACT

The topic of this thesis is "ESTIMATION OF THE SOCIAL PRICE OF INVESTMENT AND THE SHADOW WAGE RATE OF UNSKILLED LABOUR FOR THE KENYAN ECONOMY". Thus the main objective was to estimate the social price of investment, consumption discount rate and the shadow wage rate of unskilled labour for the Kenyan economy.

The scarcity of resources requires that the available one be used as efficiently as possible. This efficiency could partly be enhanced by using social cost-benefit analysis to distribute limited resources among competing uses. To undertake social cost-benefit analysis there is a need to obtain social prices which are not available for the Kenyan economy. This thesis is then intended to partly provide the required social prices.

In trying to determine these prices the approach has been to take the state of the economy as we find it rather than to assume conditions of optimality. As a result we identify separate social prices for investment and for the rate of discount of consumption, rather

than making the conventional 'optimality' assumption of equality between them. The guiding principle has been to define these prices in terms of opportunity cost.

It was found impossible to estimate the consumption discount rates directly so indirect methods were used /based on market interest rates and estimates of the marginal productivity of capital. As regards the social price of investment, this is derived as a function of consumption discount rate, the marginal propensity to save and the social price of investment.

The crucial variables in this analysis are the marginal productivity of capital, the marginal propensity to save, the market wage rate, interest rates and productivity of labour. From this one can observe the need for data on these variables.

Due to data and other limitations we were unable to determine a unique value for the consumption discount rate, providing instead a range of values, namely 10, 15 and 20 per cent per annum. This also made

it necessary to estimate three values for the social price of investment and the shadow wage rate. Our estimates for the social price of investment are 5.25, 2.47 and 1.60. These are rates which give us the consumption equivalent of a unit of investment. We estimated the shadow wage rate of unskilled labour as K.Shs.303.19, 125.02 and K.Shs.71.21 per month, based on consumption discount rate of 10, 15 and 20 per cent respectively.

Lastly we applied the methodology to a case study - The Kenyan Fiberboards Corporation. The results were then compared to that of the conventional approach and private project appraisal (using market prices). It was noted that the net present values obtained are different. Since we are avoiding the conventional 'optimality' assumption we argued that the methodology we followed appears logical.

As mentioned above the data requirements were very large and statistics were not available in a usable form in several cases. However, this deficiency was partly overcomed by using the research findings of others,

with some adjustments as necessary. Our inability to work out a unique value of the consumption discount rate forced us to be satisfied with minimum, intermediate and maximum values for the social price of investment and the shadow wage rate.

These findings will be useful as a starting point for more research in this area. The results could also be used, with some caution, to evaluate projects.

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As mentioned before this work is my own but a number of people have contributed to its realization.

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TABLE OF CONTENT

LIST OF TABLES

INTRODUCTION

Under the assumptions of perfect competition the market is said to bring efficiency in production and exchange. Thus the supporters of perfect competition argue that if the market is left by itself it will produce an optimal allocation of resources. However, this (optimal allocation) has failed to be true for the following reasons.

The first reason is that the market is not perfect. There are monopoly and monopsony powers, factor imobility, impefect knowledge both among consumers and producers, etc. These will bring unemployment of resources and distortion in the distribution of goods and services. In the presence of such inefficiency the allocation of resources will be less than optimal (in the Paritian sence).

The second reason is the presence of externalities. There are factors or activities which do not pass through the market but provide benefits and costs to society. Such things as air pollution due to industrialization are costs to society - diseconomies. On the other hand industrialization leads to skill formation and there is a benefit. Hence to value social costs and benefits of an activity externalities have to be included as much as possible.

The notion that the market, if left alone, will bring efficiency is doubtful. This is due to various factors which are not in line with the assumptions of perfect competition. To this effect there arose the need to devise a system where inputs and outputs will reflect social costs and benefits. Thus the need for 'shadow or accounting prices' became apparent. As a private enterpreneur uses market prices to evaluate a project and determine its profitability, economists involved in public project appraisal should replace market prices with social prices to do the same. The process by which public projects are evaluated is known as social cost-benefit analysis (simply referred as cost-benefit analysis (cba) in this paper). Apart from cost-benefit, cost effectiveness and linear programming are also used but it appears that cba has a wider acceptance in academic circles.

The aim in this paper is to estimate the social price of investment (also called the shadow price of capital) and the shadow wage rate (also called the social price of labour) for Kenya.

In Chapter I I will discuss the theoretical basis of cost-benefit analysis. This chapter is a brief survey of the theoretical foundation of cost-benefit analysis. As will be observed it lacks completeness because a full exposition of welfare theory is beyond the scope of this paper.

Chapter II deals with the Social Price of Investment which requires the prior determination of the Consumption Discount Rate (also called the social discount rate). After discussing the model advocated by the writers of the UNIDO Guidelines I have estimated the social price of investment for Kenya.

Chapter III deals with the shadow wage rate which requires the prior determination of the social price of investment. After the theoretical basis of the model is discussed I have estimated the shadow wage of unskilled labour in Kenya.

Chapter IV is intended for case study. The aim is to apply the social price of investment and the shadow wage rate and obtain the net present value of the project. In this section I have attempted to show the difference between the convential and the UNIDO Guidelines methodology of social project appraisal.

Chapter V is concluding remarks where I intend to bring together the mertis and demirets of the UNIDO Guidelines methodology used in this paper.

CHAPTER I

Cost-Benefit and the Theory of Welfare

1 Relation of cost-benefit analysis and Welfare theory.

The use of cost-benefit analysis is to aid public authorities 'to choose the best or most feasible projects out of a set of projects' and to guide decision makers to determine "the level at which firms should operate" and other similar policy issues. [36 16] The projects to be chosen should be the ones which yield the highest gain in 'net benefits' to society. Therefore, we are involved in maximization of social utility or welfare. [31 5] There is an objection on the assumption that governments are maximizers. It is more believed that governments are intererested in satisfying a given aspiration. Thus the satisfying approach is the other one but is not in confirmity with welfare theory.

Welfare theory is concerned with well being of society and to quote Winch's [54] definition of welfare economics;

> Welfare economics is the study of the well being of the members of a society as a group, in so far as it is affected by the decisions and actions of its members and agencies concerning economic variables. These variables include the extent and nature of the use of factors of production, the types and quantities of goods and services produced both individually and collectively, and the distribution of the benefits and costs resulting from economic activity among the members of society [25].

The objective of cost-benefit analysis is to maximize net social benefits, through the regulation of the use of factors of production, types and quantities of goods and services to be produced and the distribution of benefits among various classes of a society. Hence cost-benefit analysis is applied economics based on the theory of welfare. In this section an attempt will be made to show the welfare basis of cost-benefit analysis.

It has to be noted that the theory of welfare is controversial and the theoretical foundation of cost-benefit analysis has some weak points. A full discussion of welfare economics is not the aim of this paper and only some mention of the important points - as regards to cba - will be made. Mishan's[1] article is recommended for those interested in pursuing the controversy in detail.

2. Preferences and Benefits

In welfare economics individual preferences are the basis of obtaining social preferences, based on the axiom that the "welfare of an individual is what the individual perceives it to be." [54 12] An individual

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[1] Mashan, E.J. " A Survey of Welfare Economics, 1939-59," in American Economic Association and the Royal Economic Society (ed) Survey of Economic Theory, Vol .1, pp 154-222.

reacts to economic activities in one of the following two ways. If the activities 'cost' him he shows aversion to it. If the activities give him 'benefits' he shows preference for them. In short he reacts to economic activities by paying for the activities which give him benefits and by asking for compensation for activities which he does not prefer. In such circumstances by evaluating his preferences and aversions he " could be helped to reach the most preferred state" and "this is possible by ranking the alternative states facing the individual." [37 5]

It is inappropriate to take individual preferences always because "individuals behave such that they choose on the basis of the outcome of a policy as it affects them and not as it affects others." [37 6] Individual preferences are specially defective when it comes to the following conditions. First, public goods such as defence cannot be properly valued by individuals. According to Prest and Turvey [37] this is because;

> ....some goods and services supplied by the government are of a collective nature in the sense that the quantity supplied to any one member of the relevant group cannot be inependetly valued. [107]

Secondly, merit wants - economic independence, employment (taken as an end by itself) - cannot be valued by individual preferences. This is because the benefits

are obtained in a general way and as such difficult for an individual to perceive the benefits as it affects him. Thirdly, some projects have external benefits and costs and those who cause them and those who benefit or lose fail to value the external economics and dis-economics properly. This could be due to - as is also the case with the above two - the fact that these effects do not pass through the market. In such cases there is a need to arrive at the benefits and costs accruing to society using approaches different from individual preferences.

3. Concept of Cardinal Utility

In section (2) above it is noted that gains and losses of welfare are reflected in the preferences of individuals. On this there are two schools of thought; the ordinal utility school of thought which asserts that utility cannot be measured and the cardinal school which accepts the measurability of utility.[1] In cost - benefit analysis according to Pearce [36] the aim is "to quantify the social advantages and disadvantages of a policy in terms of a common monetary unit." [8] Therefore, cba makes use of cardinal utility approach, in that it pretends as if utility can be measured and the unit of account is money. The cardinal

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[1] Apart from the measurability of utility there are other differences between the ordinal and the cardinal utility school of thought.

approach enables us to compare and aggregate the utility gains and losses of individuals and society arising from a policy. Discussing the need for cardinal utility approach in cba Dasgupta and Pearce [8] say,

> ....The most important aspect of cardinal approach is the assumptions of interpersonal comparisions of utility (IPCU).IPCU requires that the utility of an individual be comperable with the utility of another. [42]

using the cardinal approach, which assumes IPCU to be permissible, one can aggregate individual preferences and aversions. Regarding the mechanism of social choices as reflected by preferences and aversions Arrow [1] comments that:

> In capitalist democracy there are essentially two methods by which social choices can be made: voting, typically used to make "political" decisions and the market mechanism, typically used to make "economic" decisions. [453]

The interest in cba as Pearce [36] points out "is the preference that is recorded in the market place (or which would be recorded if there was a market) and not preferences recorded by a simple vote." [10] Therefore in cba, eventhough adjustments are required in some instances, individual preferences count.

This is because cardinal utility approach enables us to infer utility levels of individuals from preferences revealed in the market place.

4. Intertemporal Comparision of Utility

Intertemporal comparision of utility (ITCU) will be fully discussed in connection with the consumption discount rate and the social price of investment in Chapter II. ITCU is required because present consumption has more value than future consumption either because of the diminishing marginal utility of consumption or pure myopia. Therefore there is a need to weight future consumption so that it be comparable with present consumption.

Accepting interperaonal and intertemporal comparision of utility enable us to add the utilities of different people and also the utility being obtained at different points in time. This aggregation is helpful to obtain the net benefit or cost during a project's life span.

5. Measurement of Benefits and Cost and Gains in Social Welfare.

On accepting that ITCU and IPCU being permissable and accepting that the interest in cba is on preferences revealed in the market place one has to be clear on what constitutes benefits and costs and how to measure them.

> ....Benefits are understood in the most comprehensive sense to include all additions to social welfare that can, in Pigou's words, 'be brought into relation with the measuring rod of money.' [26 18]

Costs can be taken to mean all deductions to social welfare. To measure benefits of goods and services one can take the willingness to pay of those members of society affected by the activity. Cost, on the other hand, can be measured by the 'maximum compensation required by all input suppliers'. [30 286]

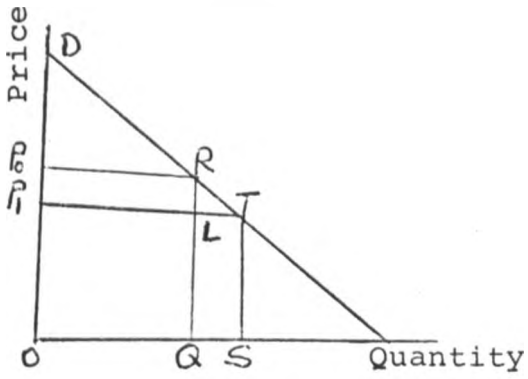
According to Winch [54]

> ....In a Paretian system, changes in welfare are dependent on changes in utility, and the problem therefore becomes one of assessing the impact of policy changes on individuals' utility levels, as well as that of determining the net changes in welfare from a set of changes in utility levels.
>
> One promising approach to the measurement of utility changes, which has had a chequered history in the literature of economics, is the concept of surplus .... [135].

In cba, therefore, consumers' and producers' surplus are used in defining changes in welfare. These concepts have been used to measure welfare changes, hence it is appropriate to discuss, in brief, what is meant by consumers' surplus.

According to Marshall, as cited by Mishan [32], consumer surplus is "the maximum sum of money a consumer would be willing to pay for a given amount of the good, less the amount he actually pays." [26] Mishan uses the following diagram to explain the definition.

Figure 1a



Assume that OQ amount of the good is produced. Consumers get a satisfaction (for which they are willing to pay) worth ODRQ but since the price is OPo the amount consumers pay is OPoRQ. Therefore the difference between ODRQ (the total willingness to pay) and OPoRQ (the total sum of money paid) is PoDR which is called consumers' surplus. The interest here is in measuring changes in welfare and the principle of consumers' surplus will help.

Assume that price is reduced from OPo to OP_1. Consumers will respond to this by increasing consumption by QRTS but they only pay QLTS the difference

between the two, RLT, is a surplus. In addition to this PoP_1LR is also a surplus because they pay less for the value they consume prior to the price change. Thus the change in price resulted in an increase of consumers' surplus by an amount equal to $PoRTP_1$.[1]

The ordinal school objects to this approach. The ordinal approach is more clear but cannot be used due to measurement problem. Noting this the cardinal utility approach is used. Thus to value benefits we apply the willingness to pay approach while gains and losses in social welfare are inferred by analyzing consumers' surplus.

To value costs the concept of opportunity cost can be used, i.e. what resources would have contributed to society's well being if they were employed in the best alternative among set of alternatives provided. According to the UNIDO Guidelines [53]

> ....It is clearly, the best of the opportunities that he is sacrificing, i.e. the maximum benefit from a feasible alternative course of action. Thus, the appropriate concept of cost is that of the maximum alternative benefits foregone.

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[1] This method of obtaining consumers' surplus is based on the assumption that utility is measurable in money terms - cardinal utility approach .

Thus the definition of cost is the maximum benefits foregone and hence what is being measured is aggregate consumption costs applying the willingness to pay approach.

So far the concern was how to measure benefits and costs based on the cardinal utility theory. What is now left is to discuss what is meant by social gains.

The most commonly used theory to express gains in social welfare is that of Paretian value judgements. Since the concept of Pareto optimum is useful in the analysis of shadow prices it is worthwhile to discuss it in some detail.

Pareto optimality is concerned in technical and exchange problems. The problem of production (technical), quoting Millward [30] can

> ....be viewed as discovering how outputs and inputs should be allocated between firms so that; (a) No further shuffeling would increase the quantity of one commodity without decreasing the quantity of another, given a fixed quantity of inputs, and, (b) it is impossible for any given stock of commodities to decrease the use of one input without increasing the use of others. [13]

For these conditions to hold true the marginal rate of technical substitution, MRTS, between two factors, L and K, must be equal in different employments, say two products, x and y

$$(MRTS_{LK})^{x}_{a} = (MRTS_{LK})^{y}_{b} \quad \ldots\ldots\ldots(1.1)$$

where a and b refer to firms producing x and y respectively. The fulfilment of this condition asserts that factors are equally productive in different employment.[1] In addition, since factors are paid according to their productivities the equality of the ratio of factor productivities ensures that a factor earns the same in different employments.[2] These conditions require the presence of perfectly competitive markets. The equality of the marginal technical substitution

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[1] $(MRTS_{LK})^{x}_{a} = (MP_L/MP_K)^{x}_{a}$ .....(1.12)

where MP_L and MP_K are marginal productivities of L and K respectively. This will also hold true for commodity y.

$$(MRTS)^{y}_{b} = (MP_L/MP_K)^{y}_{b} \text{ ----------(1.13)}$$

Since $(MRTS)^{x}_{a} = (MRTS)^{y}_{b}$ ----------(1.1)

$$(MP_L/MP_K)^{x}_{a} = (MP_L/MP_K)^{y}_{b} \text{----------(1.14)}$$

Thus one can conclude that factors are equally productive in different employments.

[2] From 1.14 $(MP_L/MP_K)^{x}_{a} = (MP_L/MP_K)^{y}_{b}$

Since factors earn according to productivities

$$(MP_L/MP_K)^{x}_{a} = (P_L/P_K)^{x}_{a} \text{----------(1.15)}$$

From this it can be shown that

$$(P_L/P_K)^{x}_{a} = (P_L/P_K)^{y}_{b} \text{ --------1.16)}$$

Thus the earning of factors between different uses is the same

of factors between different employments ensures that it is impossible to increase the production of one commodity without decreasing that of the others. In addition it is impossible to increase the use of one input without increasing the use of the others.

The second condition of Pareto aptimality is known as 'the goods - to - consumers - condition.' It requires that goods and services "be allocated between consumers such that no reallocation could increase total utility." [8 99] This requires that the marginal rate of substitution (MRS) of say two goods, x and y, must be equal for all consumers say M and N

$$(MRS_{xy})^{M} = (MRS_{xy})^{N} \quad \ldots\ldots\ldots\ldots (1.17)$$

In a perfectly competitive market when this condition is fulfiled the ratio of marginal utility of the two products is the same among consumers.[1] In addition since the price of a commodity is determined by its utility it confers on the consumer, the ratio of the

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[1] The MRS can be thought of as an expression of the ratio of the marginal utility of the two goods. Therefore
$(MUx/MUy)^{M} = (MUx/MUy)^{N}$ .....(1.18)
where MUx and MUy refer to the marginal utility of commodity x and y respectively.

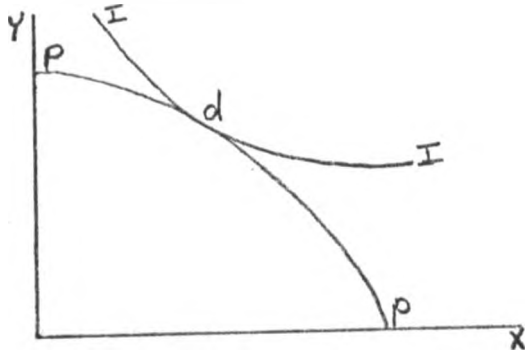
marginal utility of two products is equal to their price ratio.[1] The fulfilment of this condition, 'the goods - to - consumer - condition'. ensures efficiency in exchange.

The third condition of Pareto optimality is what is known as the optimal output condition. This requires that the two conditions must hold and there be tangency between the indifference curve (MRS) and the production possibility curve (MRTS)

$$(MRTS_{LK})^X = (MRTS_{LK})^Y = (MRS_{xy})^M = (MRS_{xy})^N \ldots\ldots\ldots (1.21)$$

Pareto optimality can be explained using the following diagram.

Figure 16b



The optimum combination of the two factors, L and K, to produce two products, x and y, is given by PP and its slope shows the $MRTS_{LK}$. The indifference curve II gives the combinations of x and y that give the same satisfaction and the slope shows MRS_{xy}. Given the production possibility boundary

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[1] This implies $(MU_x/MU_y)^M = (Px/P_y)^M \ldots\ldots\ldots\ldots\ldots\ldots (1.19)$ where Px and P_y refer to the price of x and y respectively. Using equation (1.18)

$$(Px/P_y)^M = (Px/P_y)^N \ldots\ldots\ldots\ldots\ldots\ldots (1.20$$

PP and the indifference curve II, d is the highest production and utility obtainable. The point of tangency between PP and II, d, is optimal out put condition. This condition ensures that the economy has obtained Pareto optimality. When an economy achieves this it is efficient and optimum.

Having discussed Pareto optimality in brief, one can look at 'Pareto improvement' - a concept which deals with social gains. 'Pareto improvement' is defined as a 'change in economic organization that makes every one better off without making anyone else worse off'. [8 55] Based on this Pareto criterion two economic situations, say X and Y, can be compared. According to Dasgupta and Pearce [8] the possible rankings are the following:

> (1) XPY (X is Pareto preferred to Y) if either XPY for all individuals comprising society, or XPY for some individuals and XIY (X is Pareto indifferent to Y) for the remainder.
>
> (2) XIY (X is Pareto indifferent to Y) if XIY for individuals comprising society.
>
> (3) XRsY (X is Pareto preferred or Pareto indifferent to Y) if XRY for all individuals.....
>
> (4) X and Y are Pareto non comparable if for any individual XPY and for any other YPX.
>
> (5) Any state, say X, is said to be Pareto optimal if, given the states of consumers' preferences, and prevailing technology, there is no state, say Y, such that YPX. That is Pareto optimality is defined as a state in which no one can be made better off without someone else being made worse off. [55]

Out of the above Pareto rankings it can be seen that (a) Pareto criterion cannot be applied for a situation where there are gainers and losers. This situation is observed in ranking (4) and is implied in ranking (5) above. (b) Pareto optimality discussed previously and ranking (5) can be obtained irrespective of the nature of income distribution.

In comparing Pareto criteria and cost-benefit analysis we find that projects are such that there will be gainers as well losers. This makes Pareto criteria, as it is, inapplicable for cba. However, the Kaldar - Hicks compensation criteria attempts to bridge this gap. It states that;

> .... a social state Y is socially preferable' to social state X if those who gain from the move to Y can compensate those, who lose and still have some gains left over. [8 57]

The criteria does not require that actual compensation be paid, it only requires it be hypothetically possible to compensate losers.

The Kaldar-Hicks compensation criteria is said to lead to contradictory results. However leaving out the controversies, for it is not yet resolved, it is better

to discuss how much compensation is required. According to Winch [54].

> The assumption that redistribution is costless and would always be optimally implemented is an heroic one, but with it we find the Hicksian measurement of compensating and equivalent variations appropriate criteria to assess policy changes that would affect price levels .... [147]

The amount of compensation required to leave the individual neither better nor worse off than his initial position is known as compensating variation. Thus those who lose from a policy change must be compensated by the gainers of the change equal to the compensating variation. If this is paid and if the gainers are still left with some gains then there is improvement in social welfare.

Suppose the losers can bribe (compensate) the gainers from the move so that the policy will not be undertaken. In this case the equivalent variation, "the amount of compensation, paid or received, that will leave the consumer in his subsequent welfare position in the absence of the price change if he is free to buy any quantity of the commodity at the old price" [7 746], is the appropriate measure. If they succeed welfare will remain unchanged.

The two Hicksian[1] measurements are the best means assessing the fulfilment of the Klador-Hicks criterion. One can infer that the policy change leads to increased welfare if compensation is actually paid or if the policy leads to some preferred distribution. [54 159]

The compensation criteria implicitly assumes that £1 has equal weight whether it accrues to a poor man or to a rich man. However, in cba this assumption is not accepted and it can be handled in one of the following ways, " (a) to use some system of distributional weights" or (b) "simply to show the net benefits to each party and let the policy maker apply his own evaluation." [26 16] The first approach appears to have gained more acceptance in academic circles while in practice it is the second approach that is employed . Various[2] authors in this field support the use of different weights to consumption or income of individuals depending on the income bracket they belong.

In practice compensation is not actually paid therefore the concern in cba is to find out whether or

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[1] In addition to these two measurements there are two others known as 'equivalent surplus' and 'compensating surplus' but are ignored here because they are used less in the literature of distribution and they also lead to the same conslusions as using compensating and equivalent variation.

[2] Dasgupta and Pearce [8] Little/Mirrlees [25] UNIDO Guidelines [53]

not the policy leads to a preferred state of income distribution. However, the compensation criteria could be used to show the effect of the policy on income distribution.

6. Summary and Conclusions

Theoretically governments in less developed countries by undertaking economic activities want to maximize social welfare. As discussed in the beginning of the chapter we have mentioned that the view that governments are maximizers is doubtful. In addition, that governments are maximizers is based on the assumption of a representative government which may not be applicable for most developing countries. Noting these defective assumptions we accept that social cost-benefit analysis is based on the theory of welfare.

Welfare theory has some controversial points and only some of the controversies are mentioned here. In trying to quantify benefits and costs we accepted the cardinal utility approach which enables us inter-personal and intertemporal comparison of utility. This is objected to by the ordinal school of thought and there has not been found a solution to this controversy.

In welfare theory benefits are to be measured by the willingness to pay approach. Therefore benefits which are direct can be inferred from market values. While indirect benefits are to be treated as if they pass through the market. The problem faced in measuring direct benefits is not as great as the problem faced in evaluating indirect benefits. This problem is obvious when welfare theory is applied to social cost-benefit analysis. One such problem is measuring the effect of employment on income distribution which is advocated to be left to the judgement of the decision maker.

Similar problems are faced when we want to evaluate costs. To estimate costs direct opportunity cost, i.e. the benefits foregone from the best alternative, is applied. The problem arises when we want to quantify the indirect costs. We will see that some of the indirect costs such as the costs of employment on saving is approximated. However, most of the indirect costs are not considered and one reason to be given is quantification problem.

After evaluation of social benefits and gains one has to decide whether there is social gains or losses due to the proposed economic activity. For this we considered the Paretian value judgement and we have noted

the defects and controversies arising from it. The theory of Pareto optimality is concerned with optimal allocation of resource and is based on the assumption of perfect competition, the absence of which has required the estimation of shadow prices.

From our discussion one can conclude the following: First, cost-benefit analysis is based on that part of economics which is controversial. Secondly, shadow price estimation is an attempt to arrive at the price that would have prevailed if the economy has attained Pareto optimality. Third, due to various problems - theoretical and practical - shadow prices will be approximations and not exact. In the chapter to follow one could note how we deviate from the second conclusion.

CHAPTER II

THE CONSUMPTION DISCOUNT RATE AND THE SOCIAL PRICE OF INVESTMENT

1. Ambiguities and Clarifications

1.1 Problem due to methodology

Prior to mentioning the various methodologies used to derive social discount rate (SDR), the following point should be discussed. Shadow pricing is taken as an 'optimal pricing' by some economists.[1] This is in line with the discussion of Pareto optimality in Chapter I. If one follows the approach of optimal pricing it is possible to equate the consumption discount rate (CDR) obtained by using social time preference rate (STPR) with that of the social price of investment, P^{inv}[2] This prompted the search for a discount rate mainly SDR. However, we have argued in Appendix II that the developing economies are far from obtaining equilibrium. In addition the concern here is not to look for the equilibrium prices but for a price mechanism that will facilitate government decisions. In view of this equating CDR and P^{inv} is wrong and unnecessary. In this case we

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1 Optimal price is the price obtained when the economy has achieved a Pareto optimum.

2 P^{inv} is the abbriviation used by the UNDO Guidelines to refer to the social price of investment which is similar to the social price of capital as well as saving.

are not looking for one discount rate but a rate to discount future consumption and a social price of investment. This is discussed in Appendix II.

Going back to the problem of methodology Pearce [36] says that there are three schools of thought as regards the derivation of SDR.

> ....First, the social time-preference rate (STPR) school of thought argues that the SDR should reflect society's preference for present benefits over future benefits.... The second theory is that the SDR for use in public projects should reflect the rate of return foregone on the displaced project... Third there is a presumption that the STPR ... will be less than the opportunity cost rate... Since both rates are relevant to the public investment decision it has been argued that some 'synthetic' reflecting both influences is required. [40]

There is also a fourth school of thought which propagates that the STPR and P^{inv} are equal, therefore either one of them could be used as CDR.

1.2 Terminology problem and definitions

There appears to be ambiguity between the social discount rate (SDR), the consumption discount rate (CDR) and the social price of investment (P^{inv}). One source of the problem is the inconsistent use of the term SDR by economists. The following are few examples of such inconcistency.

The SDR in the UNIDO Guidelines [53] refers, apart from other things, to the rate of fall of utility with time, i.e. the social time preference rate as derived from the diminishing marginal utility of consumption.

Little and Mirrlees [25] say that the term SDR is inappropriate and they call it the 'consumption rate of interest' which is equivalent to CDR. This term is synonymous to what the UNIDO Guidelines refer as SDR.

Dasgupta and Pearce [8] analyse different methods of deriving SDR. They discussed the STPR and the social opportunity cost of capital, p^{inv}. They found both incomplete to estimate SDR separately. This is because, they argue that, SDR is a function of STPR and p^{inv}. Even though they do not provide a methodology, they recommend the use of a synthetic rate which will incorporate both the STPR and p^{inv}.

The following are definitions which we will adopt to avoid the terminology problem.

(a) Consumption discount rate (CDR) is the marginal rate of time preference between present and future consumption. For the purpose of deriving CDR we employ the notion of diminishing marginal utility of

consumption (DMUC) as will be discussed in section (2) of this chapter. The term CDR is similar to what the UNIDO Guidelines [53] refer as SDR, Little and Mirrlees [25] refer as the consumption rate of interest and Dasgupta and Pearce [8] refer to it as the social time preference rate (STPR).

(b) Social Price of Investment, p^{inv}, is "the net present value of the aggregate - consumption stream resulting directly and indirectly from a unit of marginal investment." [53 193] It is derived by using the social opportunity cost of capital direct and indirect (refer to section (3) of this chapter). The social price of investment is similar to what Dasgupta and Pearce [8] call the social opportunity cost of capital and others call the shadow price of capital.

2. Consumption Discount Rate

2.1 Reasons for discounting future benefits

In the process of project formulation and evaluation, after a stream of benefits and costs are obtained, there is problem of aggregation. This is because, as various authors[1] recognise, it involves intertemporal choice. It rests on the premise that present consumption is preferable to future consumption and the former should be given greater weight.

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[1] UNIDO Guidelines [53], Little and Mirrless [25], Dusgupta and Pearce [8], and Lal [22]

Usually society has preferences for the present over the future. According to Dasgupta and Pearce [8] there are two reasons and they are:

> (a). society simply does prefer the present to the future - there is 'pure myopia.'
> (b) Future generations are likely to have higher levels of consumption. If the diminishin marginal utility of consumption operates, then the utility gains to future generation from a gain in consumption will be less than the utility gains of present generation. Hence, the future gains should be discounted. [139]

The principle of diminishing marginal utility of consumption is also applicable for present generation. That is, if people expect higher income in future years then they tend to consume more at present. A third reason for preferring present consumption is uncertainity. This is because an individual does not possess the knowledge to know in advance the commodities that will be available and their prices. In addition his future income and his life span are not known to him.

It is the second reason that has mostly formed the basis of discounting future consumption. Feldstein [10] describing the role of CDR says:

> ....A social time preference function assigns current values to future consumption. It is a normative function reflecting society's evaluation of the relative desirability of consumption at different points in time .... [245]

2.2 Consumption discount rate - derivation of the formula

As mentioned above people prefer present consumption due to pure myopia and the diminishing marginal utility of consumption (DMUC). To determine CDR usually DMUC has been concidered.

The derivation of CDR from DMUC ignores the presence of uncertainity and 'pure myopia.' It rests on the premise that future generations will be relatively better off than the present generation and similarly future income is higher than the present. Therefore, accepting the principle of DMUC implies that less weight should be given to future consumption.

Lal's [22] presentation of the mathematics is simpler but basically the same as the others.[1] However, he differs from the rest because he accepts Irving Fisher's method of estimating the elasticity of marginal utility with respect to consumption whioh the others treat as unknown.

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[1] Marglin [27], Feldstein [10], Dasgupta and Pearce [8].

Taking a two period model the following is the definition of CDR according to Lal [22]. "The current consumption rate of interest (CDR) is the marginal rate of substitution between consumption in period t + 1 and consumption in period t." [152] Therefore, in terms of marginal utility which is dependent on consumption we get the following.[1]

$$i_t = (U'_t/U'_{t+1}) - 1 \quad \ldots\ldots\ldots\ldots (2.1)$$

where U'_t and U'_{t+1} refer to the marginal utility in year t and t + 1 respectively and i_t refers to CDR. Assume a constant elasticity of utility with respect to consumption, η, which is a function of per capita

---

[1] Due to diminishing marginal utility of consumption.

$$U_t > U'_{t+1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2.11)$$

Therefore future marginal utility has to be discounted so that it be comparable to the present

$$U'_t = U'_{t+1} \quad (1 + i) \quad \ldots\ldots\ldots (2.12)$$

$$(1 + i) = U'_t/U'_{t+1} \quad \ldots\ldots\ldots (2.13)$$

$$i_t = \left(U'_t/U'_{t+1}\right) \quad \ldots\ldots\ldots (2.1)$$

consumption, C,[1]

$$U = C^{\eta} \text{----------(2.14)}$$

Let us define the elasticity of marginal utility with respect to consumption, e, as,[2]

$$e = (U''/U')C \text{ ---------- (2.17)}$$

where U" and U' refer to the second and the first derivative respectively.

Substituting (2.14) into (2.17) we get[3]

---

1 $U = C^{\eta}$ ----------(2.14)

$du/dc = \eta C^{\eta-1}$----------(2.15)

$du/dc \cdot C/u = \eta$----------(2.16)

2 $e = \frac{d(U')}{dc} \cdot C/U'$----------(2.18)

$= U'' C/U'$ ----------(2.19)

$= (U''/U')C$ ---------- (2.17)

3 This is because; from equation (2.14)

$U' = \eta C^{\eta-1}$ ---------- (2.21)

$U'' = \eta(\eta-1)C^{\eta-2}$ ---------- (2.22)

and taking equation (2.3)

$e = (U''/U')C$ ----------(2.23)

Substituting (2.24) and (2.25) into (2.3)

$e = \left\{\frac{\eta(\eta-1)C^{\eta-2}}{\eta C^{\eta-1}}\right\}C = \frac{\eta(\eta-1)C^{\eta-1}}{\eta C^{\eta-1}} = \eta-1$ ----------(2.20)

$$e\left[\frac{\eta(\eta-1)\ C^{\eta-2}}{\eta C^{\eta-1}}\right] - 1$$

$$= \eta-1 \text{ ----------(2.20)}$$

Substituting (2.14) into (2.1)

$$i_t = \left[\frac{-\eta c_t^{\eta-1}}{\eta C_{t+1}^{\eta-1}}\right] - 1\text{----------(2.24)}$$

which simplifies to

$$i = \left(C_{t+1}/C+\right)^{-(\eta-1)} - 1 \text{ ----------(2.25)}$$

Let us define the one period growth rate of per capita consumption, g_t, as

$$g_t = \frac{C_{t+1} - C_t}{C_t} \text{ ----------(2.26)}$$

Substituting (2.20) into (2.25) we get

$$i_t = \left(C_{t+1}/C_t\right)^{-e} - 1\text{----------(2.27)}$$

Substituting (2.26) with (2.27) we get,[1]

$$i_t = (1+g_t)^{-e}-1 \qquad \text{----------(2.28)}$$

Thus equation (2.28) defines consumption discount rate, i_t. Then what is left is to obtain estimates of g_t and e. Estimates for g_t, per capita consumption growth rate is fairly available. The elasticity of marginal utility with respect to consumption, however, is difficult to estimate. That is why most authors prefer to treat, e, as unknown.[2]

---

[1] This is because

$$1 + g_t = 1 + (C_{t+1}-C_t/C_t)$$

$$= \frac{C_t+C_{t+1}-C_t}{C_t}$$

$$= C_{t+1}/C_t \qquad \text{----------(2.28)}$$

[2] Lal [22] adopts Irving Fisher's model and defines elasticity of marginal utility with respect to consumption as the "ratio of the income elasticity for food, ep, (after the elimination of the income effect." [15] This approach was tried and dropped because of shortage of data and problem of justifying the model.

2.3 Estimating CDR for Kenya

Noting the problem faced to quantify i (the consumption discount rate) it has to be assumed. One method of obtaining an assumed value for i, according to the Guidelines [33] is to look into the internal rate of return of government projects.[1] The Guidelines suggest that with repeated exercise the decision - maker can obtain the "cut-off" internal rate of return which can be used as consumption discount rate. There are two problems with this approach.

First, in evaluation of public projects, according to Birgegard [3], shadow prices are rarely used in Kenya. Thus from projects one can obtain a private rate of return and not a social rate of return. Hence previous exercises in project evaluation cannot be used as basis of obtaining an assumed rate.

Second, I have opted to follow the UNIDO Guidelines which requires prior determination of i to obtain the shadow price of capital and labour. Then before one

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[1] Internal rate of return (IRR) can be defined as the "rate of discount which makes the present value of the entire stream 'benefits and costs-exactly equal to zero." [32 183]

determines the consumption discount rate one cannot undertake social cost-benefit analysis. Unless one assumes equality between i and P^{inv} such an approach will not work and the inequality of the two is shown in Appendix II.

The second method considered was to take the average i used in the four case studies included in the UNIDO Guidelines (Part IV) The following consumption discount rates are used.

Table 2.1

Assumed consumption Discount Rates Used in the UNIDO Guidelines Case Studies

Case Study	Assumed rates		
	Low	Medium	High
Pulps and paper mill in Sarania	0.08	0.10	0.12
Chemical Plant in Palavia	0.08	0.12	0.16
The Mangua Water Project	0.05	0.075	0.10
Fiberboard Plant in Oasis	0.10	0.13	0.16
Mean of the four	0.078	0.106	0.135
Say	0.08	0.11	0.14

Source: UNIDO: Guidelines for Project Appraisal New York, United Nations, 1972.

The Guidelines provide no justification why these rates are used. The other point to be noted is that i, varies between 5 and 10 per cent for the low rate. Observing such variation it is difficult to rely on the average rates 8, 11 and 14 per cent for low, medium and high respectively.

Looking into the Kenyan economy one could be tempted to use interest rates as an approximation to consumption discount rate, i. The first problem is the imperfection of the capital market. There is a formal capital market whose rate is different from the informal market. In the presence of such dualism we cannot equate interest rate and consumption discount rate. The second problem is the multiplicity of interest rates and the difference between what borrowers pay and savers get.[1] Borrowers pay 8-12 per cent on long term loans while the bank pays 5-6 per cent on time deposits, as shown in Appendix XII. The former can be seen as a payment to capital and the latter as compensation to

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1 This will be discussed in detail in connection with the social price of investment in section (3) to follow.

deferred consumption. Thus what borrowers pay and savers receive are measures of two different concepts, namely, interest paid to the bank can be seen as the cost of capital and what the bank pays to deposit can be seen as payment to post-pond consumption. This approach is defective because one is taking the preference of those who can save which constitutes a small number of the population. Noting the skewed mature of income distribution in Kenya (shown in Appendix Xl) the preference of savers in no way reflects the social preferences.

Assume that P^{inv} is equal to q, the marginal productivity of capital. As discussed in Appendix II pinv and i are equal when the economy is inequilibrium. However, in developing countries like Kenya, $i < P^{inv}$ This is because in less developed countries investment is not optimal and hence the high value for P^{inv} . The value of q is estimated to be 0.286 (to be discussed in section (3) of this chapter). Therefore i will be less than 0.286. Noting this, the maximum value of i is assumed to be 0.20.

To fix the minimum value of i we revert to interest rates. If interest rates (both paid by borrowers and received by depositers) were not controlled, the interest rates on deposits would have served as a minimum value of i. Subject to the condition that the private value of saving equals to its social value, which is doubtful, i can be assumed to equal 6 per cent. However, this rate (6 per-cent) under estimates the social rate. This is because the majority of the people do not save and their social rate would be higher than this rate. Thus 10 per cent is assumed to be the minimum value of i.

The midium value for i is then taken to be 15 per cent. Thus in the following sections i will have the three assumed values, viz., 10,15, and 20 per cent.

3. The Social Price of Investment - p^{inv}

3.1 Factor price determination under perfect competition

In the following brief exposition of factor price determination under perfect competition some of the usual assumptions of perfect competition are

made. The main ones are (a) there are large number of buyers and sellers such that one buyer or seller cannot influence the market, (b) there is perfect mobility of resources between different employments and (d) all economic activities pass through the market.

Assuming perfect competition, one can employ the willingness to pay approach to determine the price of a factor. Suppose there are two factors labour (L) and capital (K). Using figure 2a, the relative price of the two factors - determined by the market - is given by the line X^1X^1. The slope of this curve is then

$$P_L/P_K \quad \ldots\ldots\ldots\ldots\ldots\ldots (2.29)$$

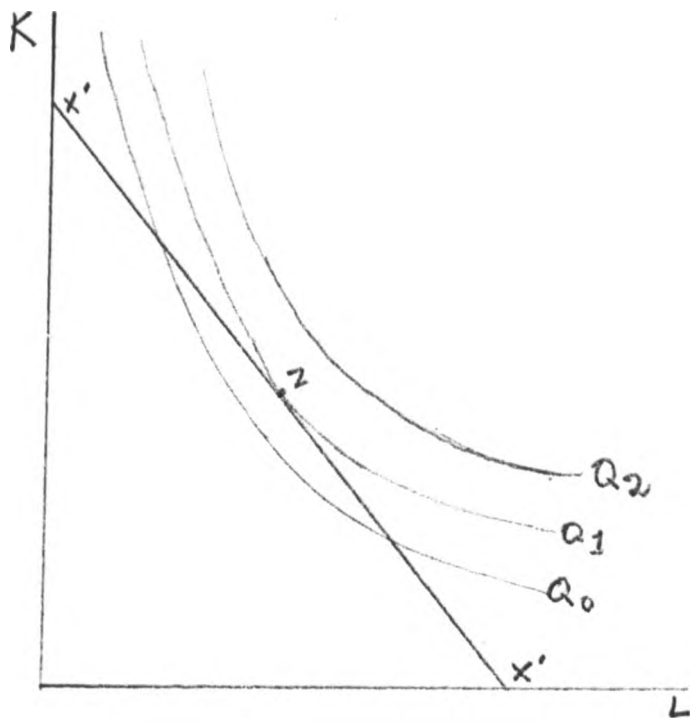
where P_L and P_K refer to the price of labour and capital respectively. Thus (2.39) and the following equations are similar to those of equations (1.12) and (1.16) of chapter I.

Curves like Q_o, Q_1, Q_2 .....are isoquent curves. An isoquent curve, take Q_o for example, shows the possible combination of L and K,

i.e. the ratio of the marginal productivities (MPP) of the two factors:

$$MRTS_{LK} = MPP_{L}/MPP_{K} = P_K / P_L \ldots\ldots (2.30)$$

Figure 2a



Optimal position is obtained when the isoquent curve is tangential to the price line.[1] Referring to Figure 2a this is obtained at Z.

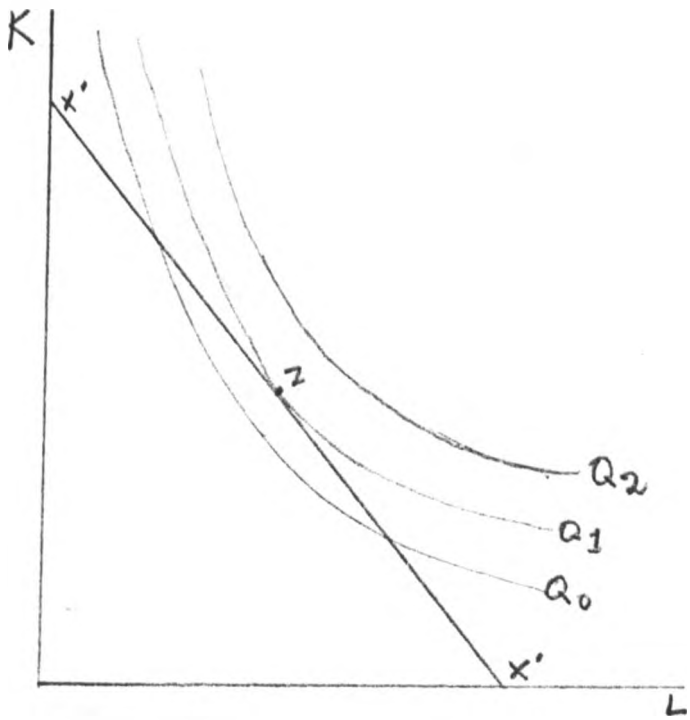
---

[1] Point Z is optimal because if the economy is to the left of Z then it is not efficient since it is possible to increase production to Q_0. Any point to the right of Z is impossible because of resource limitations.

i.e. the ratio of the marginal productivities (MPP) of the two factors:

$$MRTS_{LK} = MPP_L/MPP_K = P_K/P_L \quad \ldots\ldots (2.30)$$

Figure 2a



Optimal position is obtained when the isoquent curve is tangential to the price line.[1] Referring to Figure 2a this is obtained at Z.

---

[1] Point Z is optimal because if the economy is to the left of Z then it is not efficient since it is possible to increase production to Q_0. Any point to the right of Z is impossible because of resource limitations.

At this point

$$MRTS_{LK} = MPP_{L}/MPP_{K} = P_K/P_L$$

$$\text{or } MPP_{L}/P_L = MPP_K/P_K \ldots\ldots\ldots\ldots\ldots\ldots (2.31)$$

For convinience let us assume that,

$$MPP_{L}/P_L = 1 \quad \text{If so,}$$

$$P_K = MPP_K \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.31.1)$$

If we assume $MPP_K/P_K = 1$, however, we get :

$$P_L = MPP_L \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.31.2)$$

From this it can be concluded that profit maximizing level of labour and capital employment is the point where the prices per unit of the resources are equal to their respective marginal productivities.

The above also describes the least-cost compination of factors which can be derived using the marginal cost approach according to Leftwich [24].

> ....The least cost combination can also be stated as the price of a factor equal to the marginal physical product of the factor multiplied by the marginal cost of output. [51].

That is,

$$MC.MPP_L / MC.MPP_K = P_L / P_K \ldots\ldots\ldots\ldots (2.32)$$

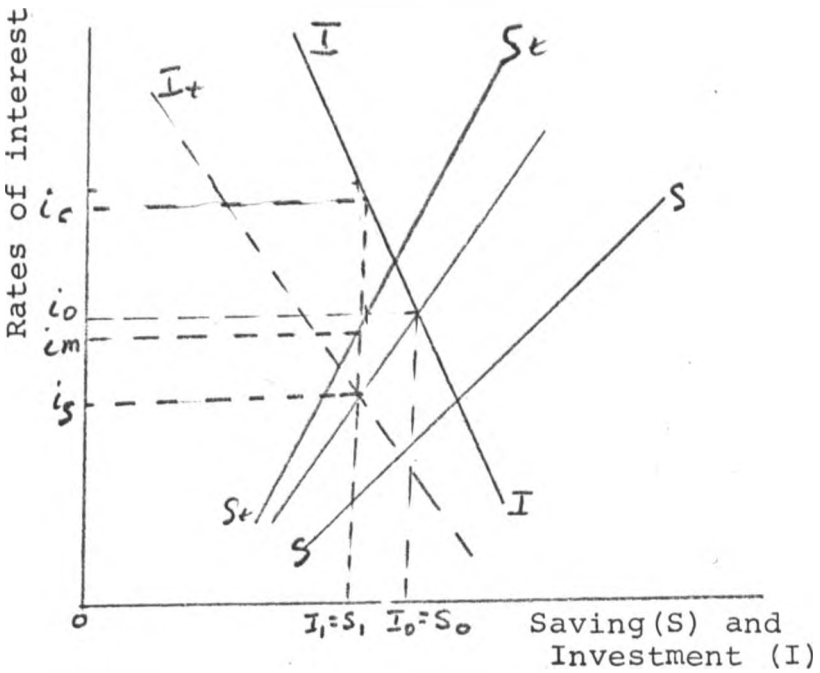
The above shows that factor price determination under perfect competition is efficient, in the sense that factors earn according to their productivities. This approach is in conformity with Pareto criteria as regards production.

This is a general approach to show factor price determination in perfectly competitive market. Based on this approach some attempts have been made to derive the shadow price of a factor. Roemer and Stern [42] developed an approach to the determination of shadow price of capital based on the above principle of factor price determination. Their approach is summerized below. There are some special approaches to determine the shadow wage rate but only capital will be discussed.

Interest is the cost of capital. Lower interest means higher demand for fund, because projects which are less profitable can then be accepted.

If interest is i_c - refer to Figure 2b- projects yielding equal to and more than i_c will be accepted and the demand for fund will be I_o.

Figure 2b.



Considering i_o.

> .... Since capital in these projects would have yielded i_c per year, the foregone output of the diverted capital will be i_c. The II curve gives the opportunity cost of capital at any level of investment. [42 54]

At the same time interest is price paid to savers for giving up present consumption. The higher the interest rate the greater the saving - because the reward in terms of future consumption is attractive.

> .... Since we have social values on consumers' decisions the interest rate indicated by SS curve give the social value or the opportunity cost of capital through additional saving. [42 56]

In the absence of taxes and other restrictions in capital markets, saving equals investment at i_o and it can be taken as the opportunity cost of capital. At the same time it also reflects the consumption discount rate as it affects saving - a decision to postpone present consumption.

The above approach has two features. First it assumes equality between CDR and P^{inv} which is discussed in Appendix II. In the appendix it is concluded that such an approach is inappropriate to a developing economy. Second, it uses preferences revealed in the market which is defective due to the following reasons.

The first arises from capital market imperfections. Some of the savings and investments (in less developed economies particularly) do not enter the organized capital market. What borrowers pay and savers receive are different. In such a situation it is hard to rely on preferences revealed in the market place.

The second is related to the multiplicity of market rate of interest. Interest rates vary between commercial and development banks, types of investment, mode of borrowing and saving, etc. These can be attributed to three factors. The first is risk which causes variation, high / interest rate for risk prone projects and low interest rate if otherwise. The second is -; governments in less developed countries provide subsidy in a form of loan with low interest rate to encourage investors to undertake investment in areas which are given priority. The third one is imperfections in the capital market. As mentioned before dualism in the capital market is the main cause of capital market imperfections. These are main reasons for the variation of interest rates.

The third problem arises from the assumption of a rational economic man. To quote UNIDO Guidelines [53].

> .... this approach assumes a rational, calculating basis for individual decisions on saving and borrowing, a basis that remains, after econometric research, a hypothesis supported more by the preoccupation of its authors than by emperical observations .... [158]

The assumption of a rational economic man is to make use of the principle of consumer sovereignity. However, this principle becomes defective when dealing with intertemporal choice due to various reasons. According to Fedstern: [10]

> .... individual savers must forsee their future incomes and wants, as well as the future prices of all goods. But the future income of individual(or household) depends on the savings and investment decisions of society as a whole. The individual cannot possibly have the information required for rationally redistributing his income through time .... [363]

Another argument presented by Marglin [27] is that, even assuming perfect capital market and equilibrium interest rate, there is no guarantee that it will equal the socially required level of saving.

This, as discussed before is because savers in a developing economy constitute a small percentage of the population. Hence, the equilibrium level may reflect the optimal level of saving viewed from the point of view of the minority but not from the total population point of view. Thus the market determined interest rate could lead to saving and investment which is not socially optimal.

It is due to these problems that the market determined rate of interest can not serve us to obtain the shadow price of capital. As discussed in Chapter I resources should be valued by what they would have contributed to society's well being if they are employed in the best alternative, among a set of alternatives provided. It is this approach the UNIDO Guidelines [53] advocates and the method of deriving the social price of investment, P^{inv}, is summarized below.

3.2 Basis of determining the social price of investment.

The social price of investment, also called the shadow price of capital, is defined as "the net present value of the aggregate consumption stream

resulting directly or indirectly from a unit of investment." [53 193] It has been noted that the market rate of interest, even assuming perfect competition, does not serve as a measure of the value of capital to society. It is also noted that the proper method of evaluating resources is to use its opportunity-cost.

The social price of investment to be derived here is to be used for evaluating "public projects that displaces marginal investment." [53 206] That is to say that the government had a fixed amount of investment fund. To use Little/Mirlees' [25] terminology this fund can be called 'uncommitted social income' - uncommitted in a sense that it is not allocated to finance a particular project.

The opportunity cost of capital can be defined as a maximum benefit foregone from an alternative project. In other words, capital used in a project, say A, could be withdrawn from another project, say B. In this case the cost of capital can be seen as

---

[1] Note that the social price of investment is a value and not a rate expressed in percentile.

the benefit that would have been realized if project B was undertaken. This approach requires that all possible projects be evaluated and the best alternative determined. However, this is a costly (in terms of manpower and time) process. Therefore, this approach although theoretically valid, has practical difficulties.

The other approach to obtain opportunity cost of capital is to use the marginal productivity of capital. The UNDO Guidelines [53] derive the social price of investment using the marginal productivity of capital and other indirect effects. What follows is a brief exposition of the methodology advocated by the UNIDO Guidelines [pp 173 - 200].

The present value of a future stream of benefits, B^*, can be shown by mathematical expression:

$$B^* = Bo + V_1 B_1 + \ldots\ldots V_T B_T \ldots$$

$$= \sum_{t=1}^{T} B_t/(1+i)^t \quad \ldots\ldots\ldots (2.33)$$

where V_1, V_2 ... V_T are weights attached to future benefits Bo, B_1 ... B_1 and i is the consumption discount rate.

Assume that all capital costs, K_o, is incurred in year zero and marginal investment earns q which is immediatly consumed.[1] In this case the net present value is:

$$B^* = O + V_1 (B_1 - q K_O) + \ldots + V_T (B_T - q K_O) - V_T K_O$$

$$= \sum_{t=1}^{T} B_t/(1+i)^t - \sum_{t=1}^{\alpha} q K_O/(1+i)^t \ldots (2.34)$$

Assuming that the return on marginal investment, q, is constant overtime equation (2.14) reduces to:[2]

$$B^* = \sum_{t=1}^{T} B_t/(1+i)^t - (q/i) K_O \ldots\ldots\ldots (2.35)$$

From the definition of the social price of investment we see that

$$p^{inv} = q/i \ldots\ldots\ldots\ldots\ldots\ldots (2.36)$$

---

[1] q is the marginal productivity of capital.

[2] This is because of by virtue of the identity,

$$\sum_{t=1}^{T} \frac{1}{(1+i)^t} = \frac{1}{i} \ldots\ldots\ldots$$

Substituting (2.36) in (2.35) we get

$$B^{*} = \sum_{t=1}^{T} B_t/(1+i)^t - p^{inv}_{ko} \quad \ldots\ldots(2.37)$$

However, if the marginal return, q, is not consumed immediately and a fraction of it, s, is reinvested then;

> ---- reinvestment from the returns of an initial £1 investment leads to an accumulated investment A_t in year t the over-all-direct and indirect-return will be $q\ A_t$. [53 175]

In this case the contribution to aggregate consumption will be,

$$(1-S)q\ A_t \quad \text{----------} \quad (2.38)$$

Equation (2.35) can then be written as

$$p^{inv} = \frac{(1-S)\ q\ A_t}{(\ 1\ t\ i\ )} \quad \text{----------} \quad (2.39$$

What remains now is to evaluate A_t, which depends on the marginal propensity to save, S, and the marginal productivity of capital, q. In year 1 the accumulated capital is the same, i.e.£1

$$A_1 = 1$$

In year 2 $A_2 = A_1 + Sq\ A_1 = (1+Sq)A_1 = (1+Sq)$

In year 3 $A_3 = A_2 + Sq\ A_2 = (1+Sq)A_2 = (1+Sq)$

In year t $A_t = (1-Sq)^{t-1}$ .....(2.39.1)

Substituting equation (2,39.1) in (2.39) we get

$$P^{inv} = \sum_{t-1}^{\alpha} \frac{(1-S)\ q\ (1-Sq)^{t-1}}{(1+i)^t}$$

$$\text{or } P^{inv} = \frac{(1-S)\ q}{1+Sq} \sum_{t=1}^{\alpha} \left(\frac{1+Sq}{1+i}\right) \text{.....(2.40)}$$

Since it is a geometric progression (2.40) reduces to

$$P^{inv} = (1-S)q/i-Sq \text{.....(2.41)}$$

Equation (2.41) represents the social price of investment. It depends on the marginal propensity to save, the rate of capital accumulation, and the consumption discount rate.

The above argument is based on the following assumptions. First, the projects to be financed are marginal projects. This implies that each project is so small that it will not change prices of factors and

outputs. Second the project is to be financed by public sector saving. Third the marginal productivity of capital, q, the marginal propensity to save, S, and the consumption discount rate, i, do not differ between the public and the private sector or the difference is so small that it can be ignored.

Taking the first assumption, marginality of projects - the following can be said. Marginal projects will not change significantly the existing income distribution and relative prices. If the project is big enough to bring a significant change then partial analysis (that is what cba is) will not be adequate. Therefore, for such projects there is a need of general equilibrium analysis.

The second assumption requires that the project be financed by public sector saving, i.e. resources are drawn from alternative investments. In this case the value of the investment is

$$p^{inv}K_o \qquad (2.42)$$

and net present value formula considering reinvestment will be

$$B^* = \frac{[(1-S) + sp^{inv}]Bt - pinv_{Ko}}{(1+i)^t} \quad \ldots\ldots (2.43)$$

Suppose that resources are drawn from investment and consumption and let the amount be a^{inv} and a^{con} respectively. Then the appropriate formula for net present value is,

$$B^* = \sum_{t=1}^{T} B_t/(1+i)^t - (a^{inv} P^{inv} + a^{con}) Ko \quad \ldots(2.20$$

If the proprotion of capital that comes out of investment is equal to the marginal propensity to invest, i.e.

$$a^{inv} = S$$

Then $$a^{con} = 1 - a^{inv}$$

Therefore, $a^{inv} pinv + a^{con} = S\ pinv + (1+S)$

Substituting this in equation (2.41) we get

$$S p^{inv} + (1-S) = (1-S)i/i-Sq$$

This represents the appropriate opportunity cost when capital is drawn both from alternative investment and consumption.

In this case the appropriate formula for the net present value, and considering reinvestment, equation (2.37) becomes

$$B^* = \left[(1-S) + SP^{inv}\right] \left[\frac{Bt - K_o}{(1+i)^+}\right] \quad \text{--------(2.44)}$$

The third assumption says that the marginal produductivity of capital and marginal propensity to save, q, and s respectively, do not vary between the public and private sector. However, if the difference is large then the appropriate opportunity cost of capital is not

$$p^{inv} = (1-S)q/i-Sq \quad \ldots\ldots\ldots\ldots (2.41)$$

but

$$p^{gov} = \frac{(1-S^{gov})\ q^{gov}}{i - s^{gov}\ q^{gov}} \quad \ldots\ldots\ldots\ldots (2.45$$

where the super scipt gov refers to government.[1] In such a situation then the net present formula is, taking equation (2.37)

$$B^{*} = \left[a^{pri}\ p^{pri} + a^{gov}\ p^{gov} + a^{con} \right] \left[\frac{B_t - K_o}{(1\ t\ i)^t} \right] \quad \ldots\ldots\ldots\ldots (2.47)$$

---

[1] Equation (2.21) can be derived following a similar reasoning like equation (2.19)

where super scripts $_{pri}$ refer to private.[1]

Thus the three assumptions are crucial. In the section to follow I will estimate p^{inv} for Kenya using equation (2.41). This equation is taken mainly because the data requirement is not as great as the others.

To obtain net present values we have equation (2.43), (2.46) and (2.47). One can note that equation (2.27) can not be used. This leaves us with the two equations (2.43) and (2.47) for obtaining net present values. As to which one is applicable depends on the mode of financing the project.

3.3 Estimating the Social Price of Investment, p^{inv} for Kenya.

3.31 Estimating the marginal productivity of capital, q.

According to Blitzer (4) there are two views regarding marginal productivity of capital.

---

[1] The derivation of opportunity cost of capital for the private sector is involving and as will be discussed in the section to follow formula (2.23) will not be used. Therefore I have left out its derivation but can be obtained in the Guidelines pp 182-183.

> .... The authors of the Guidelines suggest that the parameters, q and S, be directly estimated.[1] The parameter q, the marginal productivity of investment can perhaps be estimated by econometric techniques. Alternatively, if we assume a labour supplies economy[2], then the increamental output - capital ratio becomes the marginal product of capital, q and perhaps can be derived from a large sample of projects or from some national economic plan. [20]

The increamental output capital ratio as an approximation of q is fully discussed in Appendix III. I have discussed the findings of various authorities as regards IOCR. In conclusion we said the estimates of Powell [38] and Tobin [51] assuming zero marginal productivity of labour, over estimates q. On the other hand those who included labour in their Report [55] and Singh [48] have obtained a better value of IOCR.

In Appendix III it is concluded that the assumption of zero marginal product of labour is not acceptable. In addition to this, IOCR, y, leads to

---

[1] q and S refer to marginal productivity of capital and marginal propensity to save respectively.

[2] Labour surplus economy in this content refers to zero marginal productivity of labour.

overestimate q. This is because, according to the Guidelines [53], in developing countries y is greater than q. [206] Therefore the first approach, econometric determination of q appears to be preferable than equating y to q. For this purpose I have considered Singh's [48] model here. A full discussion of this model is given in Appendix IV.

To determine q Singh uses the following model:

$$q = a_1 - a_2 \left(Q/L\right)^{C_1} + a_3 (\log Q) - a_4 \left(Q/M\right)^{C_2} + a_5 \left[\frac{1}{\log (Q/L)} \cdot \frac{PT}{TI}\right] - a_6 D_1 - a_7 D_2 \text{--------} (2.48)$$

where Q,L,M, are output, labour and import (total) respectively, PI and TI refer to public and total investment, D_1 and D_2 refer to price distortions in capital and exchange market respectively and q, a_1.... a_7 are constants.

Singh uses cross country data of 70 countries. The data used is the average for 1965-1970. When solving the above equation the value obtained for Kenya is the following.

$$.286 = .424 - .018\left[\frac{1}{\log(Q/L)}\cdot\frac{PI}{TI}\right] - .018\ {}^{Q}/_{M} - .121\ D_2$$

From the above one can see that q is 0.286 and it takes account of the inefficiency of public sector employment. Therefore q for the private sector is 0.304 (i.e. 0286 + 0.018). However, the interest here is to obtain the national value for q. Hence I took 0.286 as the value of q.

Singh's model to obtain growth rate $({}^{dQ}/_{Q})$ of the economy is given by

$${}^{dQ}/_{Q} = q\ {}^{dK}/_{Q} + \beta\,{}^{dL}/_{Q} + \alpha\,{}^{dM}/_{Q} \quad \ldots\ldots\ldots\ldots (2.49)$$

So as to know the effect of labour and import on growth rate I have regressed

$${}^{dQ}/_{Q} = q\,{}^{DK}/_{Q} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2.50$$

For output I have taken monetary GDP and for capital Powell's [38] estimate is used. A comparision of Powells and Mureithis' [34] capital stock estimate is given in Appendix VI, Table Vl.1.

TABLE 2.2

Monetary GDP and Capital Stock, 1964 - 1974

(K £ million, 1964 Prices)

Year	Monetary GDP[1]		Fixed Capital	
Year	(Q)	(DQ)	Stock (K)[2]	DK
1964	242.0	-	467	-
1965	247.6	5.6	473	6
1966	283.1	35.5	479	6
1967	294.5	11.4	494	15
1968	322.2	27.7	523	29
1969	345.6	23.4	554	31
1970	372.4	26.8	585	31
1971	396.4	24.0	628	43
1972	425.5	29.1	663*	35
1973	462.2	36.7	731*	68
1974	479.9	17.7	774*	43

Source: [1]Kenya: Statistical Abstract 1970.
Kenya: Statistical Abstract 1975.

[2]Powell, R.P., "The Stock of Fixed Capital in Kenya in the Monetary Economy, 1969-1971." Occasional Paper No.9, Institute for Development STudies, University of Nairobi, 1973.

*Own estimates refer to Appendix V, Table V. 2.

I have regressed dQ over K rather than $^{dQ}/_{Q}$ and $^{dK}/_{Q}$ to avoid spurious correlation and for mathematical simplicity. The value obtained for q is 0.24. The result is very close to what Singh got using his model. I have considered only capital and this shows that the effect of labour and import is very small.

To update Singh's [48] estimate was found difficult due to lack of data, mainly the small number of observations. On the other hand the simple model (equation 2.50) is not so reliable. Therefore Singh's estimate of q, 0.286 is taken even though it is for the period 1965-1970.

3.32 Estimating the Marginal Propensity to Save, S.

There are three sources of saving in Kenya they are household, government, and business saving. As is shown in Table 2.3 the major source is household followed by business saving. Up to 1969 household saving was increasing and was about 14.5 per cent of disposable income. From then onwards it has been declining and was only 7 per cent by 1971. [55 357]

TABLE 2.3

Source of Saving in Kenya, 1964-1971

			Business	
			Undistributed	Depreciation
Years	Household	Government	Profit	Allowance
1964	24.8	12.8	13.5	16.8
1965	17.0	9.8	6.7	17.4
1966	31.7	10.3	12.0	19.2
1967	33.8	10.6	6.9	22.6
1968	39.8	10.7	3.6	26.3
1969	55.4	7.4	10.6	30.1
1970	47.3	20.4	12.0	33.4
1971	30.5	26.2	13.1	41.0

Source: World Bank: Kenya: Into the Second Decade, Baltimore and London, The John Hopkis University Press, 1975.

Depreciation allowance is the major part of business saving. It accounted for 37 per cent of total saving in 1971. On the other hand the share of undistributed profit is falling. According to the World Bank Report [55]

> .... the contribution of undistribubuted profits registers a decline from 11.8 per cent in 1971 to 6 per cent in 1978 [Using the data of the Development Plan 1974-1978].... [357]

Government saving accounted for 24 per cent of total saving in 1971 and is expected to hold this position till 1978. [357]

The findings of the World Bank Report is similar to that of the Development Plan 1974-1978 [19]. The major source of saving in 1972 is personal saving. Contribution of each sector business, household and Government - is shown in Table 2.3.

One problem with saving data is that it is derived as a residual. It is possible to estimate government saving and to some extent business saving. Household saving is treated as a residual after taking account

TABLE 2.4

Investment and Saving Account: Preliminary 1972, Projected 1974, 1978.

	(K £m. 1972 Prices)			Average Growth	Share of Tot	
	1972	1974	1978	Rate	(%)	(%)
Investment						
Capital formation	159.94	189.15	269.83	9.1	89.9	89.0
Changes in stock	9.04	13.16	20.16	14.3	5.1	6.7
Net change in international services	9.00	13.06	13.06	6.4	5.0	4.3
Total investment	177.98	215.35	303.05	9.3	100.0	100.0
Source of Investment Fund						
Business saving	53.04	69.70	102.64	11.6	29.8	33.9
Personal saving	60.15	55.46	87.25	6.2	34.1	28.8
Net inflow of international capital	34.0	52.10	73.40	13.7	19.1	24.2
Total sources	177.98	215.35	303.05	100.0	100.0	100.0

Source: Kenya: Development Plan for the Period 1974-1978, Nairobi, Ministry of Finance and Economic Planning, 1974.

of other enteries. Therefore it might include the errors of the other estimates. Hence the data is very unreliable.

Our concern here is to obtain the value of s, and the above discussion is to show the saving situation in Kenya.

An attempt is done to obtain the marginal propensity to save directly and is shown below.

TABLE 2.5

Marginal Propensity to Save

1968-1974

Year	S (Domestic Saving K£m)	Y (GDX K£m)	D S	D Y	DS/DY
1968	97.4	483.32	-	-	-
1969	108.3	520.85	10.7	37.53	0.28
1970	134.9	572.66	26.6	51.81	0.51
1971	110.3	635.14	- 24.6	62.48	- 0.39
1972	145.6	711.82	35.3	76.68	0.46
1973	223.3	814.87	77.7	103.05	0.75
1974	212.7	957.81	-10.6	139.94	-0.08

Source: Statistical Abstract 1975.

The marginal propensity to save, s, shown in the last column varies between years. Using three years moving average the marginal propensity to save during the 1968-1974 period is found to be 0.24. AS mentioned before the saving data presented in the Statistical Abstract is defective. At the same time the model for saving is very simple. Therefore one could not place much weight on the value obtained, namely 0.24.

The World Bank Report [53] quotes Scott's findings, as regards marginal propensity to save, which is 0.20. I have taken this value because it is said to be an econometric determination. Secondly our estimate is only for the monetary economy and could be upward biased.

3.33 The Social Price of Investment, p^{inv}, for Kenya

In section (3.2) we have concluded that we will make use of equation (2.41) to estimate p^{inv}. To solve this need the values of i, s, and q are given below.

$i = .10, .15, .20$

$S = .20$

$q = .286$

Using the above estimates we can solve equation

(2.19) for Kenya.

$$p^{inv} = (1-S)q/(i-Sq) \quad \text{----------(2.41)}$$

For $i = .10$

$$p^{inv} = 5.35$$

For $i = .15$

$$p^{inv} = 2.47$$

For $i = .20$

$$p^{inv} = 1.60$$

We have defined the shadow price of capital, p^{inv}, as "the net present value of the aggregate consumption stream resulting directly from a unit of investment." [53 193] Then it is expressing a unit of investment in terms of consumption. Taking 15 per cent discount rate a unit of investment is equal to 2.47 times a unit of consumption.

The use of p^{inv} in project evaluation is to determine the net present values of the project. To obtain net present values we have to use formulae (2.44) and (2.43) given below.

$$B^* = \frac{\left[1-S)+S^{pinv}\right] \; B_t - K_o}{(1+i)^t} \quad \text{----------(2.44)}$$

and

$$B^* = \frac{\left[(1-S) + S^{pinv}\right]B_t - pinv \; K_o}{(1+i)^t} \quad \text{----------(2.43)}$$

In the case of equation (2.44) the investment fund is coming from saving as well as consumption. In this case we argued that the opportunity cost of capital is expressed by $\left[(1-S) + S^{pinv}\right]$ which comes to 1.87, 1.29, and 1.12 for consumption discount rate of 10, 15 and 20 per cent. Due to reinvestment the benefits have also to be converted by these factors. Since the ratios are the same for investment and benefit one can take the net benefits and use 1.87, 1.29 and 1.12 to obtain aggregate consumption benefits.

In the case of equation (2.43) the opportunity cost of capital is given by P^{inv}. This is because the sacrifice is only saving. Thus the investment cost has to be adjusted by using 5.35, 2.47 and 1.60, for 10, 15 and 20 per cent discount rate. The benefits, however, should be adjusted using 1.87, 1.29 and 1.12 since it contributes both to saving and consumption.

4. Summary and Conclusion.

It has been noted that the estimation of the consumption discount rate, i, is difficult. To some, since utility cannot be measured they reject the calculation of i. The model advocated by Lal would have enabled us to calculate i. However, due to data and other problems it was found difficult. Therefore, I have resorted to assumed rates. To fix the maximum i I used the marginal productivity of capital, q, which is 0.286. I have discussed in Appendix II that q has nothing to do with i. However, I used it because P^{inv} and i are equal when the economy is in equilibrium. In less developed countries $P^{inv} > i$ hence I chose 0.20. This is more or less the only logical means I considered.

To fix the minimum value, I considered interest rates. In Kenya interest rates are not competitive and there is no way of assigning social values from the behaviour of savers. In addition, the interest on deposits is 5-6 per cent and hence less than the existing inflation. This implies a negative interest rate. If one is to take this rate as a minimum value, i cannot have any rational economic explanation. Therefore as a minimum an arbitrary figure is used, which is 10 per cent. Then I took the midium value which is 15

per cent. Thus the assumed consumption discount rates are 10, 15 and 20 per cent.

To estimate the social price of investment, p^{inv} the opportunity cost approach is used. That is the benefit foregone from the best alternative projects with some adjustments. Even though, the UNIDO Guidelines provide different formulae I have taken the simplest (2.41). This is mainly due to data problem. Ideally one should get the value of q, s and i for government and private sector separately. However, existing data will not enable one to use such an approach.

To solve equation (2.41) one has to obtain the value of q and s in addition to i. If one was to assume surplus labour (zero marginal productivity of labour) then y - incremental output - capital ratio - will equal q. Moreover, some emperical studies have shown that $y > q$. That is why I have taken the value of q as calculated by Singh which is 0.286. To up date Singh's finding an attempt was made but the number of observations is smaller relative to the number of parameters to be estimated. Therefore, I have accepted 0.286 as an estimate of q.

The other parameter to be estimated is S. The value of S is estimated to be 0.20. The main problem here is data problem.

Given the values of i, s, and q one can solve P^{inv}. The values obtained are 5.35, 2.47 and 1.60 for 10, 15, and 20 per cent consumption discount rate. These values are said to express a unit of investment in terms of consumption.

The main conclusion here is that the values of P^{inv} must be taken with caution. The parameters s, q and i are approximations and the error of one might cancel that of the other or it may make it worse. The social price of investment, P^{inv} as well as q, S and i are assumed to remain constant. As will be discussed in Chapter IV this is a defective assumption. The same holds for using similar P^{inv} for government and private sector.

Chapter III

THE SHADOW WAGE RATE

1. Need for Shadow Wage Rate, W*

If factors were paid according to their productivities the difference between the social and private cost will be negligable. It has been discussed that in a perfectly competitive market the price of a factor equals its marginal productivity. However, we also noted that due to market imperfections and externalities factor prices have been distorted. Therefore market prices will no longer reflect social values.

It is noted in chapter II, that the cost of a factor is the benefit foregone from the best alternative employment. The benefit foregone could be direct and indirect. In this section the aim is to obtain the social price of labour or the shadow wage rate, in urban employment.

2. Basis of Estimating W*

2.1 Direct opportunity cost

The social cost of a resource is best approximated by its opportunity cost. There are direct and indirect opportunity costs of public sector employment. "The direct opportunity cost of the public sector employment is the social value of the marginal product foregone by adding the worker to the public payroll."

[53 204] This requires that one should know the source of labour, and the marginal productivity in that employment. Suppose that the worker leaves firm x to join the public sector. If the firm does not replace him then the direct opportunity cost of the labour is the social value of the reduction in the output of firm x. However, if firm x employs a farmer to replace the worker, then the direct opportunity cost of the worker who joined the public sector is the social value of the farm output foregone. Suppose that more than one farmer leave the rural areas, say two, in this case the opportunity cost is the social value of the farm output foregone due to the transfer of the two farmers. The other situation will be when the public sector gets its workers from the unemployed, in this case the direct opportunity cost will be zero. However if one accepts the Harris - Todaro model, [26 52] employment creation in urban centers will induce people to migrate to urban centers and the ratio of people who migrate to the job created is more than one. In other words for each job available in the urban centers more than one persons migrate from rural to urban centers.

Eventhough the above method of obtaining the direct opportunity cost of labour is theoretically sound it is difficult to apply it in practice. It requires the estimation

of (a) the source of labour, (b) the marginal productivity of labour and (c) the social value of the output foregone. There are variations in marginal productivities between regions and the type of products they produce. This calls for a short cut and according to the Guidelines [53]

> ....One approximation is the income of individuals in traditional sectors who possess only their own labour power, lacking capital and land; for example, the wages of landless labourers in agriculture, or the net income of pedi-cab drivers who divide the gross with the cab owner. The wage income of landless labourer...is likely to over estimate the marginal productivity of the smallholder. But so long as the direction of bias is clear .... [it is acceptable]. [204]

Instead of using this approximation we will try to obtain the weighted average income of a migrant.

In addition to obtaining the earning of landless labourers in agriculture the nature of rural-urban migration has to be studied. Once we establish the effect of employment creation on migration it is then possible to use the Guidelines [53] recommendation.

The other situation to be considered is the belief that there is surplus labour meaning that the marginal productivity of labour is zero. This makes the direct opportunity cost of

labour zero. However, the Guidelines use of surplus labour is different.

> The essence of surplus labour lies in the gap between the market wage and the social value of the marginal product of labour in the rest of the economy, and not in the value of the marginal product per se . [204]

Then the assumption of zero marginal productivity of labour is unnecessary. The validity of the assumption of zero marginal productivity of labour will be explored in section (3) of this chapter. In addition to this, how employment creation affects migration and the gap between rural and urban wage will be discussed.

2.2 Indirect Opportunity Cost

2.21 Effect on the rate of saving

Employment creation means that people who were unemployed will be employed and/or those who have been in low paying job will move to a high paying job. Low income earners are said to have high propensity to consume. Therefore employment creation is accompanied by increased consumption.

In developing economies saving is said to be below optimal, i.e. " at the margin investment [saving] is more important than consumption." [53 150] Thus society, at the margin,

attaches greater weight to saving than consumption. Due to this the reduction on the saving rate because of employment is a cost to society.

In deriving the social price of investment, p^{inv}, (in chapter II) the effect of employment creation on saving was not considered. If we take this to consideration p^{inv} will take a special form. The model developed by the UNIDO Guidelines is summarized below:

Assume that a unit of investment creates l jobs. Then the nominal profit to capitalists (owners of capital) will be

$$y - w\,l \quad \ldots\ldots\ldots\ldots\ldots\ldots (3.00)$$

where y is the incremental output-capital ratio (IOCR), w is the market wage rate and w l measures the wage bell.

Let the capitalists save S^{cap} of their income and consume the remainder. The aggregate consumption value of their annual income from a unit of investment is given by:[2]

$$p^{inv}\, S^{cap}\,(y-w\,l) + (1-S^{cap})(y-w\,l)$$

---

1 l is labour capital ratio

2. The equation is derived as follows

Capitalists income = $y-w\,l$

Capitalists saving = $S^{cap}(y-w\,l)$

If we assume that workers save nothing the consumption benefit they derive from a unit of investment is

$$(w-z)\ 1 \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3.12)$$

where z is earning in previous employment.

For reasons given in Chapter II the social value of saving is higher than the private value. Therefore,

Social value of capitalist saving = $P^{inv}S^{cap}\ (y-wl)$

Capitalists consumption = $(1-S^{cap})\ (y-wL)$

Then the total aggregate consumption value from a unit of investment is:

$$P^{inv}S^{cap}(y-wl) + (1-S^{cap})(y-wl) \qquad \ldots\ldots\ldots\ldots (3.11)$$

Adding equation (3.00) and (3.11) the aggregate consumption value from a marginal investment is given by:

$$P^{inv}S^{cap}(y-wl) + (1-S^{cap})(y-wl) + (w-z)\ 1 \qquad \ldots\ldots\ldots\ldots (3.13)$$

Assuming that the parameters in equation 3.13 are constant "we can derive the shadow price of investment from the formula of present value of a perpetuity, as in equation 2.39" [53 205] That is P^{inv} is a ratio of equation (3.11) to i.

$$P^{inv} = \frac{P^{inv}S^{cap}(y-wl) + (1-S^{cap})(y-wl) + (w-z)1}{i}$$

Solving for P^{inv} we get.[1]

$$P^{inv} = \frac{(1-S^{cap})(y-wl) + (w-z)\,l}{i - S^{cap}(y-wl)} \qquad \ldots\ldots(3.14)$$

This equation (3.14) is then the social price of investment in labour surplus economy, and using this we can measure the costs of employment.

It is now possible to derive the shadow wage rate incorporating the direct opportunity cost, z, and saving costs, and P^{inv}. Incorporating the two costs the shadow wage rate can be obtained as follows.

Suppose that the additional public sector employment is financed by taxing capitalists sector. This reduces their investment-consumption ratio by $(1-S^{cap})$: S^{cap}. In this case public sector employment expansion is followed by positive income distribution. The income of capitalists is reduced by w (market wage) and that of workers is increased by w.

---

1. $P^{inv} = \frac{P^{inv} S^{cap}(y-wl)+(1-S^{cap})(y-wl)+(w-z)\,l}{i}$

$i\,P^{inv} = P^{inv} S^{cap}(y-wl) = (1-S^{cap})(y-wl)+(w-z)\,l$

$P^{inv}(i-S^{cap}(y-wl) = (1-S^{cap})(y-wl)+(w-z)l$

$$P^{inv} = \frac{(1-S^{cap})(y-wl) + (w-z)l}{i - S^{cap}(y-wl)}$$

The first effect of this is to reduce aggregate consumption equal to:[1]

$$\left[(1-s^{cap}) + p^{inv}\, s^{cap}\right] w \qquad \ldots\ldots \quad (3.15)$$

The second effect of such a policy is that consumption of workers [1] is increased by w[2]. The consumption gain of workers is taken as a social benefit. Therefore, we have to deduct w from equation (3.15) to get the net cost

$$\left[(1-s^{cap}) + p^{inv}\, s^{cap}\right] w - w = s^{cap}\,(p^{inv})\, w$$

The indirect opportunity cost of employment taking saving cost only is

$$s^{cap}\,(p^{inv} - 1)\, w \qquad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.16)$$

The direct opportunity cost is z, that is the average income of a migrant before migration. Therefore the social wage rate, w^*, is

---

1. Capitalists income declines by w,
   Therefore capitalists consumption declines by
   $(1-s^{cap})\, w$
   Capitalists saving declines by $s^{cap}\, w$
   Social value of $s^{cap} = p^{inv}\, s^{cap}\, w$
   Total effect of income reduction of capitalists
   $(1-s^{cap})w + p^{inv}\, s^{cap}\, w =$
   $\left[(1-s^{cap})\, p^{inv}\, s^{cap}\right] w$

2. Marginal propensity to save of workers is assumed to be zero.

given by the following equation.

$$w^* = z + s^{cap} (p^{inv}-1) w \quad \ldots\ldots\ldots\ldots\ldots\ldots (3.17)$$

Thus in labour surplus economy equation (3.17) gives the proper formula for w^*.

2.22 Effect on income distribution

One of the objectives of governments is to bring equitable income distribution.[1] In project selection, therefore it has to be considered as one of the benefits or costs. There are economists[2] who believe that income distribution has to be included in project selection.

The other view regarding income distribution is that, it should not be included in project selection. It is believed that income distribution will best be done by taxes and other measures. However, such transfers are said to cause factor price distortions because the social cost of labour may not reflect the total opportunity cost.

Taking the first view which says that income distribution

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1. The concern here is interpersonal distribution of income.

2. Little and Mirrlees [25] the authors of UNIDO Guidelines [53].

be included as a benefit, equation (3.17) has to be adjusted. According to the UNIDO Guidelines [53]

> If income redistribution objectives are pursued in project choice, unemployed and under employed workers will generally be one of the groups whose consumption is accorded a greater social weight than consumption in aggregate .... [208]

Thus the recommendation is to attach a higher weight to the consumption of the poor as compared with that of the rich. However, the problem arises when one wants to determine the weights and hence difficult to incorporate this effect with the shadow wage rate. Thus one can only indicate the direction of the change in distribution and to leave the weighting to the decision maker. This is what I have done in this paper.

3. Estimating the Shadow Wage Rate for Kenya

For obtaining the shadow wage rate we will make use of equation (3.17). Prior to the estimation of w^* we have to calculate the social price of investment, P^{inv} using equation (3.14) and then compare it to the findings of chapter II. So as to determine w^* we want to estimate l, y, w, i, S^{cap} and z.

3.1 Estimating labour-capital ratio, l

For estimating l I have used Powell's [58] capital stock estimates and employment figure is obtained from the Statistical Abstracts 1975 [20]. As is shown in Table 3.1 the labour-capital ratio in Kenya is almost constant over the 1964 - 1974 period. Hence the value of l is taken as 0.0011 and Powell's and Mureithi's [53] estimates are given in Table 3.2 as a comparison.

Table 3.1

Labour-Capital Ratio in Kenya, 1964-74

Year	Capital Stock[1] (K£m, 1964 prices)	Employment[2] (000's)	Labour - Capital Ratio
1964	467	575	.0012
1965	473	582	.0012
1966	479	585	.0012
1967	494	597	.0012
1968	523	606	.0012
1969	554	627	.0011
1970	585	644	.0011
1971	628	692	.0011
1972	663*	720	.0011
1973	731*	761	.0011
1974	744*	826	.0011

Source: 1) Powell, R.P., "The Stock of Fixed Capital in Kenya in the Monetary Economy 1964-1971," Occasional Peper No. 9, Institute for Development Studies, University of Nairobi, 1973 p. 5.

2) Kenya: Statistical Abstract 1970

Kenya: Statistical Abstract 1975

* Own estimates refer to Appendix V Table V.2

Table 3.2

Capital-Labour Ratios and Labour-Capital Ratios, 1964-1971

	Mureithi's Estimate		Powell's Estimate	
Year	Capital-Labour Ratio(K£)[1]	Labour-Capital Ratio (L)	Capital-Labour Ratio (K£)[2]	Labour Capital Rat(
1964	657	.0015	817	.0012
1965	704	.0014	818	.0012
1966	759	.0013	831	.0012
1967	821	.0012	853	.0012
1968	924	.0011	888	.0011
1969	1010	.0009	907	.0011
1970	1100	.0009	941	.0011
1971	1183	.0008	965	.0010

Source: 1. Mureithi, L.P., "Demographic and Technological Variables in Kenya's Employment Scene," Discussion Paper No. 201, Inistitute for Development Studies, University of Nairobi, 1974, p. 14.

2. Powell, R.P., "The Stock of Fixed in Kenya in the Monetary Economy, 1964-1971" Occasional Paper No. 9, Institute for Development Studies, University of Nairobi, 1973, P. 31.

As shown in the table above Powell's[38] estimate is in line with what is shown in Table 3.2 for we have used his capital stock estimates. Mureithi's[34] estimate is different because he uses current prices for his capital stock estimates as opposed to Powell's constant prices. Taking this to consideration

our estimate for l, .0011, is acceptable.

3.2 The direct opportunity cost of labour, z

On the outset a word of warning is found assential. The opportunity cost of labour, z, is measured by the marginal productivity of labour which can be approximated by the earning of a landless labourer [53 204]. The wage of a landless labourer is expected to approximate z because of the absence of union pressure wage in the rural areas will approximate the marginal productivity of workers. The value of z may vary between regions. In this paper we will deviate from the UNIDO Guidelines [53]. This is because instead of using the earning of a landless labourer we will use the weighted average of a migrant income before migration to urban centers.

In Appendix VI estimates of number of people in wage employment in small farms and settlement schemes' and their yearly earning are given. There are two types of employees, those who are casually employed and those regularly employed. Their average monthly income is given in Table 3.3.

From the table the following can be noted. First, there is variation between provinces in the level of earning. For regular employees earning in the Coast / province is the highest

K. shs. 134 per month and lowest for Nyanza shs. 45 per month. Second, there is variation between the earning of casual workers. Third, with the exception of Nyanza province the average monthly earning of casual workers is less than the earning of regular workers. Thus to obtain a national average these variations cause problems.

Table 3.3

Small Farms and Settlement Schemes: Estimates of Monthly Average Earning, 1971/72.

Kshs.

Province	Regular Employees	Casual Employees	All Employees
Nyanza	45	51	49
Western	51	27	39
Rift Valley	78	19	52
Central	115	42	77
Coast	134	45	105
Eastern	93	45	76
Average	86	38	66

Source: Refer to Appendix IV TableVI.1 and TableVI.2

The above given average will not be accepted as a national average unless we assume the number of people migrating to urban centers from the provinces are equal. To solve the problem of provincial earning differential we have resorted to weights.

The percentage distribution of rural-urban migration by province has been worked out using the 1968 Migration Survey as summarized by Harris, Remepel and Todaro.[12] Their findings is given in Appendix VII. Using this as weight the national average for the 1971/72 period for regular employees is shs. 84.60 per month.

Table 3.4

Small Farm and Settlement Schemes, Estimates of Weighted Monthly Average Earning, 1971/72

(Kshs)

Province	Source of Migration to urban Centers (%)	Regular Workers	Casual Workers	All Employees
Nyanza	23	10.35	11.73	11.27
Western	17	8.67	4.59	6.63
Rift Valley	4	3.12	0.76	2.08
Central	34	39.10	14.28	26.18
Coast	7	9.38	3.15	7.35
Eastern	15	13.95	6.75	11.40
Average (Total)	100	84.57	41.26	64.91

The nature of employment prior to migration will have effect on the national average earning of a migrant. The necessary weight is shwon in Table 3.5 which is derived from Appendix VII. Here some approximations are found necessary so that it be comparable to Table 3.3 and the approximations are the following.

First, those who have been in school prior to migration are considered as unemployed. Second, those who were self employed, farming and employed as part-time are taken as casual employees.

In Table 3.5 it is shown that out of the total migrants on the average 61 per cent reported unemployed, 24 per cent employed part-time and 15 per cent were regularly employed.

Table 3.5

Nature of Employment Prior to Migration, 1971/72

(%)

Province	Regular Employees	Casual Employees	Unemployed
Nyanza	15.15	24.68	60.18
Western	15.64	25.99	55.36
Rift Valley	15.38	15.38	69.23
Central	14.59	16.28	69.19
Coast	14.48	28.95	56.58
Eastern	14.56	36.71	48.29
Average	15.41	23.90	60.68

Source: Refer to Appendix VII.

Taking the nature of employment prior to migration into consideration the average earning of a migrant to urban centers is given below.

Table 3.6

Monthly Earning of a Migrant Weighted for Nature of Employment Prior to Migration 1971/72

(K. shs.)

Province	Earning
Nyanza	20
Western	18
Rift Valley	14
Central	24
Coast	32
Eastern	31
Average	23

The above table is worked out by taking Table 3.4 and Table 3.5. The former shows us average income weighted for income differential between regions. Table 3.5 gives us income weighted for nature of employment prior to migration. Table 3.6 gives the effect of both income differential between regions and nature of employment prior to migration. Note that the average income of a migrant shown above includes the regularly employed, casually employed and the unemployed.

When the two-provincial earning differential and nature of employment prior to migration-are considered together the average earning of a migrant is shs. 23.5 per month. How this

is obtained is shown in Table 3.7 below.

Table 3.7

Monthly Earning of a Migrant Weighted for Nature of Employment Prior to Migration and Provincial Income Differential, 1971/72

Province	Percentage Distribution of Migrants to Urban Centers(%)	Weighted Earning (Kshs
Nyanza	23	4.6
Western	17	3.1
Rift Valley	4	0.6
Centeral	34	8.2
Coast	7	2.3
Eastern	16	4.7
Average	100	23.5

Without using weights the average income of a migrant (regular and casual employees) was shs. 66. per month. When we considered provincial source of migration the national average earning of a migrant is found to be shs. 64.91. When we considered earning prior to migration alone we got shs. 23 per month. When the two - provincial income differential and earning prior to migration- are considered togather we got shs. 23.5.

Information on earning per month is obtained from 1971/72 survey and published in Statistical Abstract, 1975 [20]. In light of the existing inflation, the general awareness of the people and increased economic activity one can assume that the

average money income is higher in 1974/75 as compared to 1971/72.

The other point to note is that the employment data and earning covers those who are working on small farms and settlement schemes. Therefore, it does not cover additional earning, if any, of the people who are working in these areas. It is likely that some might have additional work, such as helping in the family shamba, or the women being involved in house work.

I have taken the income of those who reported 'unemployed' on the 1968 Migration Survey as having zero income. However, apart from those who are straight from school the others might have been involved in some sort of family work. Their income could be in a form of family income as opposed to individual. However, this statement is subject to qualification. If the remaining member of the household works harder to replace the production foregone due to the migrants absence, there is no social cost apart from the disutility of work. However, we have no information on the earning of the unemployed and whether the remaining farmily members work harder or not. Taking these points into consideration and noting that 48 per cent of the migrants are school leavers (refer to Appendix VII) the average earning obtained, shs. 23.5, of a migrant appears to be sound.

The weights are based on the 1968 Migration Survey undertaken

in Kenya's eight largest urban centers. Between 1968 to now one can assume that the percentage distribution of migration by province will remain the same. The same can be said regarding the nature of unemployment prior to migration. Thus we will try to adjust only for money wage increase.

To update this average (shs. 23.5) the index of wage rates for Kenya is used.

Table 3.8

Average Earning Foregone of a Migrant Due to Rural-Urban Migration 1972-1974

Year	Current Prices Average Wage Increase in % [1]	Rural Average Monthly Wage of a Migrant (Kshs) [2]
1972	5.6	24.8
1973	5.7	26.2
1974	9.3	28.6
1975	15.7	33.1

Source: 1. Kenya: Economic Survey, 1976. p. 47.

2. Refer to Table 3.7.

The index for wage increase is for Nairobi and is used here in the absence of other data. Thus our estimate of rural average wage i.e. the opportunity cost of labour, z, is shs. 33.1 per

month. According to Collier and Rempel [6] the average length of unemployment is 3.5 months.[1] [3 6] Thus prior to the employment of a migrant the rural production foregone is shs. 115.85. Acording to Scott [45] the labour turnover rate is 10 years and hence shs. 0.97 (shs. 115.85 over 120 months) must be included. This will give us the average income of a migrant foregone during the 3.5 months of job Search / distributed over 120 months. Thus the average earning of a migrant is shs. 34.07 per month.

Before concluding this section we will discuss the work of Collier and Rempel. [12] They have attempted to obtain the private and social costs of rural-urban migration. I will briefly summarize their findings. As regards the average rural income they write:

> ....The men with a maximum of primary education averaged 62 shs. per month. The few who were wage employed averaged 229 shs. per month while the self employed averaged 53 shs. per month and average farm income was 2.3 shs. per month [the last figure is doubtful]. [3]

From this they arrive at an average for rural income, namely shs. 64. per month which is identical to the estimate shown in Table 3.4. Their study throws some light on the viability

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1. Collier and Rempel's work will be discussed in this section.

of our estimate. They obtained an average for rural income which is shs. 64 per month. They have considered only regular and casual workers and thus did not include the unemployed. Including the unemployed we get shs. 23.5 per month for 1971. Thus our estimate of shs. 34.07 for 1975 appears acceptable.

3.21 The Harris - Todaro Hypothesis

It is essential that we consider the effect of employment creation on rural-urban migration. Harris and Todaro [19] argue that, in less developed countries, for each job created in urban centers more than one persons migrate from rural areas. The magnitude being a function of rural-urban income differential, the implicit probabability of finding a job (of the migrant), etc. In this regard one of the studies to be mentioned is that of Scott's [45].

The findings of Scott disagrees with Harris-Todaro hypothesis. According to him "for every extra job created in the modern sector, the stock of applicants for such jobs is reduced by about 0.75 men."[1] [3 45] Scott accepts that the above is an uncertain

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1. Scotts model is

$$dA/d_N = \frac{q/P - \eta}{1+\eta}$$

where q = rate of labour turnover
p = probability of getting a job
η = elasticity of the cost curve
dA = increase in the stock of applicants
dN = increase in the modern sector jobs.

estimate and he recommends a range of values for the ratio of increase in modern sector jobs, dA/dN, between - 0.4 to -0.9 Note that it,(dA/dN), is less than unity.

Taking the above findings of Scott the Harris - Todaro model appears not to function in Kenya.

On the other hand there are other studies which appears to support the Harris - Todaro hypothesis. However, the problem is quantifying the hypothesis. One study to be mentioned is that of Rempel's [19]. He found that people are motivated to migrate to urban centers by economic opportunities. According to him, "the regression results point to the primary availability of economic opportunities as determinants of the observed migration." [25]

To conclude this section the following can be said. There is no concensus on the impact of employment creation on rural-urban migration. In some cases there are contradictory results. In the absence of any reliable estimate I have assumed that for each job created in urban centers only one person migrates from the rural areas. Therefore, the value of the direct opportunity cost of labour, z, is taken to be shs. 34.07 per month.

3.3 Estimation of the Market Wage Rate, w

We are concerned here in projects which are financed by the Government. Therefore, we can safely assume that the Government pays the legislated minimum wage for unskilled workers. The following table shows the consolidated minimum wage, housing allowance and national social security fund contributions. It is taken from Appendix VIII and IX.

Table 3.9

Consolidated Minimum Wages, Housing Allowance and Social Security Fund contributions - 1975 (K.Shs.)

	Nairobi & Mombasa	Municipalities & Townships*	Other Areas	Farm Workers
Employees Aged 18 Years and Over				
Monthly Contracts[1]	260	240	145	120
Housing Allowance[1]	40	35	30	20
NSSF[2]**	15	13	8	7
Total	315	288	183	157
Employees Aged Below 18 years				
Monthly Contracts[1]	192	165	113	77
Housing Allowance[1]	25	20	15	30
NSSF[2]**	11	9	6	5
Total	228	194	134	112

Source: 1. Refer to Appendix VIII

2. Refer to Appendix IX

* The municipalities and townships considered here are Eldoret, Kisumu, Kitale, Nakuru, Thika, Nyeri, Embu, Meru, Kakamega, Kericho, Nanyuki, Machakos, Kisii, Nyahururu, and Naivasha.

** NSSF refer to the national social security fund.

From Table 3.9 above one can observe that the rate differs between the four catagories. The last two Other Areas and Farm workers can be ignored. Thus we are left with 'Municipalities and Townships'. To obtain a national average we will make use of weights. The following table gives wage employment in Nairobi, Mombasa, other 'municipalities and townships'

Table 3.10

Wage Employment in Main Towns,1974

	Number	Percent
Nairobi	226,959	77
Mombasa	69,148	
Other Municipalities	58,676	15
Townships	31,508	8
Total	386,297	100

Source: Statistical Abstract, 1975, p. 240

The percentage distribution shown in the table above is used as weights to obtain the national average for the minimum wage in Kenya. This is given in Table 3.11 below.

Table 3.11

Weighted Consolidated minimum Monthly Wage, 1974

	Minimum Wage[1]	Weights[2]	Weighted Minimum Wage
Nairobi & Mombasa	330	.77	245.10
Other Municipalities	280	.15	43.20
Townships	288	.08	23.04
Weighted monthly wages			309.34

Source: 1 Refer to Table 3.9

2. Refer to Table 3.10

Employees aged 18 years and over earn more than those who are below 18 years, we will consider those who are above 18 years. This is justified since the main labour force is above 18.

Taking the above to consideration the earning of employees aged 18 years and above and weighted for regional differential in employment is taken. Therefore the weighted average minimum wage is shs. 309.34 per month.

3.4 Estimating the Propensity to Save of Capitalists, S^{cap}, the Incermental Output-Capital Ratio, y, and the Consumption Discount Rate, i.

In chapter II we have discussed the problem involved in obtaining the marginal propensity to save of the private

and the public sector separately. Therefore, we have taken the national average 0.20 for s and S^{cap}. However, this is defective approach mainly because $S^{cap} > S$ but we have no estimate of S^{cap}.

We have also discussed the incremental output-capital ratio, y. In Appendix III we said that the assumption of zero marginal productivity of labour is unacceptable. Therefore we took Singh's [48] estimate of y, i.e.0.31.

The assumed consumption discount rates are .10, .15 and.20 .

3.5 Estimating P^{inv} in a labour Surplus Economy

For this purpose we will utilize equation (3.14) given below:

$$P^{inv} = (1-S^{cap})(y-wl) + (w-z)\,l \quad \ldots\ldots\ldots (3.14)$$

The values of S^{cap}, y, l, w and Z are .20, .31, .0011, shs. 309.34 per month and shs.34.07 per month. The assumed values for i are .10, .15 and .20. Using these values we obtain the following

For i = .10

$$p^{inv} = 2.60$$

For i = .15

$$p^{inv} = 1.78$$

For i = .20

$$p^{inv} = 1.34$$

We can compare the values of p^{inv} obtained in this section with that of what we obtained in Chapter II. Unless our estimates of the parameters are wrong we should obtain the same values. This is because according to the Guidelines [53] the following equality must hold.

$$(y - z\,1) = q$$

$$(1-s)\,q = (1-S^{cap})\,(y-w1) + (w-z)\,1$$

$$Sq = S^{cap}\,(y-w1)$$

Using our estimates only the first condition is met. The second and the third conditions are not fulfilled. The rate of capital accumulation is 5 per cent when we use sq and is negative 6 per cent when we used $S^{cap}\,(y-w1)$. Thus our estimate of p^{inv} obtained using the labour surplus approach (equation 3.14)

appears to be defective. Therefore, we have taken the result of P^{inv} obtained in Chapter II. The value of P^{inv} are 5.35, 2.47 and 1.60 for i equals .10, .15 and .20 respectively.

Using these values we can calculate the indirect cost of of employment. The formula to be used is the following

$$S(P^{inv}-1)\ w \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.17)$$

For $P^{inv} = 5.35$

$$.2(5.35-1)\ 309.34 = 269.12 \text{ shs. per month}$$

for $P^{inv} = 2.47$

The indirect cost is 90.95 shs per month

For $P^{inv} = 1.60$

The indirect opportunity cost is shs. 37.14.

3.6 The Shadow Wage Rate w^*

The shadow wage rate is given by equation (3.17) namely

$$w^* = z + S^{cap}\ (P^{inv}-1)\ w \quad \ldots\ldots\ldots\ldots\ldots (3.17)$$

using the value of z and the saving cost of employment obtained above in 3.5 we can calculate w^*.

For $P^{inv} = 5.35$

$w^* = 3.07+269.12 = 303.19$ shs per month

For $\check{P}^{inv} = 2.47$

$w^* = 34.07+90.95 = 125.02$ shs. per month

For $P^{inv} = 1.60$

$w^* = 34.07 + 37.14 = 71.21$ shs. per month.

These shadow prices can be directly applied if the number of unskilled workers are given. If wage bill is given one has to use the ratio of the shadow wage rate to the market wage rate (k.sh. 309. per month) to adjust it. The ratios will serve as conversion rate of the bill and are 0.98, 0.41, and 0.23 depending on the social price of investment used. The third approach which is used in chapter IV is to find out the additional consumption benefit workers have gained. This is obtained by deducting the above ratios from one, namely, 0.02, 0.59 and 0.77 depending on the value of consumption discount rate used.

4. Summary and Conclusions

The social cost of labour as is capital is the benefits foregone from the best alternative employment. Employment has direct and indirect costs. To obtain an approximate value of the average wage of a migrant we have used the earning of employees in small farms and settlement schemes. We then analysed the provincial income differential and obtained a national average for

regular and casual workers in the said employment. Next, we considered the nature of employment prior to migration to urban centers. This is then used to obtain the average income foregone by a migrant. This average is then adjusted for increase between 1971 and 1975 using Nairobi Wage Index. Thus the foregone average income of a migrant is found to be shs. 34.07 per month for 1975.

The above approach has one problem in that we were unable to find the additional income of a regular and casual workers apart from what they earn in small farms and settlement schemes as workers. This might not be a problem if the remaining family members work harder to replace the production lost by the migrant. Thus our estimate is not that much downward biased as it appears.

The only indirect opportunity cost involved is the social cost of saving due to employment. This is due to that employment creation leads to increased consumption. This has been calculated using the assumption of surplus labour. However, we found our estimate of P^{inv} unsatisfactory. Thus we used the value of P^{inv} obtained in Chapter II namely 5.35, 2.47 and 1.60 for 10, 15 and 20 per cent i respectively.

The other estimate reguired is the market wage rate. We

have taken the consolidated minimum wage for 1975. The national average obtained is shs. 309.34 per month.

The three estimates are then used to calculate the shadow wage rate, w^* . The values obtained for w^* are shs. 303.19, 125.02 and 71.21 per month depending on the social value of investment used. Thus the conversion factor for unskilled labour wage bill is 0.98, 0.40 and 0.23 depending on the value of P^{inv}.

Note that the above estimate do not include income distribution consideration. This has been left to the value judgement of the decision maker. There are other benefits not considered here - the satisfaction of being employed is one example. On the other hand, other costs such as cost of amenities in urban centers due to increased population is not considered.

To conclude this section, the w^* obtained in this paper must be taken with precaution. If income distribution and the other unaccounted benefits are to be considered the estimated value of w^* will be lower. This can be compensated in part by the unacounted costs. However, there is no evidence or guarantee that these two considerations will cancel out. Thus the estimated values of w^* are approximation and hence should be treated with caution.

CHAPTER IV

CASE STUDY

THE KENYA FIBERBOARD CORPORATION*

1. The Aim of the Exercise

The purpose of this exercise is to show the difference between the conventional approach and that of UNIDO Guidelines methodology of project appraisal. We plan to do this using the following stages. First we present the case materials. Second, we will calculate the return to equity and total investment to determine the the commercial viability of the project. Third we will show the social return using the conventional approach to social project appraisal. At the third stage we will use the UNIDO Guidelines approach to social project appraisal. This section is divided into two parts. In part one we will use the recomended method of finance and obtain the social profitability of the project. In part two we will alter the mode of finance from what has been recomended and show how the social value of investment affects the social profitability of a project at different modes of finance.

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*Originally this case study was presented in Rapanedrou and Zohar [35] and their presentation was adjusted by Prof. Killick in such a way that the case materials can be used for cost-benefit analysis.

2. The Project

The consumption of fiberboards in Kenya has been increasing recently. This demand is being met by imports. Now the Kenya Fiberboards Corporation (KFC) has submitted a proposal to the Kenya Government to establish a fiberboard mill 200 miles from Nairobi. KFC is government owned but an independent corporation.

The aim of the corporation is to establish this plant and meet the local fiberboards demand and export the surplus to the other two East African community partners. This undertaking will be foreign exchange saving, local resource using and employment creating. KFC officials are confident that they will earn 25 per cent return on their equity after tax.

3. Case Materials

3.1 Output

KFC has proposed that the implementation of the project will take only one year. The project will be operational in year one (project implementation period is taken as year zero). The output during the the first year of operation is expected to be 3506 metric tons. Starting from the second year of operation

the output will be 5260 metric tons. Since the proposal did not show how much of the output is to be exported we have used only the domestic price. Based on this the revenue from sales during the first year of operation will be K.Shs. 3,804,000 and K.Shs. 5,707,000 from year 2 to 10. To realize this revenue there is a need to incur costs. These costs are investment and operational costs which are discussed below.

3.2 Investment Costs

The main investment items are equipment, infrastructure and buildings. The following table shows the breakdown of investment cost.

Table 4.1

Investment Cost

	K.Shs.000
1. Import component	
1.1) Building, earthwork and infrastructure (c.i.f. value)	500
1.2) Duty on (4) 5%	25
1.3 Equipment, engineering and installations (c.i.f. value)	4533
1.4) Duty on (1.3) 5%	227
2. Domestic Component	
2.1) Building, etc.	1225
2.2) Equipment, etc.	1190
2.3) Land	21
2.4) Preliminary planning and sundaries	445
2.5) Total of 2.1 to 2.4	2,881

Table 4.1 Cont.

Investment Cost

	K. Shs. 000
of which:-	
2.6) Expatriate labour	
2.61) Net earnings	36
2.62) Tax 20% of gross income	9
2.7) Unskilled labour	260
2.8) Stamp duties	70
2.9) Others	2506
3. Working capital	1290
4. Total investment cost	9456

As shown above all imported equipment and materials are subject to 5 per cent duty. It can be noted that there is no entry for skilled labour this is because KFC will use its existing supervisory staff. All the above costs except working capital will be incurred in year zero. Working capital is built up in year zero and one on equal installments.

3.3 Annual Operating Costs

The main expenditure items are labour and materials. Labour has three catagories - expatriate, skilled and unskilled Expatriate personnel are subject to 20 per cent income tax. The corporation, being government owned, is expected that it will pay unskilled workers according to

the minimum wage legislation which we have discussed in Chapter III to be K.Sh.309. per month. (This is actually the national average). The second cost item is raw materials which partly requires foreign exchange. The third cost item is insurance while the last is office vehicles which fully represents foreign exchange and is subject to 40 per cent import duty. Table 4.2 gives the breakdown of annual operating costs.

Table 4.2

Annual Operating Costs

K.Sh.000

Year	1	2-10
1. Wages and Salaries		
1.1 Expatriates		
1.11 net earnings	36	36
1.12 income tax	9	9
1.2 Skilled workers	79	91
1.3 Unskilled workers	297	334
2. Raw materials		
2.1 Imported	571	856
2.2 Domestic	674	994
3. Insurance	158	184
4. Office Vehicles		
4.1 c.i.f value	46	56
4.2 Duty	18	23
5. Total annual costs	1888	2583

3.4 Source of investment fund

KFC has the power to borrow funds from any source provided the government accepts the project. The corporation has proposed to borrow K.Sh.4405500 of the required fund from commercial banks at 9 per cent interest rate. The loan is to be repayed in ten years with equal installements. The remaining fund is to be provided by the government through increasing its equity in the corporation. All investments by the corporation should have a return of 20 per cent before tax.

3.5 Other considerations

The KFC proposal shows that the equipment and the building will be fully depreciated by year ten. However, the expense on land and working capital will be fully recovered at the end of the tenth year. Thus when we calculate the depreciation rate these (land and working capital) are excluded. For simplicity we have used a straight line depreciation method.

KFC as any other corporation is subject to 40 percent profit tax. However, depreciation and interest are deductible expenses for purpóses of profit tax.

3.6 The question

The main question is, should the government approve this investment and contribute the required equity? To answer this we need to find out the commercial and social viability of the project. We are also required to obtain the commercial and social internal rate of return.

4. Commercial Appraisal

To obtain the commercial profitability we have worked out a profit and loss statement shown in Table 4A (attached). To obtain net profit after tax we have to deduct investment, annual operating costs, depreciation,interest, and profit tax from the revenue. The net profit (after tax) is positive starting the first year of operation.

To obtain the return to equity we have to work out cash flow to equity. To do this loan finance, revenue from sales, and salvage values are treated as cash inflows. The cash outflow consists of expenditures on investment, operating expenses, loan repayment, interest payment and profit tax. This is done on table 4B (attached). The cash inflow less cash outflow will give us the net cash inflow to equity. This is then discounted at 20 per cent because it

is the minimum required and the net present value is found to be positive. Then we tried at 30 per cent and found the net present value to be negative. From this we obtained the internal rate of return which is 28.3 per cent.

In Table 4C (attached) we worked out the cash flow to total investment. The cash inflow constists of revenue from sales and salvage value. The cash outflow on the other hand consists of investment and operating expenses. Then the net cash flow is discounted at 20 and 30 per cent and the internal rate of return is found to be 28.5 per cent.

For our purpose the internal rate of return and the net present values are the only criteria to be considered. Hence we do not attempt to obtain such considerations as liquidity and others. From the point of profitability the project appears to be sound. The return to equity and the return to total investment are 28.3 and 28.5% respectively and is greater than the required 20% return.

5. Social Appraisal

5.1 Based on the proposed mode of finance

To obtain the social profitability of a project the first consideration is to find out which items are direct transfers. This could be in a form of tax, duties, etc. The transfers in our case is from the project to the government in most cases. The effect of these transfers will be discussed later but for the time being we exclude them both from costs and benefits side.

Table 4A (attached) is summarized in Table 4.3 below. Since our interest is centered on items A to D of Table 4A we have reproduced that. The first task is then to exclude all transfer benefits and costs to arrive at the social benefits and costs (MC) using market prices. To do this we go through the enteries A to D.

The direct transfers we consider are mainly duty (import) and income tax. Specially in the case of this project it is the same as transferring money from one pocket to another of the same jacket since the project is owned by the government. These have to be excluded from the social benefits and costs.

TABLE 4.3

OPERATING PROFIT

K.Sh.000

	0	1	2-10
A. Revenues			
1. Production (metric tons)	-	(3506)	(5260)
2. Value at K.Sh.1085 per ton	-	3804	5707
B. Investment			
1.Import component			
1.1 Building, earthwork and infrastruction c.i.f. value	500	-	-
1.2 Duty at 5%	25	-	-
1.3 Equipment, engineering and installations c.i.f. value	4533	-	-
1.4 Duty at 5%	227	-	-
2.Domestic component			
2.1 Building, etc.	1225	-	-
2.2 Equipment, etc.	1190	-	-
2.3 Land	21	-	-
2.4 Preliminary planning and sundaries	445	-	-
2.5 Total of 2.1 to 2.4	2881	-	-
of which:-			

	0	1	2-10
2.6 Expatriate labour			
2.61 Net earnings	36	-	-
2.62 Income tax (20% of gross)	9	-	-
2.7 Unskilled labour	260	-	-
2.8 Stamp duties	70	-	-
2.9 Others	2506	-	-
3. Working capital	645	645	-
4. Total investment cost	8811	645	
C. Annual Operating Costs			
1. Wages and salaries			
1.1 Expatriates			
1.11 Net earnings	-	36	36
1.12 Income tax 20% of gross	-	9	9
1.2 skilled workers	-	79	91
1.3 Unskilled workers	-	297	334
2. Raw materials			
2.1 Imported	-	571	856
2.2 Local	-	674	994
3. Insurance	-	158	184
4. Office vehicles			
4.1 c.i.f. value	-	46	56
4.2 Duty at 40%	-	18	23
5. Total annual costs		1888	2583
D. Operating profit (A-B-C)	(8811)	1256	3124

The value of such transfers (T) can be obtained from Table 4.3 as follows.

$$T = \quad + B1.2 + B1.4 + B2.62 + B.2.8 + C1.12 + C4.2 \qquad (4.1)$$

In addition to these transfer costs and salvage value(s) has to be added back to the operating profit (OP). Operating profit plus transfer costs and salvage value give us the social benefit and cost using market prices (MC).

$$MC = OP + T + S \qquad (4.2)$$

This is done in Table 4.4 below

Table 4.4

Social Benefits (costs) at Market Prices

KSh. 000

	0	1	2-9	10
OP (D of Table 4.3)	(8811)	1269	3124	3124
T (Equation 4.1)	331	27	32	32
S	-	-	-	1311
MC	(8480)	1296	3156	4467

The second stage is to obtain the social benefits and costs using social values for some of the entries. One item to be corrected is the revenue from sales. The revenue should have been a benefit to society if the sales price K.Sh.1085 per ton would have been the economic value of the output. This is because the output would have been realized in the absence of the project. To obtain the economic value of the output we looked into the price of imported fiberboards which we found to be K.Sh.900. Thus the price of KFC is greater than the import price which can be taken as the economic price. From this we can see that there is an indirect transfer of income from consumers to KFC which is equal to 13 per cent of the revenue. Thus the social benefit is 13 per cent less than what is shown in entry A of Table 4.3.

Before the establishment of the mill all fiberboards are said to be imported. The establishment of this mill will save foreign exchange. However, the revenue (A of Table 4.3) does not show the foreign exchange saved because it includes transfers discussed above. We should also consider the foreign exchange used by the project. The net foreign exchange earning (F') can be obtained as follows

$$F' = (1-\alpha)A-B1.1-B1.3-y(B2.61+C1.11)-C2.1-C4.1 \qquad (4.3)$$

The other adjustment that will be required is to obtain the value paid to unskilled workers, L^U. This is obtained from Table 4.3 as follows:

$$L^U = B2.7 + C1.3 \qquad (4.4)$$

All the other enteries, however, are assumed to reflect their economic prices.

The following table summarizes revenue (R), MC (from Table 4.4), F' and L^U

Table 4.5

Values of MC, R, F' and L^U

K.Sh.000

	0	1	2-9	10
MC (Table 4.4)	(8480)	1296	3156	4467
R (A of Table4.3)	-	3804	5707	5707
F' (Equation 4.3)	(5051)	2674	4035	4035
L^U (Equation 4.4)	260	297	334	334

Apart the estimation of F' the others are straight. We have discussed that the import price of fiberboards is less than the domestic price by 13

per cent. Therefore the revenue from sales has to be decreased by 13 per cent to obtain the foreign exchange saved. In equation (4.3) we have shown that the income of expatriate personnel has to be multiplied by a factor γ to obtain the foreign exchange cost due to income transfers. γ is assumed to be 50 per cent.

To arrive at social benefits and costs using social prices we have to adjust R, F' and L^U. The formula to be used to obtain the social benefits and costs using social prices (SC) is:

$$SC = MR + \alpha R + \phi F' + \lambda L^U \qquad (4.5)$$

α, ϕ and λ refer to the premium on revenue, foreign exchange and unskilled labour income respectively. We have discussed above that the value of α is 0.13.

In this paper we have not estimated the social price of foreign exchange. Therefore we have to obtain a value. One way of estimating it is to take the ratio of the black market rate and the official rate of foreign exchange. The black market rate is around US $1 = K.Sh.10 while the official rate is US $1 = K.Sh.8.37. The ratio is 1.195 and this shows that the foreign exchange earned or paid is under valued by 19.5 per cent which is the value of ϕ.

In Chapter III we have discussed the shadow wage rate. WE saw that it is dependent indirectly on the consumption discount rate (i) which we have discussed in Chapter II and have recommended to use three assumed values, 10, 15 and 20 per cent. Therefore we have three shadow wage rates namely, K.Sh.303, 125, and KSh.71 per month for 10, 15 and 20 per cent discount rate respectively. The market wage rate (average) is K.Sh.309 per month. Thus the shadow wage rate is less than the market wage by 0.02, 0.60, and 0.77 depending on the consumption discount rate. These figures are then the labour premium, λ. Since we have three values for λ we will have three values for the social benefits and costs using social prices. This is done in Table 4.61 to 4.63.

What we did so far is that we first adjusted Table 4.3 to exclude transfers and salvage values as cost items. This was shown in Table 4.4 and we obtained social benefits and costs at market prices, MC. Then we adjusted MC by using the economic (shadow) prices of the output, foreign exchange and wages of unskilled workers. Thus we obtained the social consumption benefits and costs using social prices. According to the conventional approach we discounted the social benefits and costs at

TABLE 4.61

Social Consumption Benefit at 10% Discount Rate

K.Sh. 000

	0	1	2-9	10
MC (From Table 4.5)	(8480)	1296	3156	4467
R (X 13 (R of Table 4.5)	-	(495)	(742)	(742)
$\phi F'$ (.195 (F'of Table4.5)	(985)	521	787	787
λL^U (.02 ($L^U$of Table4.5)	5	6	7	7
SC (equation 4.4)	(9460)	1328	3208	4519
Discount factor at 10%	1.000	.909	8(.593)	.389
Present values	(9460)	1207	15219	1758
NPV	8724			

TABLE 4.62

Social Consumption Benefit at 15% Discount Rate

K.Sh.000

	0	1	2-9	10
MC (Same as Table 4.61)	(8480)	1296	3156	4467
αR (" " "	-	(495)	(742)	(742)
$\phi F'$(" " ")	(985)	521	787	787
λL^U (.60(L^UofTable 4.5)	156	178	200	200
SC (Equation 4.4)	(9309)	1500	3401	4712
Discount factor at 15%	1.000	.870	8(.465)	.247
Present values	(9309)	1305	12652	1164
NPV	5812			

Table 4.63

Social Consumption Benefit at 20% Discount Rate

K.Sh.000

	0	1	2-9	10
MC (same as Table 4.61)	(8480)	1296	3156	4467
ϕR (" " ")	-	(495)	(742)	(742)
$\phi F'$ (" " ")	(985)	521	787	787
λL^U (.77 (L^U of Table 4.5)	200	229	257	257
SC	(9265)	1581	3458	4769
Discount factor at 20%	1.000	.833	8(.369)	.162
Present values	(9265)	1317	10208	773
NPV	3033			

10, 15 and 20 per cent and we obtained net present values which are all positive.

The above would have been justified if we had assumed the followings. First, saving and consumption have equal values to society. Second, the income distribution caused by the project will not affect the saving and consumption mix of the project output.

The methodology recommended and discussed in Chapter II is that of the UNIDO Guidelines. Hence the above first assumption is unacceptable because saving

is more valuable than consumption at the margin. The second assumption could be rejected because different groups have different marginal propensities to save. Therefore we introduce the third adjustment, that is, we will consider the value of saving to society and the distribution of income between different groups.

One can identify four groups. The government G, skilled workers, L^S, expatriate personnel, L^e, and unskilled workers L^U and their respective share can be obtained as follows:

$$SCL^S = Y\ (C1.21) \qquad (4.6)$$

$$SCL^U = (B2.3 + C1.3) \qquad (4.7)$$

$$SCL^e = B2.311 + C1.11 \qquad (4.8)$$

$$SCG = SC - L^U \qquad (4.9)$$

Out of the above four SCL^e, i.e. the consumption benefit of expatriate staff can be ignored. This is because our interest is to increase the aggregate consumption of the nationals and not of foreigners unless one takes an internationalist view. Thus we exclude equation (4.8).

In the conventional approach we did not mention as is usually the case the consumption benefits accruing to skilled and unskilled workers. An increase in consumption is an achievement of one of the goals of government. However, it is subject to the question whether or not this consumption benefit could have been realized in the absence of the project. It is true that some of the consumption benefits and costs are obtained due to the project but we have to take account of the premium we attach to skilled workers income (Y) and unskilled workers income (λ). In the case of skilled workers we will assume that the market wage rate is equal to the shadow wage rate and hence y equals one. In the case of unskilled workers we can assume that their total earning is an addition to consumption. This is to simplify the calculation because we have calculated in Chapter III the income of a migrant foregone due to the migration is K.Sh.34 per month. However, this is ignored here. Given the above we can utilize equation (4.8) and (4.9) to obtain SCL^U and SCG. Note that consumption benefit to skilled workers is left out because they could have earned the same in the absence of the project.

Table 4.7

Breakdown of Social Benefits and Costs between Groups

K.Sh.000

	0	1	2-9	10
At 10% Discount Rate				
SCG (equation 4.9)	(9200)	1031	2874	4185
SCL^U (equation 4.8)	260	297	334	334
AT 15% Discount Rate				
SCG	(9048)	1203	3067	4378
SCL^U	260	297	334	334
At 20% Discount rate				
SCG	(9005)	1284	3124	4435
SCL^U	260	297	334	334

The above table shows the values of SC broken down to the two groups who benefits from the project.

$$SC = SCG + SCL^U \qquad (4.10)$$

We have three values of SC because we have three values for the shadow wage rate depending on the consumption

discount rate. This has been discussed before.

Projects can either be financed from saving, consumption, or a combination of the two. In Chapter II we have discussed that the social price of investment (saving's social value) is higher than consumption. Therefore the investment cost that comes from saving has a higher value than the one which comes from consumption. In the case of this project we assume that the investment cost comes both from saving and consumption.

The project also generates saving as well as consumption. Therefore the appropriate formula to obtain net present value is equation (2.24) which is reproduced below.

$$\left[(1-s) + SP^{inv}\right] \quad Bt-Ko/(1+i)^t \qquad (2.24)$$

However, we have identified two groups that benefit from the project being represented by SCG and SCL^U. The consumption benefit they obtain can be shown by the following formulae.

$$C^G = \left[(1-S^G) + S^G P^{inv}\right] SCG \qquad (2.24)$$

$$C^L = \left[(1-S^L) + S^L P^{inv}\right] SCL^U \qquad (2.242)$$

where C^G and C^L refer to consumption benefit to government and unskilled workers respectively and S^L and S^G refer to the marginal propensity to save of labourers and government respectively.

From this we can obtain the total aggregate consumption benefits C.

$$C = C^G + C^L \qquad (4.11)$$

To obtain the net present value we discount C at the assumed 10, 15, and 20 per cent discount rate.

The required parameters are estimated in Chapter II and are given below.

$$S^G = 0.20$$

$$S^L = 0.00$$

$$P^{inv} = 5.35,\ 2.47,\ 1.60$$

$$i = .10,\ .15,\ .20$$

Using the above values we solve for $\left[(1-S^G) + S^G P^{inv}\right]$ and we get 1.87, 1.29, and 1.12 for 10, 15, and 20 per cent discount rate respectively. For $\left[(1-S^L) + S^L P^{inv}\right]$ we get a value of one because S^L is assumed to be zero.

Thus we can obtain C and discount it using 10, 15 and 20 per cent to get the net present value. This is done in Table 4.8 below.

TABLE 4.8

Social Aggregate Consumption Benefit

K.Sh.000

	0	1	2-9	10
At 10%				
C^G (1.87 SCG)	(17204)	1928	5374	7826
C^L ($1SCL^U$)	260	297	334	334
C (C^G+C^L)	(16944)	2225	5708	8160
Discount factor	1.000	.909	8.(.593)	.389
Present values	(16944)	2022	27078	3174
NPV	15330			
At 15%				
C^G ($1.29\ SC^G$)	(11672)	1552	3956	5648
$C(C^G + C^L)$	260	297	334	334
C^L ($ISCL^U$)	(11412)	1849	4290	5982
Discount factor	1.000	.870	8(.465)	.247
Present values	(11412)	1609	15959	1478
NPV	7634			
At 20%				
C^G (1.12 SCG)	(10086)	1438	3499	4967
C^L (1 SCL^U)	260	297	334	334
C ($C^G + C^L$)	(9826)	1735	3833	5301
Discount factor	1.000	.833	8(.369)	.162
Present values	(9826)	1445	11315	859
NPV	3793			

In the above table we obtained the net present values at 10, 15, and 20 per cent consumption discount rate. We have found that for the three rates the net present values are positive. Before we conclude our findings I have found it necessary to alter the mode of finance assumed so as to show the effect on the net present values and the different use of p^{inv}.

5.2 Project fully financed from government saving

In section (5.1) we have assumed the investment fund to come from saving and consumption. In this section, however, we will assume that the investment fund comes from government saving and hence no consumption sacrifice. In this case equation (2.24) is no longer valid. The proper equation is

$$\left[(1-S) + + SP^{inv} \right] Bt/(1+i)^1 \quad -P^{invKo}/(1+i)^1$$

The values of SC obtained in section (5.1) is valid. However, some adjustment is required in the case of Table 4.7 because of the need to show investment and benefits in year zero and 1 separately.

TABLE 4.9

Breakdown of Social Benefits and Cost Between Groups

K.Sh.000

		0	1	2-9	10
At 10% discount rate					
SCG	(a) Investment	(9200)	(645)	-	-
	(b) Benefits	-	1676	2874	4185
SCL^U		260	297	334	334
At 15% discount rate					
SCG	(a) Investment	(9048)	(645)	-	-
	(b) Benefits	-	1848	3067	4378
SCL^U		260	297	334	334
At 20% discount rate					
SCG	(a) Investment	(9005)	(645)	-	-
	(b) Benefits	-	1929	3124	4435
SCL^U		260	297	334	334

Now we have obtained the distribution of SC which we will adjust to obtain aggregate consumption benefit. In Table 4.10 we multiply investment cost by P^{inv} and benefits by $\bar{(}(1-S) + SP^{inv}\bar{)}$. The values of P^{inv} are 5.35, 2.47, and 1.60 while that of $\bar{(}(1-S)+SP^{inv}\bar{)}$ are 1.87, 1.29, and 1.12 for 10, 15, and 20 per cent

discount rate respectively.

TABLE 4.10

Social Aggregate Consumption Benefits

K.Sh.000

	0	1	2-9	10
At 10% discount rate				
C^G (a) Investment	(49220)	(3451)	-	-
(b) Benefits	-	3134	5374	7826
C^L	260	297	334	334
C ($C^G + C^L$)	(48960)	(20)	5708	8160
Discount factor	1.000	.909	8(.693)	.386
Present values	(48960)	(18)	27078	3150
NPV	(18750)			
At 15% discount rate				
C^G (a) Investment	(22349)	(1593)	-	-
(b) Benefits	-	2384	3956	5648
C^L	260	297	334	334
C (C^G+C^L)	(22089)	1088	4290	5982
Discount factor	1.000	.870	8(.465)	.247
Present values	(22089)	947	15959	1478
NPV	(3705)			
At 20% discount rate				
C^G (a) Investment	(14408)	(1032)	-	-
(b) Benefits	-	2160	3499	4967

	0	1	2-9	10
C^L	260	297	334	334
C ($C^G + C^L$)	(14148)	1425	3833	5301
Discount factor	1.000	.838	8(.369)	.162
Present values	(14148	1194	13150	859
NPV	1055			

Thus we found the project to have a negative net present value for 10 and 15 per cent discount rate and positive for 20 per cent. The negative values can be attributed to the value of P^{inv} which becomes smaller for higher consumption discount rates.

If we compare the findings in table 4.8 and Table 4.10 we reach the following conclusions. At a lower consumption discount rate the difference between the two is great. This is because of the high value of p^{inv} used. At 20 per cent discount rate the difference is low because the value of P^{inv} is low. Whether to accept or reject the project, it depends on the government assumed rate of discount. In this case study the 20 per cent discount rate criteria is given without taking the social price of investment into account.

6. Conclusion

We undertook this exercise to determine the commercial and social profitability of the project. In section (4) we discussed the commercial profitability. We found that the internal rate of return for equity is 28.3 per cent and for total investment 28.7 per cent. Using the conventional approach to social project appraisal we found the net present value to be positive at 20 per cent. Then we applied the Guidelines methodology and we obtained the net present value to be positive at 20 per cent. This is done in section (5.1).

From the above discusion we can conclude that the project is commercially and socially veable. Hence the government should contribute to the equity.

According to the case study we are required to calculate the social and commercial rate of return. We have calculated the commercial rate of return. For the social return, however, we are restricted by our assumption of the consumption discount rate (10,15, and 20 per cent). This is because the estimated values of social price of investment and hence the shadow wage rate are dependent on these assumed discount rates.

Therefore we rely only on the net present values and not on the rate of return.

We have shown the difference between the conventional approach and the UNIDO Guidelines methodology. The difference is not that great (we are not considering section 5.2) and this is due to the peculiar nature of the project. In that, the distribution of the benefit between the two groups, government and unskilled labour is not big enough the former geting the big share and the latter is so small that it will not have effect. In section (5.2) we assumed a different mode of finance and obtained negative values for 10 and 15 per cent discount rate. This section shows how important the mode of financing a project is. More will be said on the concluding chapter to follow.

PROFIT AND LOSS STATEMENT OF KFC

K.Sh.000

	0	1	2	3	4	5	6	7	8	9
A. Revenues										
1. Production (metric tons)	-	(3506)	(5260)	5260)	(5260)	(5260)	(5260)	(5260)	(5260)	(5260)
2. Value at K.Sh.1085 per ton	-									
B. Investment										
1. Import content										
1.1 Building, earthwork and infrastructure (c.i.f)	500									
1.2 Duty on (a) at 5%	25	-								
1.3 Equipment, engineering and installation (c.i.f. value	4533	-								
1.4 Duty at 5%	227	-								
2. Domestic component										
2.1 Building, etc.	1225	-								
2.2 Equipment, etc.	1190	-								
2.3 Land	21	-								
2.4 Preliminary planning and sundaries	445	-								
2.5 Total of 2.1 to 2.4	2881	-								
of of which:-										
2.6 Expatriate labour										
2.61. Net earnings	36	-								
2.62. Tax (20% of gross income	9	-								
2.7 Unskilled labour	260	-								
2.8 Stamp duties	70	-								
2.9 Others	2506	-								
3. Working capital	645	645								
4. Total investment cost	8811	645								

	0	1
C. Annual Operating Costs		
1. Wages and salaries		
1.1 Expatriates		
1.11 net earnings	-	36
1.12 income tax (90% of gross) ...	-	9
1.2 Skilled workers	-	79
1.3 Unskilled workers	-	297
2. Raw materials		
2.1 Imported	-	571
2.2 Local	-	674
3. Insurance	-	158
4. Office vehicles		
4.1 c.i.f. value	-	46
4.2 Duty 40%	-	18
5. Total Annual costs	-	1888
D. Operating profit	(8811)	1269
E. Others deductions		
1. Depreciation	-	-815
2. Interest.....	-	-397
F. Profit (loss) before tax*	(8811)	702
1. Profit tax (40%)	-	280
2. Profit (loss) after tax	(8811)	422

* Investment in year 1, Sh. 645 is added back.

2	3	4	5	6	7	8	9	10
36	36	36	36	36	36	36	36	36
9	9	9	9	9	9	9	9	9
91	91	91	91	91	91	91	91	91
334	334	334	334	334	334	334	334	334
856	856	856	856	856	856	856	856	856
994	994	994	994	994	994	944	944	994
184	184	184	184	184	184	184	184	184
56	56	56	56	56	56	56	56	56
23	23	23	23	23	23	23	23	23
2583	2583	2583	2583	2583	2583	2583	2583	2583
3124	3124	3124	3124	3124	3124	3124	3124	3124
-815	-815	-815	-815	-815	-815	-815	-815	-815
-358	-317	-278	-238	-198	-159	-119	-79	-40
1952	1992	2031	2071	2111	2150	2190	2230	2269
781	796	812	828	844	860	876	892	906
1111	1196	1219	1243	1267	1290	1314	1338	1363

TABLE 4B

CASH FLOW ANALYSIS T

	0	1	2
1. Cash inflow			
1.1 Loan finance	4406	-	-
1.2 Revenue from sales	-	3804	5707
1.3 Salvage value	-	-	-
1.4 Total inflow	4406	3804	5707
2. Cash outflow			
2.1 Investment	8811	645	-
2.2 Operating expenses.....	-	1888	2583
2.3 Loan repayment	-	441	441
2.4 Interest payment	-	397	357
2.5 Profit tax	-	280	781
	8811	3394	4162
3. Net cash inflow			
4. Net Present values			
4.1 at 20%			
Discount factor	1.000	.883	.694
Present values .....(	4405)	135	1072
NPV	1362		
4.2 At 30 %			
Discount factor 1.000		.769	.592
Present values	(4405)	315	915
NPV.....	(271)		
		IRR	= 20%

O EQUITY

K.Sh.000

3	4	5	6	7	8	9	10
-	-	-	-	-	-	-	-
5707	5707	5707	5707	5707	5707	5707	5707
-	-	-	-	-	-	-	1311
5707	5707	5707	5707	5707	5707	5707	7018
-	-	-	-	-	-	-	-
2583	2583	2583	2583	2583	2583	2583	2583
441	441	441	441	441	441	441	441
317	278	238	198	159	119	79	40
796	812	828	844	860	876	892	906
4137	4114	4090	4066	4043	4019	3995	3970
.579	.482	.402	.335	.279	.233	.194	.162
909	768	650	550	464	393	332	494
.455	.350	.269	.207	.159	.123	.094	.073
714	558	435	340	265	208	161	223

$$\left[\frac{1362}{(1362 + 271)}\right]^{(30 - 20)} = 28.3\ \%$$

TABLE 4C

CASH FLOW ANALYSIS TO TOTAL INVESTMENT

K.Sh.000

	0	1	2	3	4	5	6	7	8	9	10
1. Cash inflow											
1.1 Revenue from sales	-	3804	5707	5707	5707	5707	5707	5707	5707	5707	5707
1.2 Salvage value	-	-	-	-	-	-	-	-	-	-	1311
1.3 Total inflow	-	3804	5707	5707	5707	5707	5707	5707	5707	5707	7018
2. Cash outflow											
2.1 Investment	8811	645									
2.2 Operating expenses	-	1888	2583	2583	2583	2583	2583	2583	2583	2583	2583
2.3 Total cash outflow	8811	2533	2583	2583	2583	2583	2583	2583	2583	2583	2583
3. Net cash inflow	(8811)	1271	3124	3123	3124	3124	3124	3124	3124	3124	4435
4. Net present values											
4.1 At 20%											
Discount factor	1.000	.883	.694	.579	.482	.402	.335	.279	.233	.194	.162
Present values	(8811)	1122	2168	1809	1506	1255	1047	872	728	606	718
NPV	3020										
4.2 At 30%											
Discount factor	1.000	.769	.592	.455	.350	.269	.207	.159	.123	.094	.073
Present values	(8811)	977	1849	1421	1093	840	647	497	384	294	310
NPV	(499)										

$$IRR = 20\% + \frac{3020}{3020 + 499}(30 - 20) = 28.5\ \%$$

CHAPTER V

SUMMING UP

Our aim was to obtain the social price of investment and the shadow wage rate for Kenya. This was done in Chapter II and Chapter III. The first chapter was devoted to the discussion of the theoretical basis of cost-benefit analysis while Chapter IV was a case study. The aim in this chapter is to show the relationship between the theory of cost-benefit analysis and the UNIDO Guidelines approach, to briefly summarize the findings of chapter II and III, to show how there / findings were used in the case study and other general comments.

1. The Theory

It has been concluded in Chapter I that the theoretical basis of cost-benefit analysis is welfare theory. The main conclusions from this chapter are:

First, the theory of welfare is very controversial and therefore we are dealing with unresolved issues. The controversies mainly being: cardinal versus ordinal utility approach, the possibility of interpersonal and intertemporal comparison of utility, problem of defining social gains and losses.

Second, the basis of shadow pricing is to look into the price that would have prevailed if there were competitive markets. Thus it is optimal pricing and that is why we gave much attention to the discussion of Pareto Optimality.

Third, in cost-benefit analysis the aim is to quantifly benefits and costs (direct and indirect), thus we accepted cardinal utility approach, which made interpersonal and inter-temporal comparison of utility acceptable. To measure benefits we said that the willingness to pay approach is proper. To measure costs the concept of opportunity cost should be employed. However, opportunity cost is the benefit foregone from an alternative project measured by the willingness to pay approach.

2. The Practice and the Theory

In Chapter II we attempted to derive the social price of investment. However, we devoted one section of the Chapter (section 1) plus Appendix II dealing with the difference between consumption discount rate and the social price of investment. If we were to follow, as concluded in Chapter I, optimal pricing then there would have been no need to differentiate the two. However, the interest here is to find out what the existing social prices are and not the prices when or if the economy achieves

equilibrium. This has been discussed in detail in Appendix II.

Differentiating the two rates (consumption discount rate and the social price of investment) is the main difference between the conventional method of social appraisal and that of UNIDO Guidelines as well as the Little and Mirrlees approach. The conventional approach is more in line with the theory of cost-benefit analysis discussed in Chapter I and shown to be defective in Appendix II.

The methodology followed in this paper is that of the UNIDO Guidelines. Benefits and costs are measured in terms of consumption benefits and costs valued in terms of money. Thus consumption should have a value of one. However, we have said that at the margin investment (hence saving) is more important than consumption. Therefore the value of investment is greater than one, the value being determined by the productivity of capital, the marginal propensity to save, the rate of capital accumulation and the consumption discount rate.

In estimating the social price of investment and the shadow wage rate we employed the concept of opportunity cost, direct and indirect. In the case of the former the marginal productivity

of capital is the direct opportunity cost while consumption discount rates and the rate of capital accumulation are the indirect opportunity costs. The value obtained gives us an expression of a unit of investment in terms of consumption. In the case of shadow wage rate the direct opportunity cost is the output foregone in the alternative employment. We assumed that the average income of a migrant will reflect the output foregone. The only indirect cost considered is the cost of saving braught about by employment. If we were to follow the conventional approach the saving cost would have not been necessary, since it will be equal to the consumption benefit.

3. The Findings

In Chapter II before dealing with the social price of investment we discussed the consumption discount rate. Various authorities have agreed on the impossibility of calculating consumption discount rate using the diminishing marginal utility of approach. There were, however, some attempts following Irving Fisher, notably by Lal and Khan, to calculate consumption discount rate- which has been tried and dropped in this paper. Therefore we need to arrive at an assumed consumption discount rate. The difficult task was, what basis should one use to arrive at an assumed rate. We opted to use both productivity of capital and interest rates with some adjustments to obtain the three assumed rates. They are 10, 15 and 20 per cent.

The need to have a predetermined value of consumption discount rate arose because it is one of the determining factors of social price of investment (P^{inv}). The Guidelines methodology accepts that opportunity cost of investment is the marginal productivity of capital adjusted for saving rate, consumption discount rate and the rate of capital accumulation. To use this model we have to estimate marginal productivity of capital, q, and marginal propensity to save, s. Attemptes were made to estimate these parameters, however, the inadequacy and unreliability of the required data prevented us to do so. Therefore, we took the findings of Singh for q and for s we took Scott's estimate. Before we accepted their estimates we subjected them to some comparisons. On obtaining the national value of q and s we assumed the following. First, q and s are the same for the government and the private sector. Second q and s are constant over time. These assumptions were required because of shortage of data. The defect of these assumptions will be discussed later. Due to these assumptions, the social price of investment is the same for the government and the private sector and is also constant overtime.

We then obtained the value of P^{inv} which are found to be 5.35, 2.47 and 1.60 at 10,15, and 20 per cent consumption discount rate. Thus to convert investment to its consumption

equivalent we have to multiply by the above social price of investment. This value is not to be used only for initial investment cost but also for the output. One should find the saving and consumption mix of the output and value saving using the social price of investment.

In Chapter III we dealt with the shadow wage rate. We first estimated the direct opportunity cost of labour by using the average income of a migrant foregone. For the indirect cost we considered the cost of saving due to employment. It is shown that the indirect cost is greater than the direct. Since the cost of investment has three values we had three values for the shadow wage rate. The values obtained are Ksh. 303.19, 125.02, and 71.21 per month for consumption discount rate of 10, 15, and 20 per cent. Thus the shadow wage rate is 0.02, 0.40 and 0.23 of the value of the market wage rate which we obtained to be K. sh. 309 per month.

A word of caution as to the exactness of the estimated values of the social price of investment and the shadow wage rate is appropriate. As discussed partly we do not have a reliable information on some of the parameters, therefore, we cannot claim our findings to be exact. However, with some certainity one can say it is a useful finding. The shadow

wage rate, I accept, is an over estimation mainly because I have not considered income distribution which is one of the main objective of the government. This was left to the value judgement of the decision makes. If income distribution was considered as a benefit then the obtained shadow wage rate would have been smaller.

4. The use of social price of investment and the shadow wage rate in social project appraisal

In the conventional approach to social project appraisal one does not require pre-determined value of consumption discount rate. However, the approach we followed requires us to find the value of consumption discount rate so as to derive the social price of investment. In the case study of Chapter IV we showed how one can take market prices and through adjusting it arrive at the social benefits and costs. To do this the following steps were followed.

First by excluding transfer costs and benefits one can obtain the social benefit and cost using market prices. Second we have argued that market prices do not reflect social values. Two items are taken for consideration namely unskilled labour and foreign exchange. We found that the market price

of foreign exchange is less than the shadow price while for unskilled labour the market price is higher than the shadow wage rate. Therefore the social benefits and costs obtained using market prices are adjusted. This gives us social benefits and costs valued at social prices as opposed to market prices. If we were to follow the conventional approach we require only to discount the social benefits and costs and obtain the net present values. This is done in section (5.1) of chapter IV using 10, 15 and 20 per cent discount factor. This is justified because according to the conventional approach consumption and saving have equal values to society. This is then what is objected by the UNIDO Guidelines methodology. This implies that we need to carry the exercise two stages further (the second and the third stage).

The second task is to identify the source of investment fund and who benefits from the project. The main groups that can be identified are government, private sector, skilled workers, and unskilled workers. This classification is important because this groups are supposed to have different saving propensities. However, due to lack of data we have calculated social price of investment, P^{inv}, assuming that marginal propensity to

save for government and private sector is the same. Thus in the case study we had only two groups, the government, private sector and skilled workers are grouped together. The other group is unskilled workers whose marginal propensity to save is assumed to be zero. In the case study this classification has been done.

The third stage is to find out what percentage of the investment comes from saving and consumption. Similarly, we classif output between consumption and investment mix. To arrive at the aggregate consumption we value saving using our social price of investment and add with consumption benefits and costs.

In the case study we used a conversion factor, $\lceil(1-s)+SP^{inv}\rfloor$, for the cost incurred and benefits obtained by each group. In addition we assumed that the investment comes from both saving and consumption. Therefore we used the formula.

$$\lceil(1-s)+SP^{inv}\rfloor \quad \frac{Bt-ko}{(1+i)} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2.24)$$

The above formula did give a net present value which is simila to that obtained using the conventional approach. However, if one uses equation (2.24) consistaintly we will obtain the same project ranking.

Thus the UNIDO Guidelines will end up bringing the same result as the conventional approach. This conclusion is arrived at because of two assumptions, viz, common marginal productivity of capital and marginal propensity to save and these parameters are assumed to be constant. If we had obtained different values of P^{inv} for government and private sector our findings would have been different.

The above criticism appears to indicate that the conventional approach is enough and need not be changed. However, this conclusion could be objected on the following grounds. First, even if the UNIDO Guidelines approach leads to the same conclusion it is more logical than the conventional approach. Secondly the above conclusion is reached because of the peculiar nature of the project considered in the case study. It can be seen that the income distribution between the two identified classes is very small. In that, unskilled workers share of the income is so small that it will not bring any change. Thirdly, in the case study we have shown two modes of financing the project. The first one (5.1) was assuming that the investment fund has both consumption and saving sacrifice. The second one is assuming that the finance for investment comes from saving alone. In this case it is

argued that the proper equation to use is;

$$\frac{\left[(1-s)+SP^{inv}\right] Bt - P^{inv}K}{(1+i)^t}$$

Using this equation we found that the project is not profitable at all. On the other hand if the project was to be financed by project tied external aid we would have used the following equation:

$$\frac{\left[(1-s)+SP^{inv}\right] Bt - K}{(1+i)^t}$$

This is because the opportunity cost of foreign fund, if tied to project, is zero since it cannot be used in an alternative project. Thus even if the UNIDO Guidelines leads to same conclusion to that of the conventional approach in some cases, in others it does not. It favours more external loan financed projects and those financed from consumption. It is biased against projects whose output goes to unskilled workers.

5. Other points

The main problem that a researcher in developing countries

face is problem of data. It can be observed that in most cases to obtain parameters is the most difficult task. All parameters like the marginal propensity to save, labour-capital ratios, marginal productivity of capital, etc. have to be approximated. In the few instances where there are some information they are incomplete or unusable.

In this paper one can note that I have relied much on publications of IDS and the Statistical Abstract. The usefulness of the latter is obvious, however, that of IDS as a source of information for researchers as this one should be noted. Since the findings of the researchers of the inistitute are of value to the government it should be encouraged and supported.

To some extent government officers are reluctent to give information. Most projects and data are treated as confidential. In most cases they shift responsibility until the researcher loses hope and drops the idea. Some sort of cooperation must be worked out between the ministries and the university to avoid this problem

The data used in this paper, I ackowledge, are not so exact as one wishes them to be. However, I have tried

to quote or estimate / the required parameters as logical as possible. One might argue that such exercises as social cost-benefit analysis should wait until one accumulates enough data. This can be refuted on two grounds. One is that it is better to obtain educated guesses than to to leave out the whole exercise. Secondly, the exercise will provide the required experience for future use. In addition to these such an exercise will create or show the demand for more data and of course there will be a response to such demands.

APPENDIX I

A Brief Comparison of UNIDO Guidelines and the Little and Mirrlees Approach to Project Appraisal

From the available discussions on cost-benefit analysis the UNIDO, Guidelines For Project Appraisal,[1] and the Little/Mirrlees, Project Appraisal and Planning For Developing Countries[2] present comprehensive approaches. Both approaches recognise the fact that market distortions, externalities, and some-merit wants have rendered market prices unsuitable for social cost-benefit analysis. Therefore the need to work-out social values, termed as shadow prices in the UNIDO Guidelines and accounting prices an the Little/Mirrless, is obvious.

The two works are different from the conventional approach to cost-benefit analysis. The Guidelines differ by its use of social price of investment and at the same time the consumption discount rate. Little/Mirrless on the other hand differ from the conventional approach by their use of uncommitted social income in terms of convertable foreign currency as numeraire. Our concern here is to discuss the approach of the two works to cost-benefit analysis.

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1. UNIDO, Guidelines for Project Appraisal, New York, United Nations, 1972.

2. I.M.D. Little and J.A. Merrless, Project Appraisal and Planning for Developing Countries, London, Heineman Educational Ltd, 1974.

The Guidelines discuss the methodology for preparing shadow prices of commodities, foreign exchange, labour, investment and the social rate of discount.

The aim of this Appendix is then to show the difference and similarities of the two approaches.

A. The Theory Underlying the Two Approaches

The Guidelines as well as Little/Mirrless accept the fact that the main objective of society is to maximize social welfare. This requires, apart from other considerations, that there be efficiency in production and exchange. In addition it requires a 'fair' income distribution. The Guidlines approach is based on the principle that the value of commodities as increasing or decreasing welfare is measured by consumers' preferences as reflected in their willingness to pay. The Guidelines consider that individuals are not always good judges of their welfare. Specially on such matters as the social value of saving, income distribution, some merit wants, etc. To this effect the willingness to pay has to be adjusted to account for such variables, the valuation of which appears to be based on the assumption of a representative government, at first glance. However, the Guidelines recognize this defect and avoids using it as much as possible.

Little/Mirrlees are vague on the theoretical foundation of their methodology. However, from their use of 'border prices' as a unit of account one can deduct that they are following optimal pricing policy. Since the use of border prices as a unit of account is based on optimal pricing the approach can to justified if we assume the country to be competitive in world trade. In this case border prices can register marginal cost or value of the commodity diverted to the use under consideration be it from domestic or external sources.

The other assumption made by Little/Mirrless is optimal tariff policy. This assumption is required because their numeriere is expressed in terms of convertible foreign currency. The use of general controls on foreign exchange will lead to increased divergence between the actual and accounting prices and hence it will distorte the numeraire. Therefore the assumption of optimal tariff is required.

Eventhough vague and except for the above assumptions the underlying theory of cost-benefit analysis between the two approaches appears similar. One problem with the Little/Mirrlees approach is the assumption that the country be competitive in world trade. The less developed countries in most cases are not competitive in world market. This can be seen from existing quota ristrictions, trade blockade, weak bargaining power, etc.

At the same time governments in less developed countries are in favour of general controls unless they are pressed heavily by balance of payment and debt servicing problems.

As noted in the conclusion, cost-benefit analysis - according to the UNIDO Guidelines - is not strictly in line with the theory of welfare. Instead of looking for optimal pricing policy (discussed in Appendix II) the Guidelines follow a price system which reflects the economic situation. In optimal pricing policy, however, we are looking for the price that would have prevailed if the economy was in equilibrium.

B. The Choice of Numeraire

The Guidelines use aggregate consumption expressed in domestic prices as their numeraire. Therefore everything is expressed in terms of aggregate consumption (negative and positive). Little/Mirrlees, on the other hand, use present uncommitted social income expressed at world prices. Uncommitted in a sence that it is not assigned to any specific project. Little/Mirrlees assume that a " rational government will so far possible equalize the social value of investment." [359] Therefore the uncommitted social income can be seen as investment funds - at least in value terms - in the hands of the government. The choice of uncommitted social income is because cost-benefit analysis is used to allocate public funds between competing

projects and it helps dicision - makers in those lines. The choice of foreign currency, in the case of Little/Mirrlees, is due to the role of foreign exchange including foreign aid, loans and investments play in the less developed countries.

The Guidelines choice of numeraire - aggregate consumption - appears to be logical. This is because the function to be maximized in welfare economics is aggregate-consumption and projects should be valued by how much they contribute to this end.

According to Little/Mirrlees the choice of numeraire does not change the ranking of projects provided the other required parameters are properly estimated. However, the choice of numeraire determines which of the parameters should be estimated. Since uncommitted social income is the numeraire Little/Mirrlees need not calculate the social price of investment. They do, however, give a formula for the social value of saving in addition to estimating the social price of consumption. The UNIDO Guidelines, however, use aggregate consumption as a numeraire and hence need only to estimate the social price of investment. The unit of account has also its effect. Since the Guidelines use domestic prices the shadow price of foreign exchange has to be calculated. Little/Mirrlees use world prices, therefore there is no need to obtain the social value of foreign exchange.

C. Valuation of Outputs and Imputs

The Guidelines and Little/Mirrlees use different classification of a project output. Whereas the classification of the Guidelines is between consumer and producer goods, the Little/Mirrlees classification is based on traded and non-traded goods and services.

According to the Guidelines, to find out the benefit of a project one has to determine the "net output" and the willingness to pay for the additional supply. As for direct cost estimates of "net inputs" the willingness to pay for those inputs have to be determined. Eventhough these are the major issues to be decided there are other estimates required to come out with social values of inputs and outputs.

Little/Mirrlees apply border prices, c.i.f. prices for importables and f.o.b. prices for exportables. It is not necessary that the goods be actually imported or exported. They classify goods as traded and non-traded goods. For traded goods valuation, one has to apply c.i.f. or f.o.b. prices depending on whether the good in question is importable or exportable. For non-traded goods one has to break them down to treadables (to be valued as above) and non-traded good and the process is repeated again and again.

The distinction between traded and non-traded goods can bring problem in some cases. At the same time the recommendation for valuing non-traded goods - breaking them down to traded and non-traded goods- is hard to handle. This problem is acknowledged by Little/Mirrlees and they recommend the use of marginal cost. Similar problem can also arise between consumer and producer goods. There are goods which are used both for consumption and production. However, this problem could be solved by taking the final use of a good and the problem is not as difficult as that of non-traded and traded goods.

D. Treatment of Labour

The Guidelines as well as Little/Mirrlees concentrate on unskilled labour and both take a labour surplus economy. The Guidelines approach was discussed in Chapter. III and we will concenterate on the Little/Mirrlees approach.

Little/Mirrlees treat labour as a non-traded good. To use their model the source of labour has to be known so that the direct opportunity cost measured in terms of marginal productivity can be estimated. Marginal productivity of labour is defined by Little/Mirrlees as "the loss of production [valued in accounting prices] which would arise by withdrawing a man from agriculture or any other sector of the economy if the rest did not work harder." [170] Marginal productevity is not

equal to marginal social cost and therefore one has to take account of the value of 'additional resources devoted to consumption' and 'the consumption value of employment.'

The formula provided by Little/Mirrlees for the calculation of the shadow wage rate (SWR) is given below.

$$SWR = m+(c'-c)+(1-\frac{1}{S})(c-m)$$

Where,

c' = additional resource devoted to consumption

c = consumption of wage earner

m = marginal productivity of wage earner.

1/S = social value of a unit of consumption

S = value of uncommitted government income, measured in terms of consumption so committed through employment.

In elaborating their model Little/Mirrlees have the following to say:

> The first term is the marginal productivity of labour, the second is the cost associated with providing the consumption level c but does not form part of the consumption level (...) and the last term is the cost of having an extra c-m committed to consumption. [.271]
> The above formula can be written as,
>
> $$SWR = c'-1/S\ (c-m)$$

c' measures the committment to consumption, while the second term

measures the consumption cost of employment.

Little and Mirrlees have compared their model for SWR with that of the UNIDO Guidelines. Using their (Little/Mirrlees) symbol SWR according to UNIDO Guidelines:

SWR = M+(Capitalists Saving Rate) (S-1) W.

They assumed that it is a public project and public sector saving rate is 1.
Then the Guidelines formula becomes

SWR = M+(S-1)W

If we take the Guidelines assumption that workers save nothing the Little/Mirrlees formula becomes

$$SWR = \frac{M}{S} + (1-\frac{1}{S})W$$

Thus the Guidelines formula is S times that of the Little/Mirrlees.

If one compares the data requirement of the two approaches that of Little/Mirrlees is higher. Specially when one considers how the value of S is to be estimated (will be discussed in section D below). Apart from this, Little/Mirrlees do not provide methods of obtaining the values of the required parameters. Hence the Guidelines approach appears easier.

D. The Social Value of Investment

To obtain the social value of investment, S_o, (which Little /Mirrlees want to interpret as the social value of government income) Little/Mirrlees make use of the following formula

$$So = \frac{(1-g)(c-m)n+vg(i-gr)}{i-r}$$

where

g = marginal propensity to consume of the public sector.

c = consumption of wage earner arising from wage employment

m = marginal productivity of wage earner

n = extra employment of unskilled worker

i = consumption discount rate

r = rate of capital accumulation

v = ratio of weight for consumption in period t and t+1.

To solve This model Little/Mirrlees recommend to use an economic model and solve for an objective function. The other approach is to make a plausible assumption on the values of the parameters that make S_o. They in fact conclude that it is a difficult task to follow.

E. Conclusion

The theoretical basis of both approaches is based on welfare theory. Both are concerned with maximizing the net benefits accruing from public projects. The Guidelines make use of preferences revealed in the market place adjusted for externalities.

Therefore the concept of willingness to pay is applied for evaluating benefits and indirectely for evaluating costs. Little/Mirrlees are vague on the theoretical basis of their work. Some of the theories they use are inferred from their use of world prices. They appear to follow optimal pricing under the implicit assumptions that the country is perfectly competitive in world trade and the government follows optimal tariff policy. These assumptions are imperactical. Considering this the UNIDO Guidelines appears to be theoretically sound.

The Guidelines use aggregate-consumption valued at domestic currency as numeraire while Little/Mirrlees use uncommitted government income expressed in convertible foreign currency. In cost-benefit analysis the factor to be maximised is aggregate-consumption which can be taken as the dependent variable while uncommitted government income can be seen as a factor affecting aggregat -consumption. As is acknowledged by Little/Mirrlees the choice of numeraire should not lead to different conclusions. However, being the factor to be maximised it appears to be appropriate to use aggregate consumption.

Little/Mirrlees' methodology of cost-benefit analysis requires that one should calculate accounting prices for output, inputs, and social value of consumption. The Guidelines methodology requires the preparation of shadow prices for output,

labour, capital, foreign exchange and other inputs. The main difference arises from the selection of numeraire. Since aggregate-consumption expressed in domestic currency is the numeraire in the Guidelines there is no need to calculate the social values of consumption but has to calculate the social value of investment and foreign exchange. The Little/Mirrlees methodology takes investment expressed in foreign currency as numeraire. Therefore shadow prices of investment and foreign exchange are not to be calculated but they need to calculate the social value of consumption.

The major problem with the Guidelines is that it provides no guideline to obtain the social rate of discount. The problem is compounded when one observes that the social rate of discount is one of the factors affecting the social price of investment and the shadow wage rate. To assume the social rate of discount is a difficult task.

The major problem of Little/Mirrlees approach (in general) is that it requires much information. Prices (domestic) of outputs and inputs have to be converted to world prices. The shadow wage rate requires one to obtain the social price of government income which is difficult to solve given the model.

To conclude, given that there is possibility of estimating the social discount rate or reconcilling with the social price

of investment the Guidelines approach is sound than that of Little/Mirrlees. In addition some work specially by Scott (forth coming) has been done as regards shadow wage rate in Kenya following Little/Mirrlees approach. Hence, by comparing the outcome using UNIDO Guidelines with that of Scotts findings the difference between the two approaches can be observed.

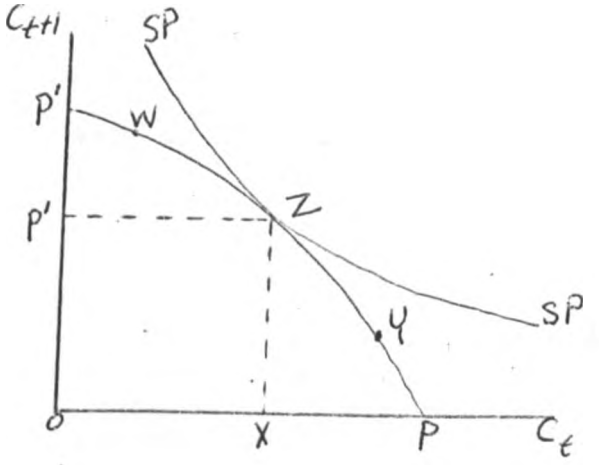
Appendex II

Consumption Discount Rate (CDR) and Social Price of Investment (P^{inv}) - Condition for Equality

In Chapter II it was mentioned that there is a school of thought which argues that CDR and P^{inv} are equal and therefore either one of them could be used as a social discount rate. In this part we will discuss the assumptions under which the two will be equal and the relevance of the assumption to developing countries.

Dasgupta and Pearce [8], UNIDO Guidelines [53] use almost similar approaches in discussing the conditions under which CDR and P^{inv} are equal. However, because of the simplicity of their approach, Dasgupta and Pearce's presentation will be discussed below.

Figure II.a



The two axis show consumption in period t and t+1. P'P shows consumption possibility curve between the two periods. If in period t investment is PX then consumption is CX. PX can be thought of as consumption diferred - through investment - to period t+1.

> The curve P'P shows the marginal net productivity of capital, any investment giving greater gains in (undiscounted) consumption in the future compared to the foregone consumption in the present period..... [148]

Therefore,

$$\text{Slope } P'P = \frac{C_{t+1}}{I_t} = MNP_k + 1 \quad \ldots\ldots\ldots \quad (II.1)$$

where I_t is investment in period t and MNP_k is the marginal net productivity of capital. Equation (II.1) can be written as

$$MNP_k = \text{Slope of } P'P - 1 \quad \ldots\ldots\ldots\ldots \quad (II.2)$$

MNPk can as well be taken as the marginal efficiency of capital or the marginal rate of return.

The slope of the curve SP shows the marginal rate of substitution between present and future consumption from society's welfare function.

$$\text{Slope SP} = \frac{u'(C_t)}{u'(C_{t+1})} \quad \ldots\ldots\ldots\ldots\ldots \quad (11.3)$$

which has been shown to be equal t+1 in discussing CDR.

Therefore:

$$\text{STPR} = \text{Slope of SP-1} \quad \ldots\ldots\ldots \quad (11.4)$$

If society reaches such a point as Z - 'the bliss point'-

then $$\text{STPR} = \text{MNP}_k \quad \ldots\ldots\ldots\ldots\ldots (11.5)$$

and since,

$$P^{inv} = \text{MNP}_k \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (11.6)$$

and $$\text{CDR} = \text{STP}_k \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (11.7)$$

Then it follows that,

$$\text{CDR} = P^{inv} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (11.8)$$

There are two points to be mentioned with regard to the equality of the two.

The first is the assumption that the economy has or we pretend as if optimality is achieved. However, as Dasgupta and Pearce

[1] and others acknowledge, less developed countries are on a point such as Y where $STPR < MNP_k$ which indicates that investment is below optimal. Points like W, i.e. to the left of Z, indicate that $STPR > MNP_k$ which shows that there is over investment. As investment increases and reaches optimality, at point Z it is tangential with the society's preference curve, SP. It is the highest possible indifference curve and is tangential to the transformation curve P'P at Z. Therefore, the equality of CDR and P^{inv}.

Since the justification is based on optimality one cannot accpet equality of CDR and P^{inv} in non-optimal situation. Therefore, inappropriate for a developing economy.

The second defect is that it is a two period model. This is defective to derive the social price of investment because of the presence of reinvestment. Therefore using a two period model leads to under estimation of P^{inv}. There are other variables ignored in obtaining values of P^{inv}. CDR has an influence on P^{inv}. The consumption benefit obtained from this years investment should be discounted so that the future aggregate-consumption benefit will be comparable to the present aggregate cost.

Taking the above into consideration the theoretical justification for the equality of CDR and P^{inv} and to use either one

to discount future benefit is unacceptable. This leaves us then with the school of thoughts which recommend to discount future benefits by CDR and to value investment costs using p^{inv}. Feldstein [10], regarding this approach, says that it is better to value capital costs,

> .....directly by placing a "shadow price" on the funds used in project and to make all inter-temporal comparisons with an STP [consumption discount rate] function.
>
> [365].

Thus we have accepted this approach and have rejected the assumption of the equality of CDR and p^{inv}.

Appendix III

Incremental Output - Capital ratio, y

The assumption of surplus labour could imply two things. The first is that productivity of labour is zero. The second is that, there is divergence in the wage rate between the formal or capitalist sector and the informal or traditional sector. To estimate y (incremental output-capital ratio) some authors[1] take a linear production function where the independent variable is only capital, K. This implies zero marginal productivity of labour.

This approach has been adopted by Tobin [51] who uses the following model:

$$y_t = yK_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (III.\ 1)$$

where, y_t = GDP originating in the sector at factor cost and constant prices in period t.

K_t = The stock of capital at the beginning of period t.

y = marginal productivity of capital (assumed to be equal to average productivity).[2]

Tobin does not include time lag because K_t is given at beginning year value, and thus there is a built-in time lag.

Given the above model (III. 1) average capital-output ratio (ACOR) and average output-capital ratio (ACCR) can be obtained. By definition ACOR is capital over output and AOCR is the inverse of ACCR.

$$ACOR = k_t/y_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (III.1.1)$$

---

1. Tobin [51], Powell [38], etc.

2. The production function used is such that the average and marginal productivity of capital are equal.

$$AOCR = y_t/k_t \quad \text{.....(III.1.2)}$$

from (III.1) we can see that

$$k_t/y_t = 1/y \quad \text{.....(III.1.3)}$$

Noting equation (III.1.1)

$$ACOR = 1/y \quad \text{....(III.1.4)}$$

From equation (III.1) we can see that

$$y_t/k_t = y \quad \text{.....(III.1.5)}$$

Noting equation (III.1.2)

$$AOCR = y \quad \text{.....(III.1.6)}$$

By definition IOCR is change in capital to change in output

i.e. Dk_t/Dy_t .....(III.1.7)

Taking equation (III.1) it can be seen that ICOR is the inverse of marginal productivity of capital

$$ICOR = 1/y = Dy_t/Dk_t \quad \text{.....(III.1.8)}$$

In a similar fashion it can be shown that;

$$IOCR = y = Dy_t/Dk_t \quad \text{.....(III.1.9)}$$

Due to the production function used equation (III.1.3) and equation (III.1.8) are equal .

Tobin takes the intial capital and the annual capital formation as known but K_t as unknown[1]. He, therefore, assumes alternative rates of depreciation of .01, 0.02, 0.04, 0.07, and 0.10 of the operational stock of capital during the year under consideration. Using the assumed depreciation rates, given the initial capital formation, the value of K_t and y_t, ICOR can be estimated.

---

1. Tobin appears to have used the 1958 survey as the initial capital.

Tobin has calculated ICOR by industry based on 1964-1971 data and is shown in Appendix IV. From this IOCR is obtained and is given in Table III.1 below. The main findings are the following.

First, for all enterprises y has a minimum value of 0.35 and a maximum of 0.80. The minimum and the maximum is obtained by the depreciation rate used.

Second there is large variation between the sectors. Taking the depreciation rate of 0.02 the minimum is 0.17 for 'Electricity and Power' and the maximum is 2.99 for 'Banking, Insurance and Real Estate'.

Table III.1

Estimated Incremental Output-Capital Ratio by Industry - 1964-1971

Sector	Assumption about depreciation rates. .01	.02	.04	.07	.10
A. Enterprises					
B. Manufacturing & Repair	.41	.50	.60	.79	.90
C. Building & Construction	.26	.34	.40	.50	.57
D. Electricity & Power	.13	.17	.21	.26	.36
E. Transport & Communication	.19	.24	.30	.38	.50
F. Mining & Quarying	.35	.41	.50	.60	.61
G. Agriculture, Forestry & Fishing	.45	.60	.80	.90	1.20
H. Commerce	.90	1.07	1.30	1.80	2.04
I. Banking, Insurance & Real Estate	2.40	2.99	3.00	3.90	4.80
J. All Services including Dwellings	.32	.38	.40	.56	.67
All Enterprises	.35	.47	.53	.67	.80
General Government					
K. Public Administration	.70	.95	1.20	1.60	1.90
L. Education	1.45	1.70	1.92	2.30	2.70
M. Health Services	.57	.80	.82	1.00	1.20
N. Agricultural Services	.22	.31	.40	.53	.67
P. Other Government Services	.20	.22	.24	.27	.30

Source: Calculated from Tobin, J. "Estimation of Sectoral/Output Ratios in Kenya." Discussion Paper No. 171, Inistitute for Development Studies, University of Nairobi, 1972.

Tobin [51] did not provide an overall averge as regards incremental output-capital ratio. To obtain an overall average the percentage contribution of each industry to GDP is worked out for 1964 and 1971. The average of the two is then used as weights. The following table III.1 shows the derivation of the weights.

Table III.2

GDP by Industerial Origin, 1964 and 1971

(at current prices K£m)

	1964	%	1971	%	Average of
	(1)	(2)	(3)	(4)	(2) and (4)**
Monetary Economy*					
All Enterprises	195.69	81	344.78	78	80
General Government					
Public Administration	16.84	7	26.80	6	7
Education	11.20	5	32.05	7	6
Health	4.69	2	10.68	2	2
Agricultural Services	4.41	2	7.83	2	2
Other Services	3.13	1	12.06	3	2
Total General Government	40.28	18	89.42	20	19
Total Monetary Economy	235.97		439.27		100

Source: Statistical Abstract, 1975

* Private households (domestic services and defence is excluded.

** Total doesn't add upto 100 because of approximations.

The average of the two years, column 5, is used as weights to derive an overall average IOCR as shown in Table III.3 below. From the table we note that the overall IOCR is higher than what has been obtained for 'All Enterprises.' This is not surprising if one observes (Table III.1) that 'Public Administration,' 'Education', and 'Health Services' have a higher IOCR as compared to most enterprises except 'Banking, Insurance and Real Estate.'

Thus IOCR, y, according to Tobin can be taken as .44,. 61, .67, .86, 1.00 for .01,.02, .04, .07 and .10 rate of depreciation respectively.

Figure III.3

Derivation of Overall Incremental Output-Capital Ratio, by Industry (1964-1971)

		Assumption about Depreciation Rates				
Sector	Weight	.01	.02	.04	.07	.10
All Enterprises	.80	.28	.38	.42	.54	.64.
General Government						
Public Administeration	.07	.05	.07	.08	.11	.13
Education	.06	.09	.12	.13	.17	.19
Health	.02	.01	.02	.02	.02	.02
Agricultural Services	.02	.00	.01	.01	.01	.01
Other Government Services.	.03	.01	.01	.01	.01	.01
Overall	1.00	.44	.61	.67	.86	1.00

The other work to be mentioned in this connection is that of Powell's [38]. Powell's production function is similar to that of Tobin's [51] and therefore the marginal and the average productivity of capital are equal. Powell has calculated ICOR for Kenya from which it is possible to obtain y (IOCR). His findings are given below

Table III.4

Incremental Capital-Output Ratio and Incremental Output-Capital Ratio, (1964-1974)

Year	Incremental Capital Output Ratio[1]		Incremental Output-Capital Ratio[2]	
	All Sectors	Non agricultural Non Resedential	All Sectors	Non Agricultural Non residential
1964	-	-	-	-
1965	0.55	0.43	1.81	2.32
1966	0.31	0.50	3.23	2.00
1967	1.77	1.27	0.57	0.79
1968	1.07	1.16	0.93	0.85
1969	1.35	1.69	0.74	0.59
1970	1.36	1.42	0.74	0.70
1971	2.04	1.75	0.49	0.57
1972*	1.55	n.a	0.65	n.a
1973*	1.58	n.a	0.63	n.a
1974*	1.61	n.a	0.62	n.a

Source: 1. Powell, R.P., "The stock of Fixed Capital in Kenya in the Monetary Economy," Occasional Paper No. 9, Inistitute for Development Studies, University of Nairobi, 1973.

2. IOCR is the inverse of ICOR.

* Enteries under these years are my own estimates-refer to Appendix V Table VI.2 on how the capital stocks are estimated. n.a.- not available.

From the above table one can observe that IOCR has shown a tendency to decline overtime. Powell's study is upto 1971 and in that year IOCR was found to be 0.49. 1971 can be considered an exceptional year because when updated Powell's capital stock estimate (refer to Appendix V Table 5.3) we have found the average IOCR between 1972 and 1974 to be around 0.63.

The third work to be mentioned as regards to incremental output - capital ratio is that of the World Bank's [55] . The authors of the Report uses Vanek's type model[1], i.e.

$$K = k^1 + {}^z/_r \quad \text{.....(III.2)}$$

where K = gross ICOR

k^1 = net ICOR showing the effect of new investment on output

z = share of current income divoted to replacement

r = rate of growth of GDP.

ICOR by industry is calculated using the above model and the purpose is to determine the capital requirement which is consistant with the target growth rate. The findings of the Report is given in Table III.5 below.

---

1. Some, like Sato [43] disagree with such an approach because of the presence of spurious correlation which "arises because the equation is divided by a variable whose value is much depressed." [504].

As in the case with Tobin's [51] findings variation between sectors is high. According to the finding of the World Bank Report, ICOR varies between 0.080 for 'Ownership of Dwellings' to 2.000 for 'Banking, Insurance and Real Estate'. As regards the overall ICOR; the Report [55] says that ICOR,

> ....(for fixed capital) of 2.1 for the total GDP and 2.34 for monetary GDP [was obtained] in Kenya in 1966. Adding 0.3 for inventories we get an overall ICOR of 2.4 ... However, over the period since 1964 overall ICOR increased rapidly, and by 1970 it has increased almost by 50 per cent to 3.2 .....[93]

From this we can see that IOCR has declined form 0.42 in 1966 to 0.32 in 1970.

Table III. 5

Sector Growth Rates, ICOR and IOCRs Assumed in Basic Projections (1970)

Sector	Sector Growth Rate	ICOR	IOCR
Non monetary Sector	4.000	2.105	.475
Agriculture	6.500	2.207	.453
Mining & Quarying	7.800	5.021	.199
Manufacturing & Repair	12.470	1.897	.527
Building & Construction	7.500	7.693	.130
Electricity & Water	8.000	6.727	.149
Transport, Storages & Communication	8.000	9.869	.101
Whole sale & Retail Trade	8.000	1.113	.898
Banking, Insurance & Real Estate	8.000	0.500	2.00
Ownership of Dwellings	8.000	12.500	.080

(continued)

Sectors	Sector Growth Rate	ICOR	IOCR
Other Services	8.000	5.361	.187
General Government	8.000	3.221	.311
Overall			.320

Source: World Bank, Kenya: Into the Second Decade, Baltimore and London, the John Hopkins University press, 1975.

The fouth work to be mentioned is that of Singh [48]. His model is discussed in Appendix IV and is given below.

$$y = {}^{dQ}/_{dk} = y_o + \beta \; {}^{dL}/_{dk} \; x \; \alpha \; {}^{dM}/_{dk} \quad \ldots\ldots\ldots\ldots \quad (111.3)$$

where Q, K, L & M refer to output, capital, labour, and import while y_o and y refer to gross and net IOCR respectively, d refers to changes β and α are constants.

Using this model and 1965 - 1970 data Singh [48] found y to be 0.31 for Kenya [39].

So far we have discussed the work of four authors as regards IOCR, y. However, the methods of estimation can be devided into two depending on the production function used. The first is Tobin's [51] and Powell's [38] while the second is the World Bank's [55] and Singh's [48] work.

Tobin estimated y to be around 0.61 for the period 1964 - 1971

using a 5 per cent depreciation rate for capital.[1] For the period 1969 - 1971 Powell obtains an average of 0,66 for y and when we update this the average for 1972 - 1974 is found to be 0.63.

For the period 1965 - 1970 Singh [48] estimated the value of y to be 0.31. The World Bank [55] on the other - hand estimated the value of y to be 0.32 for 1970.

From the above discussion we can observe that Tobin's and Powell's estimate are similar. This is mainly due to the methodology used Tobin ard Powell use a linear function with the assumption of zero MP_L. Singh and the World Bank Report use a log linear function without the assumption of zero MP_L. The same holds true for the World Bank's and Singh's estimate. The estimate of the first two is greater than the - latters.

Before concluding this section it is better to discuss the validity of the assumption of zero marginal productivity of capital. Table III. 6 below shows that during some seasons, mainly April to August labour demand is above average for the year in almost all districts. While in most cases labour demand,

1. 5 per cent is chosen because Powell uses this rate to obtain capital stock estimates.

in the enumerated districts, is below average for the period November to March.

Table III. 6

Estimated Monthly Variations in the Index of Total Labour Demand for Crop Work in Certain Districts, 1969 - 1971

(District monthly overage = 100)

Month	Bumoga	Kiambu	Kisii	Siaya	Nyeri	S. Nyanza
April	167	102	135	369	142	175
May	183	93	130	267	111	148
June	151	118	120	85	109	132
July	98	108	102	104	97	136
August	85	111	100	80	96	144
September	123	105	100	92	100	127
October	112	103	103	76	99	95
November	72	93	96	17	84	58
December	65	95	96	12	89	44
January	48	101	90	24	81	39
February	45	77	62	11	91	51
March	50	94	67	64	102	49

Source: ILO, Employment, Incomes and Equity: A Strategy for Increasing Productive Employment in Kenya, Geneva, ILO, 1972, P. 42

According to the ILO Report [14]

> .... In Vihiga, with an extremely high population density, small plot sizes and a very large number of adult males away in towns, it is estimated 30 per cent of the (and on individual holdings remain uncultivated. If these seasonal peaks could be reduced or staggered more land could be cultivated or casual wage employment, could be obtained on other firm .... [41]

The exsistence of such emperical evidences will not make the assumption of zero marginal product of labour acceptable. However, it can be shown that the ratio of modern sector employment as compared to the total labour force is around 18 per cent. This indicates that the marginal product of labour is low, the underlying assumption being that the traditional sector is less productive. Noting these one can reject the assumption of zero marginal productivity of labour but one can also note that even if it is not zero the marginal product of labour is low.

Taking the above into consideration the finding of Tobin and Powell over estimates y. Thus I have considered the World Bank's and Singh's estimate as being reasonable. This implies that we cannot use the incremental output-capital ratio y, as an approximation of the marginal product of capital, q. However, we also note that the difference between, q and y, is small. This discussion is required because we will make use of the value of y which is taken to be 0.31 (Sing's estimate) in Chapter III.

APPENDIX IV

Estimated Capital-Output Ratio (1970)

Sector	Assumption about depreciation rate				
A. Enterprieses	.01	.02	.04	.07	.10
B. Manufacturing & Rapair	2.45	1.98	1.66	1.34	1.12
C. Building & Construction	3.47	2.89	2.48	2.04	1.74
D. Electricity & Water	7.35	5.78	4.78	3.79	3.14
E. Transportation & Communication	5.13	4.05	3.36	2.67	2.21
F. Manufacturing & Quarying	2.92	2.43	2.09	1.73	1.47
G. Agriculture, Forestry & Fishing	2.21	1.66	1.32	1.02	.83
H. Commerce	1.22	.94	.76	.59	.49
I. Banking, Insruance & Real Estate	.41	.35	.31	.29	.21
J. Other Services Including Dwellings	3.11	2.55	2.60	1.77	1.49
All Enterprices (B. to J)	2.90	2.28	1.88	1.48	1.23
General Government					
K. Public Administeration	1.43	1.05	.83	.63	.51
L. Education	.69	.59	.52	.44	.38
M. Health Services	1.17	1.45	1.22	1.00	.84
N. Agricultural Services	4.57	3.25	2.51	1.88	1.50
P. Other Government Services	5.03	4.55	4.15	3.68	3.30

Source: Tobin, "Estimate of Sectoral/Output Ratio's for Kenya" Discussion Paper No. 171, Inistitute for Development Studies, University of Nairobi, 1972.

Appendix V

Estimating the Marginal Productivity of Capital

Singh [48] hypothesis that output (Q) depends on capital (K), labour (L), import (M), and time (t).

$$Q=F\ (K,L,M,t) \qquad (1)$$

Differentiating totally and dividing both sides by Q we get

$$\frac{dQ}{Q} = g\frac{dK}{Q} + \beta\frac{dL}{Q} + \alpha\frac{dM}{Q} + \gamma\frac{dt}{Q}$$

$$= g\frac{dK}{Q} + \left(\beta\frac{L}{Q}\right)\frac{dL}{L} + \left(\alpha\frac{M}{Q}\right)\frac{dM}{M}$$

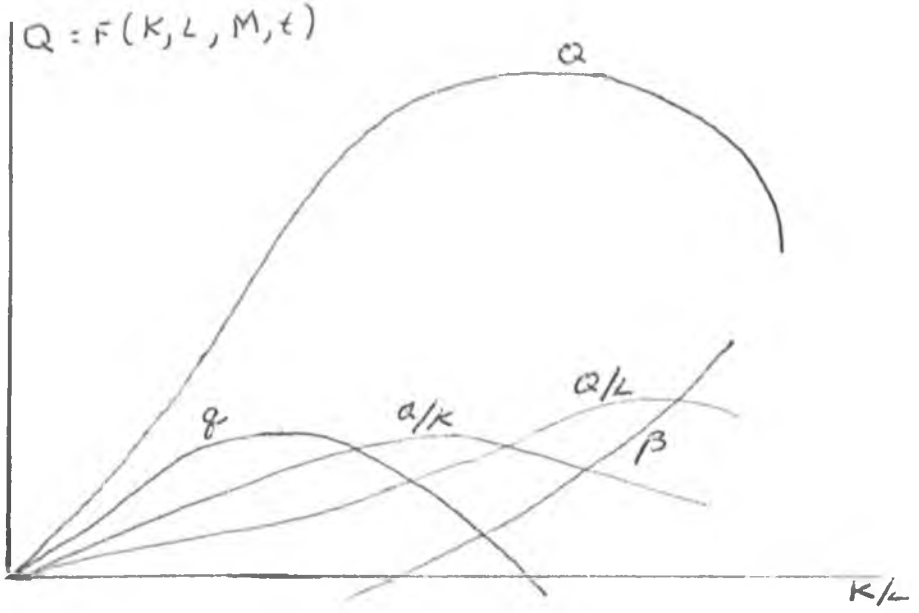
To obtain the slope of the marginal curves Singh uses the following hypothesis

1. The marginal product curve rises upto a point and declines. This is because as more of an input is used the less productive it becomes depending on the possibility of factor substitutebility, economies of scale, etc.

2. The marginal product of labour rises as the total amount of capital is increased. This is because as capital-labour ratio rises labour becomes more efficient.

These two hypothesis are shown in the diagram below

Figure V.1



The marginal product curve, q, declines as output increases before the output-capital labour ratio declines. The higher the $^{k}/_{L}$ ratio the higher β the marginal product of labour.

3. It can be shown that the marginal products of capital and labour are functions of $^{Q}/_{L}$. Taking the Cobb-Douglas production function

$$Q = F(K,L) = K^{q} L^{1-q} \qquad (2)$$

Then q the marginal product of capital can be written as

$$q = q\frac{k\, q_L\, ^{1-q}}{k} = q\ ^{Q}/_{k} \qquad (2a)$$

But,

$$K = \left[QL^{(1-q)}\right]^{1/q} = \frac{1}{Q}q\ \ L_{q}^{\frac{q-1}{}} \qquad (2d)$$

Hence

$$q = {}^{qQ}/_{Q^{1/q}} L^{\frac{q-1}{q}} = q\ \frac{Q^{\frac{q-1}{q}}}{L^{(q-1)/q}}$$

$$= q\ (Q/L)^{q-1/q} = K^{q}/_{L}$$

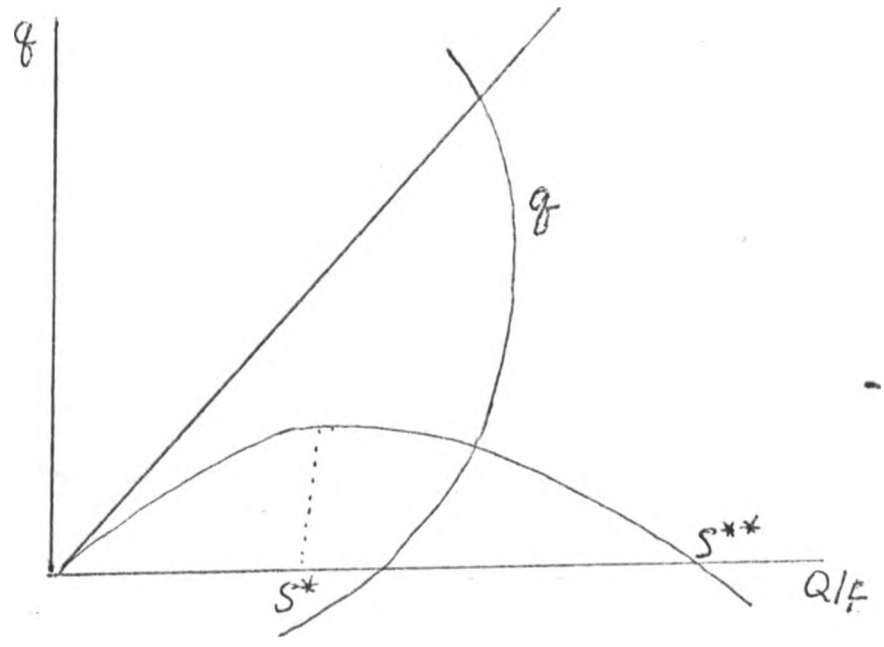
Similarly

$$\beta = (1-q)\ Q/L = 1\ (Q/L) \qquad (2d)$$

From this we hypothesize that the marginal productivities of capital and labour are both functions of output-labour ratio.

4. Substitution possibilities between capital and labour increase upto a point, say S*, and then diminishes untill it reaches a saturation point , say S**.

Figure V. 2



The decline of the marginal product curve between S* and S** can be smooth, 'suggesting high substitutability' or very abrupt suggesting 'Liontef fixity'. If it is the Leontif type it approaches a straight line, shown by C in the diagram and drops to S**. In short as the value of C rises we approach the Liontif

type. There is a problem of estimating C therefore Singh suggests that we regress with terms like $K^{1/4}$, $K^{1/2}$ K, and K^2 and choose the one which gives the best fit.

5 Hypothesis for the marginal product of capital

Accoring to Singh there are five factors that govern the marginal product of capital. The first is output-labour ratio this is explained in hypotheses two, three, and four. The second is the size of the domestic market as measured by Q. The effect is that if there is economies of scale the marginal product curve shifts upword. Taking the q and Q curves in Figure VI as Q increases q increases but at a declining rate.

The third factor is the proportion of government investment. The public sector is considered to be less efficient as compared to the private sector. This implies that the higher the share of public investment the lower the overall marginal product of capital. This view is controversial because of the presence of counter arguments against this. However, Singh does not mention this.

The fourth factor is distortion which is also said to affect productivity of capital. According to Singh

> ....Under certain assumptions there will be associated with each Pareto optimal-efficient point a set of efficiency prices, or equilibrium prices in factor markets. A departure from these prices would reduce output and shift the production possibility frontier inwards. It is possible that the further removed one is from the equilibruim prices the greater could be the reduction .... [12]

There are two factors considered in price disequilibruim. First, the distortion in capital price and second the distortion in exchange rate.

The fifth factor is availability of imports. Shortage of imported capital goods, intermidiate and primary inputs will decrease the productivity of capital.

Incorporating these effects Singh uses the following equation to determine q.

$$q=a_1 - a_2(Q/L)^{c_1} + a_3(\log Q) - a_4(Q/M)^{c_2} + a_5\left[\frac{1}{\log(Q/L)}\frac{PI}{II}\right] - a_6 D_1 - a_7 D_2 \quad (3)$$

where Q,L,M, are output, labour and import respectively and PI is public investment, TI is total investment, D_1 price distortion in capital market, D_2 price distortion in exchange rate,

$q, a_1 \ldots\ldots\ldots a_7$ are constants.

6. Hypothesis for the marginal product of imports

Imports are taken as a factor of production and Singh hypothesis that marginal product of import depends on M and Q. [13]

$$\alpha = M\,(M,Q) \qquad (4a)$$

Formally

$$\alpha = a_8 - a_9\,(M/Q)^{L_3} - a_{10}\ \lg Q \qquad (4b)$$

Thus

$$\alpha\ M/Q = a_8(M/Q) - a_9\,(M/Q)^{c_3+1} - a_{10}\ \lg Q\,(M/Q) \qquad (4c)$$

7 Hypothesis for the marginal product of labour

According to Singh as (Q/L) rises from near zero to higher levels the marginal product of labour increases from negative values and overtakes Q/L.

Therefore one can write

$$\beta = a_{11} + a_{12}\ (Q/C)^{C_4} \qquad (5a)$$

Converting to partial elasticieties we will get

$$\beta = a_{11}\,(L/Q) + a_{12}\,(Q/L))^{C_4} \qquad (5b)$$

8. The general model

Given the values of q, α and β namely equation (3), (4c), and(5b) and noting equation (1b) the model for growth rate can be written as:

$$dq/Q = a_o + (\text{equation } 3)\ dk/Q + (\text{equation } 4c)\ .dM/M + (\text{equation } 5b)\ dL/L$$

This equation is the proper one according to Singh to predict growth rate.

Appendix VI

Capital Stock Estimates

Mureithi [11] and Powell [19] have estimated capital stock in Kenya. The finding of the two is given below.

Table VI.1

Powell's and Mureithi's Estimate of Fixed Capital Stock in Kenya, 1964-1974

(1964 prices, K £ million)

Year	Powell's Estimate[1] (beginning year)	Mureithi's Estimate[2] (year end)
1964	467	367
1965	473	410
1966	479	442
1967	494	483
1968	523	536
1969	554	598
1970	585	660
1971	628	737
1972	663*	913*
1973	731*	1038**
1974	774*	1114**

Source: 1. Powell, R.P., "The stock of fixed Capital in Kenya in the Monetary Economy 1964-1971," Occasional Paper No. 9, Insistitute for Development Studies, University of Nairobi, 1973.

2. Mureithi, L.P., "Demographic and Technological variables in Kenya's Employment Scene," Discussion Paper No. 201, Institute for Development Studies, University of Nairobi, 1974.

*Own estimates using Powell's depreciation rate.

** Own-estimates using Mureithi's depreciation rate.

Powell uses a depreciation rate of around 13.3 per cent and 4.3 per cent for equipment and structures respectively and the depreciation rate for the total is around 5 per cent. Mureithi uses a depreciation rate of 2.5 per cent. This difference in the rate of depreciation has the following effects. First, capital depelets rapidly in the case of Powell than Mureithi. Due to this reason one can observe from the table above that upto 1967 Powell's estimate is greater than Mureithi's. However, 1967 and onwards Mureithi's estimate is greater. Secondly, Powell's estimate of the base year capital is greater than Mureithi's. How the two authors derive their capical stock is shown in Table VI.2 and VI.3.

Apart from the depreciation rate the coverage between the the two estimates is different. Powell excludes capital formation outside the monetary economy and also capital formation on 'Land Improvement and Plantation Development', and 'Breading Stock and Darily Cattle.' These are included in Mureithi's estimate.

The other difference is that Powell's estimates are given at beginning year values while Mureithi's are given at year end. This implies that Powell has a built-in time lag.

Noting that our interest is in the monetary economy and since Powell's estimate has a built-in time lag his estimate of capital stock has been used in this report.

Table VI.2

Powell's Estimate of Fixed Capital Stock

(at current prices)

Equipment

Capital Formation During the year (K£m) \ Base Capital Stock at End of year K£m		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
		124	107.5	93.2	80.8	70.1	60.7	52.7	45.7	39.6	34.4	29.8
	1964	24.71	21.5	18.6	16.1	14.0	12.1	10.5	9.1	7.9	6.8	5.9
	1965		24.1	20.9	18.1	15.7	13.6	11.8	10.2	8.8	7.7	6.7
	1966			31.58	27.4	23.7	20.6	17.8	15.5	13.4	11.6	10.1
	1967				45.72	39.6	34.4	29.8	25.8	22.4	19.4	16.8
	1968					39.8	34.5	29.9	26.0	22.5	19.5	16.9
	1969						41.85	36.3	31.5	27.3	23.6	20.5
	1970							55.1	47.8	41.4	35.9	31.2
	1971*								70.6	61.2	53.1	46.0
	1972*									72.88	63.2	54.8
	1973*										81.47	70.6
	1974*											78.81
	Total	124.0	128.9	132.7	142.4	163.1	175.9	188.8	211.6	244.5	275.2	309.3

* Own estimates.

Structures

Capital Formation During the year (K£m) \ Base Capital Stock at end of year K£m	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
	343	328.3	314.1	300.6	287.7	275.3	263.5	252.2	241.3	230.9	221.0
1964	19.2	18.4	17.6	16.9	16.1	15.4	14.8	14.1	113.5	12.9	12.4
1965		21.0	20.1	19.2	18.4	17.6	16.8	16.1	15.4	14.8	14.1
1966			26.9	25.7	24.6	23.5	22.5	21.6	20.6	19.7	18.9
1967				38.7	37.0	35.4	33.9	32.4	31.0	29.7	28.9
1968					46.3	44.3	42.4	40.6	38.7	37.2	35.6
1969						48.7	46.7	44.1	42.2	40.4	38.7
1970							53.2	50.9	48.7	46.6	44.6
1971								70.8	67.8	64.8	62.1
1972									82.11	78.5	75.2
1973										89.65	85.8
1974											106.31
Total	343.0	346.7	351.8	362.4	383.8	411.5	440.0	472.0	519.2	575.5	636.9

Source: Powell, R.P., "The stock of Fixed Capital in Kenya in the Monetary Economy 1964-1971" occasional Paper No. 9, IDS, University of Nairobi, 1975.

Table VI.3

Total Capital Stock in Kenya - 1964-1974

(current prices K £ m)

Year	Equipment	Structures	Total
1964	124.0	343.0	467.0
1965	128.9	346.7	475.6
1966	132.7	351.8	484.5
1967	142.4	362.4	504.8
1968	163.1	383.8	546.9
1969	175.9	411.5	587.4
1970	188.8	440.0	628.8
1971*	211.6	472.0	683.6
1972*	244.5	519.2	763.7
1973*	275.2	575.5	850.7
1974*	309.3	636.8	946.1

Source: Refer to Table VI.2

* Own estimates.

Table VI.4

Mureithi's Estimate of Fixed Capital Stock - at current prices

		1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Base Capital Stock at End of Year K£m		171.64	167.35	163.17	159.09	155.11	151.23	147.45	143.76	140.17	136.67
Capital Formation During the Year (K£m)	1958	33.51	32.67	31.85	31.09	30.28	29.52	28.78	28.07	27.37	26.89
	1959	34.63	33.76	32.92	32.09	31.29	30.51	29.75	29.01	28.28	27.57
	1960	36.60	35.68	34.79	33.92	33.07	32.24	31.43	30.64	29.87	29.12
	1961	29.00	28.28	27.57	26.88	26.20	25.55	24.91	24.29	23.66	23.07
	1962	31.14	30.36	29.60	28.86	28.14	27.43	26.74	26.07	25.66	25.02
	1963	30.29	29.53	28.80	28.08	27.37	26.69	26.04	25.37	24.74	24.12
	1964	43.21	42.13	41.07	40.05	39.05	38.07	37.12	36.19	35.29	34.41
	1965	45.74	44.59	43.48	42.39	41.33	40.30	39.29	38.31	37.35	36.42
	1966		61.22	59.68	58.19	56.73	53.31	53.93	52.58	51.27	49.99
	1967			82.21	80.15	78.15	76.19	74.29	72.43	70.62	68.85
	1968				89.53	87.29	85.10	82.97	80.89	78.87	76.90
	1969					93.73	91.38	89.10	86.87	84.65	82.53
	1970						112.71	109.89	107.14	104.14	101.85
	1971							144.20	140.59	137.08	133.65
	1972								160.37	156.36	153.23
	1973									181.50	177.96
	1974										188.78
	Total	410.02	444.35	492.93	560.75	634.01	709.52	801.67	1051.46	1208.25	1362.10

Source: Mureithi, L.P., "Demographic & Technological variables in Kenya's Employment Scene," Discussion Paper No. 201, Insititute for Development Studies, University of Nairobi, 1974.

Appendix VII

Table VII.1

Small Farms and Settlement Schemes: Estimates of No. in Wage Employment 1971/72 '(000)

Province	Regular				Casual				All Employees			
	Adult Male	Adult Female	Juvenile	Total	Adult Male	Adult Female	Juvenile	Total	Adult Male	Adult Femal	Juvenile	Total
Nyanza	29.2	1.3	8.8	39.3	44.9	12.0	8.1	65.0	74.1	13.3	16.9	104.3
Western	81.1	1.5	6.5	89.1	62.6	26.9	1.6	91.1	143.7	28.4	8.1	180.2
Rift Valley	17.1	0.8	4.0	21.9	9.9	4.9	1.7	16.5	27.0	5.7	5.7	38.4
Central	22.7	6.3	3.3	32.3	9.1	22.6	2.8	34.5	31.8	28.9	6.1	66.8
Coast	5.7	0.7	3.5	9.9	2.4	1.2	1.2	4.8	8.1	1.9	4.7	14.7
Eastern	28.1	4.5	12.4	45.0	14.8	9.7	2.3	26.8	42.9	14.2	14.7	71.8
Total	183.9	15.1	38.5	237.5	143.7	77.3	17.7	238.7	327.6	92.4	92.4	476.2

Source: Kenya Statistical Abstract 1975.

Table VII.2

Small Farms and Settlement Schemes: Estimates of Earning of Wage Employees 1971/72 (K£000)

Province	Regular				Casual				All Employees			
	Adult Male	Adult Female	Juvenile	Total	Adult Male	Adult Female	Juvenile	Total	Adult Male	Adult Female	Juvenile	Total
Nyanza	871.5	34.5	161.6	1067.2	1253.3	529.6	193.2	1976.1	2124.4	564.1	354.8	3043.3
Western	2409.8	147.0	142.0	2698.8	1120.8	343.5	19.5	1483.8	3530.6	490.5	161.5	4182.6
Rift Valley	914.1	20.6	83.8	1018.5	146.1	32.1	12.2	190.4	1060.2	52.7	96.0	1208.9
Central	1638.3	430.3	161.6	2230.2	371.6	439.8	50.9	861.5	2009.9	869.3	212.5	3091.7
Coast	714.0	18.0	61.2	793.2	80.4	43.2	7.2	130.8	794.4	61.2	68.4	924.0
Eastern	1905.5	178.9	439.8	2524.2	418.7	280.1	32.3	731.1	2324.2	459.0	472.1	3255.3
Total	8452.8	829.3	1050.0	10332.1	3390.4	1667.5	315.3	5373.7	11843.7	2496.8	1365.3	15705.8

Source: Kenya Statistical Abstract 1975.

Table VII.3

Small Farms and Settlement Schemes: Average Annual Earning 1971/72 (K£).

Provinces	Regular				Casual				All Employees.			
	Adult male	Adult Female	Juvenile	Total	Adult Male	Adult Female	Juvenile	Total	Adult Male	Adult Female	Juvenile	Total
Nyanza	29.83	26.54	18.36	27.16	27.91	44.13	23.85	30.40	28.71	42.41	20.99	29.18
Western	29.71	98.00	21.85	30.29	17.90	12.77	12.14	16.29	24.57	17.27	19.94	23.21
Rift Valley	53.46	25.75	20.95	46.51	14.76	6.55	7.18	11.54	39.27	9.25	16.84	31.48
Central	72.17	68.30	48.97	69.05	40.84	19.42	18.18	24.97	63.20	30.08	34.84	46.28
Coast	125.26	25.71	17.49	80.12	33.50	36.00	6.00	27.25	98.07	32.21	14.55	62.86
Eastern	67.81	39.76	35.47	56.09	28.29	28.88	14.04	27.28	54.18	32.32	32.12	45.34
Total	45.96	54.92	27.27	43.50	23.60	21.57	17.81	22.51	36.15	27.02	24.29	32.98

Source: Calculated from Table VII.2 and VII.3.

Appendix VIII

Nature of Employment Prior to Migration, 1968

Source of migration	In School	Employed For Wage	Self Employed	Farming	Employed Part-time	Un-Employed	Total
Urban Center	12	6	1	4	3	3	29
Nyanza	113	35	11	38	8	26	231
Western	74	33	4	37	5	24	177
Rift Valley	21	6	3	1	2	6	39
Central	187	50	12	33	11	51	344
Coast	38	11	3	17	2	5	76
Eastern	63	23	7	44	7	14	158
Uganda & Tanzania	7	10	4	6	1	4	32
Total	515	174	45	180	39	133	1086

Source: Haris, J., Rempel, H., and Todaro, M., " Rural-to-Urban Labour Migration: A Tabulation of the Responses to the Questionnaire used in the Migration Survey," Discussion Paper No. 92, Inistitute for Development Studies, University of Nairobi, 1970, p. 36.

Appendix IX

Consolidated Minimum Wages and Housing Allowance Deductions As of January 1, 1975

	Municipalities							
	Nairobi	Mombasa	Eldoret	Kisumu	Kitale	Nakuru	Thika	Nyeri
Employees aged 8 years and above								
Monthly contract (shs)	300	300	275	275	275	275	275	275
Housing allowance deductions	40	40	35	35	35	35	35	35
Employees aged below 18 years								
Monthly contracts (shs)	217	217	195	195	195	195	195	195
Housing Allowance Deductions	25	25	20	20	20	20	20	20

	Townships									Other Areas	Farm Workers
	Embu	Meru	Kakamega	Kericho	Nanyuki	Machakos	Kisii	Nuyahururu	Naivacha		
Employees aged 18 years and above											
Monthly Contracts (shs)	275	275	275	275	275	275	275	275	275	175	150
Housing Allowance Deductions	35	35	35	35	35	35	35	35	35	30	30
Employees aged below 18 years											
Monthly contracts (shs)	195	195	195	195	195	195	195	195	195	128	107
Housing Allowance Deductions	20	20	20	20	20	20	20	20	20	15	30

Source: Statistical Abstract, 1975.

Appendix X

SOCIAL SECURITY CONTRIBUTION

A. TABLE OF STANDARD CONTRIBUTION

Wage Sh.	Contribution Sh.	Recoverable from Employees Sh. cts.
206 to 215	21.00	10.50
216 to 225	22.00	11.00
226 to 235	23.00	11.50
236 to 245	24.00	12.00
246 to 255	25.00	12.50
256 to 265	26.00	13.00
266 to 275	27.00	13.50
276 to 285	28.00	14.00
286 to 295	29.00	14.50
296 to 305	30.00	15.00
306 to 315	31.00	15.50
316 to 325	32.00	16.00
326 to 335	33.00	16.50
336 to 345	34.00	17.00
346 to 355	35.00	17.50
356 to 365	36.00	18.00
366 to 375	37.00	18.50
376 to 385	38.00	19.00
386 to 395	39.00	19.50
396 to 405	40.00	20.00
406 to 415	41.00	20.50
416 to 425	42.00	21.00
426 to 435	43.00	21.50
436 to 445	44.00	22.00
446 to 455	45.00	22.50

(continued)

Wage	Contribution	Recoverable from Employee
456 to 465	46.00	23.00
466 to 475	47.00	23.50
476 to 485	48.00	24.00
486 to 495	49.00	24.50
496 to 505	50.00	25.00
506 to 515	51.00	25.50
516 to 525	52.00	26.00
526 to 535	53.00	26.50
536 to 545	54.00	27.00

B. DAILY PAID EMPLOYEES

For daily paid employees the standard contribution for each employee shall be fifty cents, of which the employee's share deductible from wages by the employer shall be twenty-five cents (Third Schedule, paragraph 2).

C. CASUAL WORKERS

The amount of the special contribution shall be one shilling for every full twenty shillings of the total sum of wages payable by the contributing employer in the month to all the casual workers employed by him (Section 13 (3)).

Source: Kenya: National Social Security Fund; Leaflet No. 9.

Appendix XI

Estimated Distribution of Income in Kenya, 1969

Decile	% share of Total income	Cumulative Share
1st	1.8	1.8
2nd	2.0	3.8
3rd	2.6	6.4
4th	3.6	10.0
5th	4.0	14.0
6th	4.5	18.5
7th	5.2	12.7
8th	8.3	32.0
9th	11.7	43.7
10th	56.3	100.0

Analysis of 10th decile:

Bottom 5%	12.0
Top 5%	44.3
Top 2%	29.0
Top 1%	18.5

Source: Morrison, C. 'Income Distribution in Kenya', World Bank, 1973, (mimeo).

Appendix XII

Principal Interest Rates, 1973-1975

Percent

	31st December		
	1973	1974	1975
Centeral Bank of Kenya			
Re-discount Rate for Treasury Bills	1.60	6.00	6.00
Advances against Treasury Bills	5.29	7.00	7.00
Bills and Notes under corp. Finance Sch.			
Discounts	5.50	7.00	6.50
Advances	6.00	7.00	6.50
Other Bills and Notes:-			
Discounts	5.50	7.00	7.00
Advances	6.50	7.00	7.00
Advances against Kenya Government Securities	6.50	7.00	7.00
Kenya Commercial Banks:			
Time Deposits:-			
Minimum 30 days (7 days notice)	3.00	5.125	5.125
3 months - less than 6 months	3.50	5.125	5.125
6 months - " " 9 "	3.75	5.375	5.375
9 " - 12 months (incl.)	4.00	5.625	5.625
12 " (K.sh. 100,000-250,000)	4.50	5.875	5.875
Savings Deposits	3.00	5.00	5.00
Loans and Advances (Minimum)	7.00	8.00	8.00
Other Fincincial Inistitution			
Kenya Post Office Savings Bank deposits	3.00	3.00	5.00
Agricultural Finance Corporation, Loans	7.50	8.00	8.00
Hire-Purchase Companies and Merchant Banks:-			
Deposity (time)	3.00-7.50	5.00-7.50	5.00-7.50
Loans	7.00-12.00	8.00-12.0	8.00-12.0
Building Societies:-			
Deposits	5.50-6.50	5.50-6.5	5.50-6.50
Loans	7.50-10.0	7.5-11.5	7.50-11.00

Source: Economic Survey 1976, p. 30.

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