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Payment Relay Type B/C Calculating For Benefit-Platform Concept And Share Cropping Duty Set Price

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ABSTRACT
This paper presents a basis for calculating economics for public finance purposes. In it, benefit platform is defined and recommended as cost value of the facility utility part of a public project. Typical methods currently used by donor organizations for benefit-cost evaluation are based on cost recovery market (such as traffic estimates for highway projects) and not directly on public receipts. However, the actual cost of setting up the facility cover indirect costs including construction, management, and administration. This paper seeks to bring government program decision basis to payment series mathematics (perceptional payment relay calculation) and separate governance for public projects financing from complementary management competence for the existence of the facility required. Relevant basics of decision theory is included in the background towards the case logic, details of the mathematics is presented in the appendices. The resulting equations and charts are situated in the discussion as necessary for a public project decision taking. They cover options for a time duration benefit-cost (b/c) control, benefit discounting, sustained benefit within envelope of maximum duration and set interest, and in step equivalent integer interest and duration based offers. Finally, share cropping as an idea is presented as a basis to share roles between two participation parties with one as a land owner and the other as a tenant. With it, both parties will not be entangled in 'payment as reward', as one debate is on pure annuity value and the other on duration offer of annuity, based on common present worth of the case project facility.
Keywords: Annuity, Benefit, Cost, Government Program, Perceptional, Public finance, Relay

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I. INTRODUCTION

Benefit in general can be said to be a 'feel' quality, that is, an individual perceives he or she has received a benefit when he or she has received (from a benefactor). Benefit is simply defined as an advantage or profit gained from something **(Concise Oxford English Dictionary)**. However, when it comes to reversing the benefactor status for objective development needs, the determination of benefit has always been a subjective action in public finance.

A road is a typical example of a public good. Its common character is described as non-rivalrous and non-excludable: (goods and services are non-rivalrous when the amount that one person consumes does not affect the amount that other people can consume, and goods and services are non-excludable when, once produced, there is no way to stop anyone from consuming them). Basic consequential questions arising cover 'who should pay more for public goods (projects and services)' – those that benefit the most from it or everybody?

Now, how can benefit and specific beneficiaries be objectively defined in public goods such as roads? In highway economics, for road as public good, estimated expected traffic and savings in vehicle operating cost, maintenance cost etc. are used as estimates of the benefit value to be weighed against cost of construction, rehabilitation, etc. Such process as common for roads seems to use cost parameters at price that are not the 'same cost parameter units', in other words, it is not complete in decision value. For there to be better normative theory for objective debate, there needs to be a 'complete' definition of the benefit as part of the cost expenditure, that is, on what part of the project can benefit be attributed as price or cost measure. That part of the project that is 'the benefit' is simply the platform of the facility objective, such as, the road pavement is the platform for the facility objective different from drainage works, earthworks, etc. that are integral to realizing it.

The underlying idea is that the existence of the platform (such as the pavement) means traffic; vehicle operating cost savings, etc. associated with it. Hence, whereas the value of the associates construction cost may not definitely be of a fixed value relative to direct recovering cost from provided benefit, the pavement cost can be of a fixed value and its existence means basis for returns recoverable.

II. BACKGROUND

A decision is said to be complete if any preference relation that refers to a set of entities over which it is defined is defined as domain of the first. A formal property of completeness is defined for a relation and its domain. The relation (≥) is complete if and only if for any elements A and B of its domain, either A≥ B or B ≥ A.

For the relation to be complete there has to be a common link to compare A and B. Preference completeness is basically assumed in the subject of decision theory (1).

Measuring economic benefits and costs is done in some ways such as (2):

1. Using willingness to pay: such as the shadow price of an output is the marginal willingness to pay for it by the people who enjoy it
2. Using marginal opportunity cost: An input's opportunity cost is its value in uses outside the government program.

Classically, benefit-cost ratio is the ratio of the present (discount) value of all net benefits apart from the initial capital costs, to those capital costs measured in money terms. The discount rate adopted being the social time preference rate. The project is considered viable if the ratio is higher than a pre-determined minimum (cut off value) which is given by the estimated ratio of opportunity cost of public investment project to its actual capital cost (3).

Nevertheless, it is noteworthy that transfers (transactions that simply transfer purchasing power among the members of the economy) are not economic benefits and costs, because they do not augment or reduce the amount of goods and services available in the economy as a whole. A basic working concept for economic efficiency is the fundamental theorem of welfare economics thus: the market equilibrium of an ideal, well-functioning market system yields an efficient allocation of the available economics resource. Simply, economists understand economic efficiency ahead of distributional equity which is also important. Having a more efficient economy is like having a larger cake in principle notwithstanding how the cake should be shared. It is desirable that the cake be as large as possible. Secondly, economic efficiency is the specialized contribution of economists to the debate about desirable government policies. Debate on government spending as wastage is common, however, to function efficiently government must determine whether the costs of government program is as low as possible and whether the benefits are greater than the cost. Benefit-cost analysis is a systematic methodology for measuring the benefits and costs of government programs to the population as a whole. An important feature of benefit-cost analysis is the inclusion and valuation of nonmonetary benefits and costs which should be considered in government decisions even if they are ignored in commercial decisions. Economists emphasize that both efficiency and equity are important for determining the level of social welfare (2).

III. METHODOLOGY

An arrangement whereby the product of a piece of land is divided between tenant and landlord on the basis of a fixed proportion is referred to as 'sharecropping' (4).

The idea behind this is that rent need not be paid in the form of produce (as when the tenant undertakes to give a certain proportion of the output he derives from the land to the landlord) or labour (as when in exchange for the use of a piece of land, he undertakes to devote a certain proportion of his labour time to work on the landlord's holding). Clearly there is no important difference between the last two since receipt of produce is equivalent to receiving the benefit of given amounts of land and labour.

As feature idea, a different utility-activity based definition of benefit-cost $\left({}^{b}/_{c}\right)$ as a fraction of the total project cost is suggested thus, given a combination of an equivalent annuity value and the time spread is defined here as Benefit Platform:

$$ {}^{b}/_{c} = \frac{Cost\ of\ Utility\ Platform\ as\ delivering\ benefit,\ C_{bp}}{Total\ Cost\ of\ Project\ as\ C_{bp} + other\ associated\ project\ costs\ C_0} \qquad 3.1 $$

That is,

$$ {}^{b}/_{c} = \frac{C_{bp}}{C_{bp} + C_0} \qquad 3.2 $$

Being guided by price engineering concept as based on payment series mathematics (5), a perceptional for benefit cost is determined. The details of the calculations is in the appendices, however,

With existence of other associated construction and management costs as C_0, where $C_0 \neq 0$. Then, C_0 has a consequence value and C_{bp} has a market return value. Thence,

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$$b/_c = \frac{An}{An + F} \tag{3.3}$$

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For $future\ progress\ gauge\ (F)\ based\ annuity =\ a_x A$; where $a_x =$ weighted number of parallel projects within the case program. Then,

$$\left(b/_c\right) = \frac{ni}{[a_x((1+i)^n - 1) + ni]} \tag{3.7}$$

Now, in attempt to create a complete theory of governance quantities for program benefit-cost definition, focus is placed on the impact of government on an economy. From (2), there are three parts of government impacts studied by public finance economics:

1. Changes in the allocation of resources (Time Duration Control)
2. Changes in relative prices (Discounting Value Control) and
3. Changes in the distribution of economic well-being (Sustained Benefit Control)

For a Time Duration b/c control, a short term market effect has:

$$\frac{d\left(b/_c\right)}{dn} = \frac{(a_x((1+i)^n - 1) + ni)i - ni(a_x(1+i)^n \ln(1+i) + i)}{[a_x((1+i)^n - 1) + ni]^2} \tag{3.8}$$

But for $\frac{d(b/_c)}{dn} = 0$, n is maximum:

$$\left(b/_c\right)_n = \frac{i}{a_x(1+i)^{n_m} \ln(1+i) + i} \tag{3.12}$$

Also for discounting case, to determine a maximum value for i, for a long term investment effect:

$$\frac{d\left(b/_c\right)}{di} = \frac{\left((a_x(1+i)^n - 1) + ni\right)n - ni(a_x n(1+i)^{n-1} + n)}{[a_x((1+i)^n - 1) + ni]^2} \tag{3.13}$$

At $\frac{d(b/_c)}{di} = 0$

$$\left(b/_c\right)_i = \frac{1}{(a_x(1+i_m)^{n-1} + 1)} \tag{3.17}$$

Also

$$n = 1 + \frac{\log\left[1 - \left(b/_c\right)_i\right]}{\log a_x \left(b/_c\right)_i . \log(1+i_m)} \tag{3.21}$$

Also considering, Base Interest vs Duration within the Sensitivity Borders of Maximum interest and Returns Duration, for a sustained benefit scenario: $\left(b/_c\right)_i = \left(b/_c\right)_n$

$$n = 1 + \frac{\log\left[\frac{a_x(1+i)^{n_m} \ln(1+i)}{i}\right]}{\log(1+i_m)} - \log a_x \tag{3.27}$$

IV. DISCUSSION

The basic outline of benefit-cost analysis is relatively easy to describe in terms of six steps (2):

1. **Identify objectives and alternatives**: Such form the functional definition of wants. Given these to imply a benefit value targeted at maximum time duration as in figure 1, (n_{max}), the possible interest value can be estimated at the suggested benefit.
2. **Discount benefits and costs occurring in the future**: Usually the benefits and costs of a program occur over several years hence we introduce a discount factor for this. The parallel chart is illustrated in figure 2.
3. **Identify inputs and outputs**: from receipts as public program inputs, government provides utility wares as program. That is, government provides annuity within an in-house arrangement to pay off the production output in form of partnership for work time effort and transportation leverage arrangements.
4. **Deal with limited information**: In general, benefit-cost analysis is typically conducted under conditions of informational uncertainty. Sensitivity analysis is used to determine the effects of such uncertainty on the recommendations, such as in figure 3 below: in this case, a load of three projects will take less time within the maximums set, than say one or two projects.

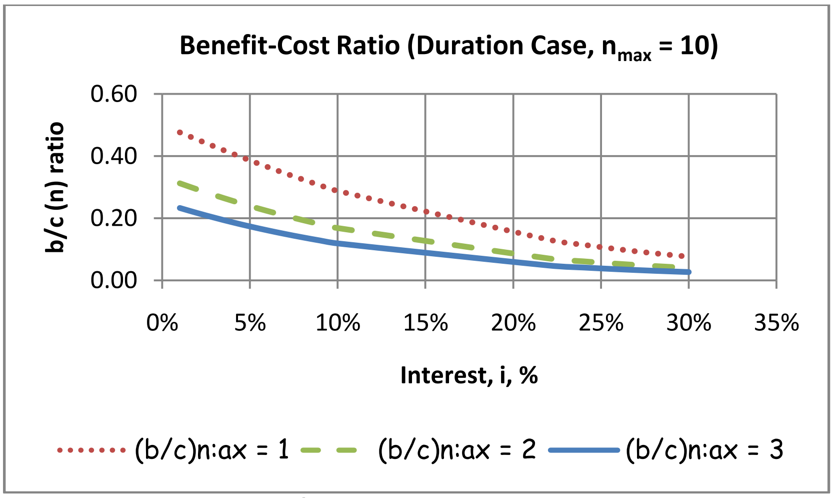

Figure 1. Time Duration b/c control

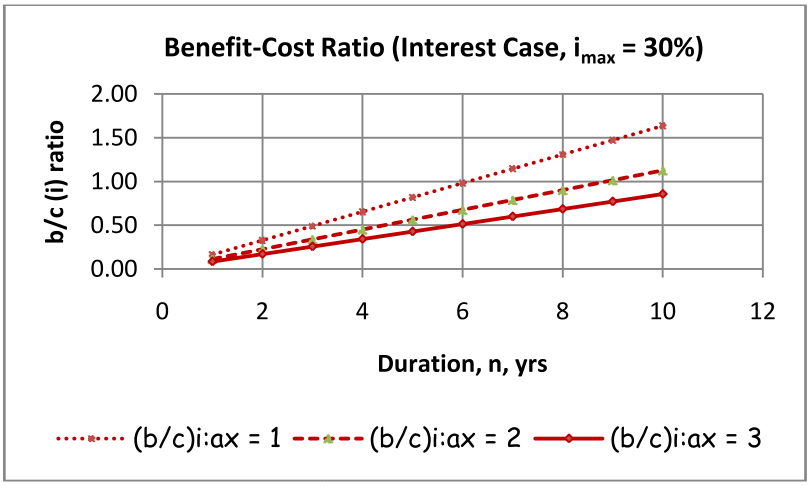

Figure 2. Benefit Discounting

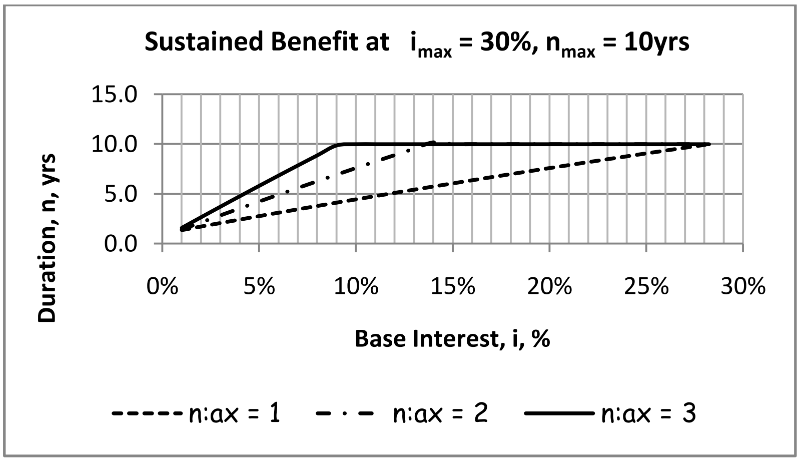

Figure 3. Base Interest vs Duration within the Sensitivity Borders of Maximum interest and Returns Duration

5. **Value the inputs and outputs at their 'shadow prices'**: At this point the program quantities are converted to common value. A baseline common value is as in figure 4 in which the interest value is kept in digit steps with duration against the benefit-cost value. This gives a similitude of a demand-supply concept, different from a third option as the investment locos concept, compare (6).
6. **Establish criteria to determine whether a program should be implemented**: The purpose of benefit-cost analysis is to ensure that the government allocates resources wisely in the public sector. The critical step is to recommend to the policy decision makers whether a program should be accepted or rejected.

In this case, for selected returns duration, n and the estimated return annuity A, the benefit platform as $C_{bp} = An$, is useful as a basis for policy decision makers to accept or reject a program. The C_{bp} becomes a measure of benefit platform items such as the road pavement and traffic for transportation projects, plant-seeds and fertilizers for farming projects, etc.

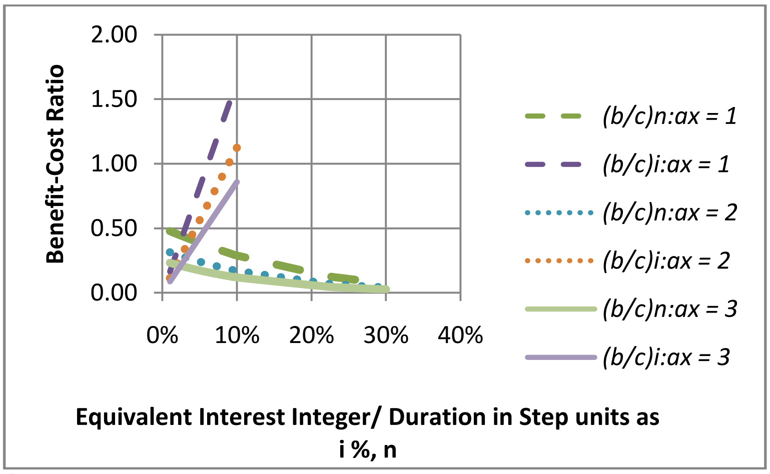

Figure 4. An In-step B/C Equilibrium at Equivalent Duration and Interest Integer

The workman micro share cropping duty set price A_{mi} is determined based on selected n *and* i basis, calculated from the existence of a common corporate lend value P. For a complementary rent duty set price A at the existence of maximums n_m *and* i_m:

$$A_{mi} = A \frac{i(1+i)^n[(1+i_m)^{n_m}-1]}{[i_m(1+i_m)^{n_m}][(1+i)^n-1]} \qquad 4.1$$

The ratio $A_{mi} : A$ is as a duty set based basic units partnering ratio for public government and a private, useful for contributory type taxation (compare (6)and (7).

V. CONCLUSION

As can be observed in the basic equations and charts:

1. In a combined control of interest i and duration n, benefit-cost ratio $\left({}^{b}/_{c}\right)$ cannot be 100% since the associated initial construction cost $C_o \neq 0$.
2. However, if i or n is held at optimal value point relative to the trend of the other, $\left({}^{b}/_{c}\right) \geq 100\%$ can be achieved at increased number of parallel projects (a_x) in a program period or at high interest rate as maximum control.
3. At sustained $\left({}^{b}/_{c}\right)$ and gradual growth, more parallel projects are achievable in shorter time. If the digits of i or n are in proportionately equal independent steps, the two controls operating at maximum have equilibrium at lower interest rate.

Appendices:

Notation: The following symbols are used in this paper:

a_x = Weight of Consequence value as factor of the annuity of the defined benefit-cost, NGN

A = Duty set price value of defined benefit-cost, NGN

A_{mi} = Workman micro share cropping duty set price, NGN
$^b/_c$ = Defined benefit cost ratio, %
$\left(^b/_c\right)_i$ = Defined benefit-cost ratio operated by interest, %
$\left(^b/_c\right)_n$ = Defined benefit-cost ratio operated by duration, %
C_{bp} = Benefit Platform, NGN
C_0 = Initial Construction Cost, NGN
F = Future progress gauge value acting as value of other public projects parts outside the benefit platform, NGN
i = Operating growth rate of project actors, %
i_m = Bank peak interest rate as maximum price of interest, %
n = Duration for project actors, (years, time unit)
n_m = Maximum duration of the case public project (years, time unit)
P = Common Corporate Lend value for land owner and tenant, NGN

Mathematics Details:
With existence of other associated construction and management costs as C_0, where $C_0 \neq 0$. Then, C_0 has a consequence value and C_{bp} has a market return value. Thence,
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$$^b/_c = \frac{An}{An+F} \quad 3.3$$

$$\left(\left(^b/_c\right)An + \left(^b/_c\right)F\right) = An \quad 3.4$$

SOLVING FOR OBJECTIVE PARAMETRIC SUBJECTS AND ASSIGNING OFFER RATIOES/FACTOR GIVES
For $Future\ Progress\ Gauge\ (F)\ based\ Annuity = a_x A$; where $a_x =$ weighted number of parallel projects within the case program. Then,

$$An\left(1-\left(^b/_c\right)\right) = \left(^b/_c\right).a_x A\left[\frac{(1+i)^n-1}{i}\right] \quad 3.5$$

$$ni\left(1-\left(^b/_c\right)\right) = a_x\left(^b/_c\right).[(1+i)^n-1] \quad 3.6$$

$$\left(^b/_c\right) = \frac{ni}{[a_x((1+i)^n-1)+ni]} \quad 3.7$$

For a Time Duration b/c control, a short term market effect has:

$$\frac{d\left(^b/_c\right)}{dn} = \frac{(a_x((1+i)^n-1)+ni)i - ni(a_x(1+i)^n\ln(1+i)+i)}{[a_x((1+i)^n-1)+ni]^2} \quad 3.8$$

But for $\frac{d\left(^b/_c\right)}{dn} = 0$, n is maximum:

$$(a_x((1+i)^{n_m}-1)+n_m i)i - n_m i(a_x(1+i)^{n_m}\ln(1+i)+i) = 0 \quad 3.9$$

$$\frac{(a_x((1+i)^{n_m}-1)+n_m i)}{n_m i} = \frac{a_x(1+i)^{n_m}\ln(1+i)+i}{i} \quad 3.10$$

$$\frac{1}{\left(^b/_c\right)_n} = \frac{a_x(1+i)^{n_m}\ln(1+i)+i}{i} \quad 3.11$$

$$\left(^b/_c\right)_n = \frac{i}{a_x(1+i)^{n_m}\ln(1+i)+i} \quad 3.12$$

Also for discounting case, to determine a maximum value for i, for a long term investment effect:

$$\frac{d\left(^b/_c\right)}{di} = \frac{\left((a_x(1+i)^n-1)+ni\right)n - ni(a_x n(1+i)^{n-1}+n)}{[a_x((1+i)^n-1)+ni]^2} \quad 3.13$$

At $\frac{d\left(^b/_c\right)}{di} = 0$

$$(a_x(1+i_m)^n-1)+ni_m - i_m n(a_x(1+i_m)^{n-1}+1) = 0 \quad 3.14$$

$$\frac{(a_x(1+i_m)^n - 1) + ni_m}{i_m n} = (a_x(1+i_m)^{n-1} + 1) \quad 3.15$$

$$\frac{1}{\left(b/c\right)_i} = (a_x(1+i_m)^{n-1} + 1) \quad 3.16$$

$$\left(b/c\right)_i = \frac{1}{(a_x(1+i_m)^{n-1} + 1)} \quad 3.17$$

Also

$$(a_x(1+i_m)^{n-1}) = \frac{1}{\left(b/c\right)_i} - 1 \quad 3.18$$

$$(1+i_m)^n = (1+i_m)\left(\frac{1-\left(b/c\right)_i}{a_x\left(b/c\right)_i}\right) \quad 3.19$$

$$n\log(1+i_m) = \log(1+i_m) + \log\left(\frac{1-\left(b/c\right)_i}{a_x\left(b/c\right)_i}\right) \quad 3.20$$

$$n = 1 + \frac{\log\left[1-\left(b/c\right)_i\right]}{\log a_x\left(b/c\right)_i . \log(1+i_m)} \quad 3.21$$

Also considering, Base Interest vs Duration within the Sensitivity Borders of Maximum interest and Returns Duration, for a sustained benefit scenario: $\left(b/c\right)_i = \left(b/c\right)_n$

$$\frac{1}{(a_x(1+i_m)^{n-1} + 1)} = \frac{i}{a_x(1+i)^{n_m}\ln(1+i) + i} \quad 3.22$$

$$\frac{(a_x(1+i_m)^n + 1 + i_m)}{1+i_m} = \frac{a_x(1+i)^{n_m}\ln(1+i) + i}{i} \quad 3.23$$

$$a_x(1+i_m)^n = -(1+i_m) + (1+i_m)\frac{a_x(1+i)^{n_m}\ln(1+i) + i}{i} \quad 3.24$$

$$a_x(1+i_m)^n = (1+i_m)\left[\frac{a_x(1+i)^{n_m}\ln(1+i) + i}{i} - 1\right] \quad 3.25$$

$$n\log(1+i_m) + \log a_x = \log(1+i_m) + \log\left[\frac{a_x(1+i)^{n_m}\ln(1+i) + i}{i} - 1\right] \quad 3.26$$

$$n = 1 + \frac{\log\left[\frac{a_x(1+i)^{n_m}\ln(1+i)}{i}\right]}{\log(1+i_m)} - \log a_x \quad 3.27$$

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